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Light should guide us, not blind us.

Comment of the Soft Lights Foundation

Request for Information on Electromagnetic Fields (EMFs), Radiofrequency (RF) Radiation, and Wireless Radiation Exposure

Docket No. HHS-OASH-2026-0397 | FR Doc. 2026-19252
U.S. Department of Health and Human Services,
Office of the Assistant Secretary for Health
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The Defective Administration of the Electronic Product Radiation Control Program as Applied to Visible Light Emitted by LED Products

RESPONDENT IDENTIFICATION AND BASIS OF RESPONSE

This block responds to the RFI Instructions and to Question 2. It is placed at the front of the comment so that the reviewing office can confirm compliance without reading further.

A. Responding Entity

This comment is submitted by the Soft Lights Foundation, a nonprofit corporation incorporated in the State of Oregon in 2021 and exempt from federal income tax under section 501(c)(3) of the Internal Revenue Code.

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The Foundation addresses the health, safety, and accessibility effects of high-intensity artificial lighting. It collects reports of harm from members of the public and submits them to federal agencies, files regulatory petitions, and participates in federal and state administrative proceedings concerning light-emitting products. The record of that activity is set out in Part IV.

B. Individual Respondent and Role in the Organization

Mark Baker
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Mr. Baker prepared and submits this comment in his capacity as President of the Foundation. The RFI Instructions provide that where a comment is submitted on behalf of an organization, the individual respondent's role in the organization may also be provided; that information is given here for that purpose.

This document is the Foundation's institutional submission. Part IV.D describes litigation brought by Mr. Baker in his individual capacity. Those actions are his own and are not the Foundation's; the distinction between the two capacities is maintained throughout this comment.

Mr. Baker will also submit a separate response to this docket in his individual capacity, from a separate address. That submission is his own and is not made on the Foundation's behalf. Subsection G addresses the one-response instruction and the relationship between the two filings.

C. Perspective(s) Represented [RFI Q2]

Question 2 asks respondents to describe which perspective or perspectives their comments represent. The Foundation answers as follows.

Primary perspective: another type of organization — specifically, a nonprofit public-health and disability-advocacy organization concerned with the biological effects of artificial optical radiation.

Secondary perspective: the Foundation also transmits, in aggregate and de-identified form, the reported experience of individual consumers, patients, family members, and caregivers who have submitted reports of harm to it. Part VII describes that record and states expressly what it does and does not establish.

The Foundation states for completeness which of the listed perspectives it does not represent. It is not a healthcare professional or clinical entity and offers no clinical observations of its own. It is not an equipment or product manufacturer, a service or infrastructure provider, a business, or an industry group. It is not a government entity. It is not a research entity and conducts no primary

laboratory research; where this comment relies on scientific findings, it relies on the published work of others, cited as such.

D. Basis of the Response: Sources Relied Upon

The RFI asks respondents to identify whether their response is based on peer-reviewed research, government reports, industry data, clinical observations, or other sources. This comment draws on several distinct classes of source. They are not interchangeable and they do not carry equal weight. The table below identifies each class, what it comprises in this comment, and what the Foundation asks the Department to take from it. Full citations with active hyperlinks appear at the point of use and in Appendices C through F.

Class of source	What it comprises in this comment	Weight accorded
1. Federal statutes and legislative materials	Title 21, United States Code, part C of subchapter V (§§ 360hh–360ss); the Energy Policy and Conservation Act; enacted appropriations and the committee reports they carry; introduced bills. Parts II and IV.	Primary authority. Quoted exactly. Where the Foundation characterizes a provision rather than quoting it, the characterization is identified as the Foundation's.
2. Federal regulations and rulemaking records	21 C.F.R. subchapter J; 10 C.F.R. part 430; 49 C.F.R. § 571.108; 28 C.F.R. part 35; Federal Register notices and final rules, their preambles, and the NEPA determinations accompanying them. Parts II, IV, and VI.	Primary authority, and primary record of what each agency did and when.
3. Agency correspondence, petitions, and responses	Regulatory petitions filed by the Foundation and the agencies' dispositions of them; agency interpretation letters; records produced under the Freedom of Information Act. Part IV.	Primary record. Cited by date and document identifier. Produced records are submitted or linked rather than described.
4. Judicial records and decisions	Pleadings, orders, and published opinions in the proceedings identified in Part IV.	Primary record. Holdings are stated as decided. What a court declined to reach is identified as not reached.
5. Peer-reviewed scientific literature	Published studies on optical radiation and the eye, temporal light modulation, photosensitive and neurological response, circadian effect, and ecological effect. Part V.	Scientific evidence. Part V.A states the selection method and distinguishes established findings from emerging ones and from open questions.
6. Consensus standards and technical guidance	Photobiological safety, flicker, photometric, and measurement standards issued by IEC, CIE, IEEE, and ANSI/IES, and international exposure guidance. Parts V and VI; listed at subsection E.	Evidence of what technical criteria exist and of their voluntary, non-federal status. Identification is not endorsement.
7. First-hand reports of harm	The Foundation's LED Incident Report database — 593 reports collected from members of the public and submitted to the FDA. Reproduced in full at Appendix A. Part VII.	Each report is the account of one person, in that person's own words. Qualitative, self-reported, and self-selected. Evidence of the existence, character, and persistence of reported harm, and of notice to the agencies. Not a probability sample; not evidence of incidence or causation. Part VII.A.5 states the limits.

Class of source	What it comprises in this comment	Weight accorded
8. Public petition comments	More than 4,000 public comments on the petition to the U.S. Department of Transportation identified in Part VII.G. Reproduced in full at Appendix B.	Individual first-hand accounts, carrying the same character and the same limits as the incident reports above.
9. Public petition signatures	The signature count on the same petition, stated and sourced as of the date of filing. The signature list itself is not submitted. Part VII.G.	Evidence of the scale of public complaint. A count, not an account. Not epidemiological data and not offered as such.
10. Direct observation and measurement	Photometric and spectral measurements and photographic documentation made by the Foundation. Part VI.	Primary observation. Instrument, method, and conditions are stated wherever a measurement is reported.
11. Secondary reporting	News and trade press.	Used only to locate a primary document or to establish that a matter was publicly reported. No factual assertion in this comment rests on secondary reporting alone.

Classes 7 through 9 are already records of the Department.

The Foundation transmitted the LED Incident Reports to the Food and Drug Administration at RadHealthCustomerService@fda.hhs.gov, and the agency acknowledged receipt. The petition comments and signature totals described in Part VII.G were transmitted to the agencies as well. These materials are therefore held within the Department already, and their reproduction at Appendices A and B re-presents material the Department has had in hand rather than disclosing anything new to it. What is new in this submission is not the information. It is the request that the Department act on it. Part IV.B sets out the transmittal record with dates, recipients, and acknowledgments.

What this comment does not rely on.

The Foundation offers no clinical observations, holds no patient records, and submits none. It relies on no proprietary or confidential industry data, and submits none. It relies on no unpublished study and on no data held confidentially by any third party.

Basis for statements that a record does not exist.

Several assertions in this comment are negative — most importantly, that no federal performance standard governs visible light emitted by LED products, and that no consultation with the FDA appears in the record of the agency actions described in Parts II and IV. Each such statement rests on the Foundation's search of the Code of Federal Regulations, the Federal Register, and the agencies' own published materials, together with the agency responses described in Part IV. The one mechanism available to test these statements against the agency's non-public records was a request under the Freedom of Information Act, submitted March 30, 2025, for the Center for Devices and Radiological Health's records on these products and on the interagency liaison obligation. In litigation over that request the United States has admitted that, as of August 12, 2026, it had made no determination, produced no record, and asserted no exemption as to any responsive record. The Foundation has therefore tested its own conclusions as far as the available mechanism permits. Part IV.D.3 sets out that record. Each is stated as the result of that search. If the Department is aware of a record the Foundation has not located, the Foundation asks that it be identified.

E. Exposure Guidelines, Regulatory Frameworks, and Scientific Assessments Relied Upon

The RFI asks respondents who rely on existing exposure guidelines, regulatory frameworks, or scientific assessments to identify the specific frameworks and to explain how they inform the response. The Foundation identifies the following. They are grouped by legal status, because the distinction between a binding federal standard and a voluntary consensus document is itself the subject of this comment.

Framework	Status	How it informs this comment
Federal Food, Drug, and Cosmetic Act §§ 531–542, 21 U.S.C. §§ 360hh–360ss	Binding federal law	The governing framework. This comment concerns its administration as applied to LED products.
21 C.F.R. subchapter J, parts 1000–1040	Binding federal regulation	The implementing regulations. Part 1040 is titled "Performance Standards for Light-Emitting Products" and includes a standard for high-intensity mercury vapor discharge lamps at § 1040.30. The FDA has therefore already prescribed a performance standard for a general-illumination lamp under this authority. No counterpart exists for LED products.
21 C.F.R. §§ 1000.3(a), 1002.20	Binding federal regulation	Definition of an accidental radiation occurrence and the reporting obligation attached to it. Part VII.I.
FMVSS No. 108, 49 C.F.R. § 571.108	Binding federal regulation	Governs motor vehicle lamps on photometric and signaling criteria. Identified to show what it does and does not contain: no health-based limit on emission, and no criterion for spectral content or temporal modulation.
47 C.F.R. §§ 1.1307(b), 1.1310	Binding federal regulation	FCC radiofrequency exposure limits. Relevant to the RF thread and to the division of responsibility between the FCC and the FDA discussed at Part II.H.8.
Energy Policy and Conservation Act, 42 U.S.C. § 6291 et seq.; 10 C.F.R. part 430	Binding federal law and regulation	General service lamp efficacy standards. Identified to show that the governing metric is lumens per watt and that it is silent as to what the selected technology emits. Part IV.G.
28 C.F.R. part 35	Binding federal regulation	ADA Title II self-evaluation and accommodation duties. Identified to show what public entities are required to do and what technical referent they lack. Part VIII.
IEC 62471 / CIE S 009, photobiological safety of lamps and lamp systems	Voluntary consensus standard; not adopted as a federal performance standard	The principal existing photobiological classification scheme. Identified for what it covers, what it does not cover, and its non-binding status.
IEEE Std 1789-2015, modulating current in high-brightness LEDs	Voluntary recommended practice; not adopted	The principal existing guidance on flicker and temporal light modulation. Identified as recommended practice that no federal rule requires any manufacturer to follow.
ANSI/IES RP-27 series, photobiological safety	Voluntary consensus standard	Recommended practice on photobiological safety for lamps and lamp systems.
ICNIRP guidelines on exposure to incoherent visible and infrared radiation	International guidance; no force of law in the United States	Comparison point for Question 5, which asks what national and international frameworks federal health agencies should consider.

Framework	Status	How it informs this comment
SCHEER, Opinion on Potential risks to human health of Light Emitting Diodes (LEDs) (European Commission, 6 June 2018)	Advisory opinion of a European Commission scientific committee; not binding, and without force of law in the United States	Relied upon for what it concluded, for the condition it attached to that conclusion, and above all for its own statements of what it could not conclude and what research and measurement it identified as absent. Part V.K.
ANSI/IES LM-79, TM-30, and related measurement standards	Voluntary test methods	Measurement methodology underlying Parts V and VI and any measurement the Foundation reports.
Martinsons et al., Solid State Lighting: Review of Health Effects (IEA 4E Solid State Lighting Annex, Oct. 2024)	Intergovernmental technical assessment; not binding	Relied upon for its account of the state of the blue light hazard exposure limit, the absence of consensus on its revision, the inadequacy of present means of predicting discomfort glare, the regulatory gap as to temporal light modulation, and the research gaps it identifies. Parts V.C.2.f, V.C.4, V.D.3 and V.K.

Identification is not endorsement.

The Foundation identifies these documents because the RFI asks what frameworks exist and how they inform the response. It does not adopt the exposure values in any voluntary standard listed above as adequate, and this comment should not be read to propose any of them as a federal limit. The Foundation's position is the one stated in Part IX: that the Department should develop the evidentiary basis for a performance standard under 21 U.S.C. § 360kk, and that no voluntary document now supplies that basis.

F. Statement Regarding Personally Identifiable and Personal Health Information

Two instructions in the RFI bear on this. The Instructions direct respondents not to submit personally identifiable information or personal health information. Question 3 invites individuals, families, caregivers, healthcare professionals, and organizations to share experiences regarding potential adverse health effects, and encourages respondents to provide as much detail as they are comfortable sharing, recognizing that responses will be public. The Foundation reads the two together as asking for the accounts without the identifiers, and has prepared this comment on that basis.

The Department already holds this record.

The accounts reproduced at Appendices A and B were transmitted to the Food and Drug Administration before this RFI issued, and receipt was acknowledged. Submitting them here discloses nothing to the Department that the Department does not already possess. The de-identification described below is therefore directed at the public posting on regulations.gov rather than at the Department's own review, and the Foundation has carried it out on that basis.

The accounts are submitted in full.

The LED Incident Reports at Appendix A and the petition comments at Appendix B are reproduced in their entirety. They are not summarized, sampled, excerpted, or reduced to counts. Each is the account of one person in that person's own words, and the particularity of these accounts is itself the evidence Question 3 asks for. Reducing them to a tally would withhold from the Department the material it has requested.

Identifiers removed.

The Foundation has removed from each account: (a) names, electronic mail addresses, telephone numbers, street addresses, and social media handles; (b) the name of any employer, school, medical provider, business, or other third party named by the reporter; and (c) any remaining

detail that in the Foundation's judgment would identify the reporter notwithstanding removal of the foregoing. Locations are stated no more precisely than city and state. Self-identified categories are retained as submitted, because Question 3 asks for the nature of the effect experienced and for the characteristics of the individuals involved.

Signatures are stated as a count.

The signature total on the petition described in Part VII.G is stated and sourced as of the date of filing. The signature list itself is not submitted: it consists principally of names, which are personally identifiable information, and a signature carries no account to reproduce. The distinction is between accounts, which are submitted whole, and a count, which is reported as a number.

Reports are reproduced as submitted.

The Foundation has not edited the accounts for content and does not adopt the views expressed in any individual report or comment. Some reporters state opinions on matters outside the scope of this comment. They appear because the record is submitted whole rather than curated, and the Department should read each account as the statement of its author and not of the Foundation.

No clinical record, no diagnosis made by a clinician, and no document from any medical provider is submitted or relied upon. The Foundation submits no proprietary, classified, or confidential information, and requests no confidential treatment of anything in this comment or its appendices. The Foundation understands that this comment and its appendices will be posted publicly on regulations.gov.

G. Single-Response Certification

Instruction 1 provides that each responding entity, person or organization, should submit only one response. This document, together with Appendices A through F, is the single response of the Soft Lights Foundation to Docket No. HHS-OASH-2026-0397. The Foundation has submitted no other response to this docket.

Mark Baker will submit a separate response in his individual capacity, from a separate address. Instruction 1 distinguishes a person from an organization, and the two submissions are the single responses of two responding entities. Neither is made on behalf of the other. The Foundation states the relationship here so that the Department is not left to infer it from two filings bearing the same name.

What this single response transmits.

Counted as a docket entry, this is one comment. What it carries is not one person's view. Appendix A reproduces 593 first-hand reports of harm, each written by the person who experienced it and each previously submitted to the Food and Drug Administration. Appendix B reproduces more than 4,000 public comments describing the same class of harm. Part VII.G reports the signatures of more than 80,000 additional individuals. The Foundation asks that these accounts be weighed as the statements of the people who wrote them, and that the Department not treat the experience of tens of thousands of individuals as a single comment because it reached the docket through a single filer.

Questions regarding this submission may be directed to Mark Baker, President, Soft Lights Foundation, at mbaker@softlights.org.

EXECUTIVE SUMMARY

The sixteen propositions on which this comment rests, each stated as a conclusion and each established in the Part cited after it. This summary is navigational. Nothing in it should be relied on without the Part it points to, and where a proposition is qualified there, the qualification governs.

The Soft Lights Foundation submits this comment in response to Docket No. HHS-OASH-2026-0397. The Department asked what is known and what should be done about human exposure to electromagnetic radiation. This comment answers as to one region of that spectrum: the visible light emitted by light-emitting diode products, which is electronic product radiation within 21 U.S.C. § 360hh(1)(A) and within the control program § 360ii directs the Secretary to establish and carry out. The Foundation asks the Department to carry out that program as to these products. It does not ask the Department to find that these products injure anyone, and it does not ask for a ban on any product.

a. The authority, and the agencies that have deferred to it

1. The Food and Drug Administration is the only federal agency Congress has authorized to control the radiation emitted by electronic products. That authority is conferred by part C of subchapter V of the Federal Food, Drug, and Cosmetic Act, 21 U.S.C. §§ 360hh to 360ss, and is administered through the Center for Devices and Radiological Health. Part I.A; Part II.A.

2. Every federal agency the Foundation has asked has deferred to it. Between March 2022 and August 2023 the Foundation put the question to nine federal bodies: the National Transportation Safety Board, the Environmental Protection Agency, the Federal Highway Administration, the Consumer Product Safety Commission, the Federal Aviation Administration, the National Highway Traffic Safety Administration, the Department of Energy, the Occupational Safety and Health Administration, and the United States Access Board. Each answered that the subject was not within its authority, and several identified where the authority lay. The Environmental Protection Agency wrote that Congress has granted it no statutory authority to regulate visible light or non-ionizing radiation emitted from electrical devices, and that it maintains no experts in the field. The Consumer Product Safety Commission wrote that it is barred by 15 U.S.C. § 2080. The Federal Aviation Administration wrote that it would defer to the Food and Drug Administration. Part I.A; Part II.H.20.

3. The Foundation does not contend that any of those agencies was wrong. Having examined each position it believes each was right, and that is what gives the record its significance. This is not a subject that fell between agencies because each supposed another was attending to it. It is a subject Congress assigned to one agency, which every other agency asked about it has correctly said belongs to that agency. Because that deference is correct, no other part of the federal government can open the question. Part I.A.

b. The duty, and the test it actually applies

4. The task is minimization. Paragraph 360ii(a)(2) directs the Secretary to plan, conduct, coordinate and support research, development, training and operational activities "to minimize the emissions of and the exposure of people to, unnecessary electronic product radiation". The paragraph contains no finding, no determination and no threshold that must be reached before the duty attaches, and minimization states a direction of travel rather than a ceiling. Part II.D.

5. Safety is not the test that paragraph applies. The purpose of the subchapter is the protection of public health and safety, and the Foundation does not suggest otherwise. But the word limiting paragraph (a)(2) is unnecessary, not hazardous. Congress used both words and the Senate report on the 1968 Act lists them disjunctively, as unknown, unnecessary and potentially hazardous radiation. The question the paragraph asks is not whether this radiation has been shown to injure anyone. It is whether the radiation serves any purpose for the person exposed to it. A demonstrated history of

safety answers the question § 360kk(a)(1) asks. It does not answer the question paragraph (a)(2) asks. Part II.D.2.

6. Light pollution is a name for part of that unnecessary radiation. The radiation does not leave, it reaches people, and emission directed away from the surface an installation exists to serve performs no function for anyone. The Environmental Protection Agency has already stated that it holds no Congressional authority over it. Part II.D.3; Part III.D.1.

c. What the 2024 determination addressed, and what it did not

7. The Final Response of May 24, 2024 addressed performance standards. Of the six duties in § 360ii(a), exactly one operates through a mechanism that conditions action on a determination by the Secretary: paragraph (a)(1), which runs through § 360kk and its finding of necessity. That is the duty the letter addressed. The other five carry no such condition and the letter does not discuss them. The issue before the Department is not a single standard. It is a functioning radiation control program for this radiation. Part I.C; Part II.M.

8. The standard-setting mechanism is not presently operable, and must be reconstituted as part of any functioning program. The Technical Electronic Product Radiation Safety Standards Committee required by § 360kk(f) is chartered and continuing. So far as the Foundation can determine it last met in October 2016, at a meeting where the Center presented its own concerns about light-emitting diodes. In January 2025 nominations were sought for ten of its fifteen seats. Part II.K; Part IX.H.

9. The reports to Congress that the statute requires have never been produced for these products. Section 360jj(a) directs the Secretary to conduct the enumerated studies and report the results to Congress. The second study was performed once, during 1969, and reported in April 1970; the agency's own staff document states on its face that it was confined to three classes of products, all of them sources of ionizing radiation. It has never been performed for any product emitting visible light. A petition seeking performance has been pending since December 30, 2025. Part II.I; Part IX.K.

d. The outreach duty is the Department's own, and two windows are open now

10. The Department cannot wait to be approached. Paragraph 360ii(a)(6) directs this Department to consult and maintain liaison with the Secretary of Commerce, the Secretary of Defense, the Secretary of Labor and other appropriate federal departments and agencies. It imposes no duty on any of them. The Occupational Safety and Health Administration said so in declining a request for consultation, and it was correct. Of the two departments the provision connects, only this one can invoke it. One of the nine agencies, the Access Board, has already offered to provide technical assistance to the Food and Drug Administration on request, and the Foundation can locate no record that a request was ever made. The Foundation asks that an express written invitation be sent to each agency and that the Department state which were sent. Part II.H.10; Part II.H.11; Part IX.E.5.

11. The National Highway Traffic Safety Administration is rewriting the standard that governs vehicle lamps now. The Department of Transportation announced on October 6, 2026 a negotiated rulemaking to modernize Federal Motor Vehicle Safety Standard No. 108, docketed as NHTSA-2026-1981, with applications and comments due November 9, 2026 and headlamp glare among the announced subjects. The optical characteristics of a product class are about to be determined again, and the agency holding the radiation-health authority is not at the table. This is the one instance in this comment where that pattern is still capable of being avoided rather than merely described. Part II.H.5; Part IX.E.4.

12. The Federal Communications Commission is taking comment now, and that window closes first. Public Notice DA 26-997, released September 17, 2026 in ET Docket No. 13-84, invites comment with a deadline of October 22, 2026, which is the day after comments on this request for information close. Part II.H.8; Part IX.E.4.

e. Who is affected, what must be assessed, and what is asked

13. Disability access is a critical need and it is where the absence of a federal criterion does its most concrete damage. A public entity conducting the self-evaluation that 28 C.F.R. § 35.105 requires has no federal referent for what an emitting product may emit, so the systemic duty defaults into the individualized one and the burden of establishing harm falls on the person requesting accommodation. This Department is a designated agency under Title II of the Americans with Disabilities Act, and section 504 of the Rehabilitation Act reaches its own programs. Part VIII.

14. The assessment required is large, and no baseline exists for any part of it. Part VI describes seventeen product classes, from vehicle headlamps and roadway lighting to indicator lamps on household appliances, traffic signals, rail and marine lighting, and lighting on bicycles and personal mobility devices. Appendix F sets out thirty-six radiation-emitting product codes for these products, twenty-three the Center has already assigned and thirteen the Foundation proposes. Part III identifies sixteen characteristics of emission and exposure in which a boundary must be drawn if minimization is to mean anything, and states of each whether a number can presently be given. For most it cannot, because the research paragraph (a)(2) directs and the evaluation paragraph (a)(4) directs have not been conducted. Emissions that have never been measured cannot be shown to have been minimized.

15. The record before the Department is substantial and most of it is already in its files. Appendix A reproduces 593 LED Incident Reports in full, the majority transmitted to the Center as they arrived and acknowledged. Appendix B reproduces 4,991 public comments submitted to the headlamp petition. Appendix C appraises 153 peer-reviewed articles. Part VII states what this material establishes, which is narrow, and what it does not, which is longer and includes matters that count against the Foundation.

16. What is asked, and what is not. The Foundation does not ask the Department to find that these products injure anyone, and does not ask for a ban. It asks for one performance standard, in the single characteristic where the quantities are settled and a consensus body has already written numerical criteria in mandatory language. For the rest it asks for what a program does before it regulates: measure what these products emit, characterize how people are exposed to them, publish both, disclose emission characteristics at the point of procurement, consult the agencies whose rules determine what these products emit, reconstitute the advisory committee, conduct the studies and report to Congress, and exercise the powers of § 360ii(b)(1), which require no finding about anyone's health and may be exercised now. Part IX; summarized at Part I.H.

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Cross-reference table: each question and subpart of the request for information to which this comment responds, the subsection that responds to it, and the page on which that subsection begins. Derived from the question tags carried on the subsection headings themselves, so that the table and the document cannot diverge.

The table lists the questions this comment answers, in the order the notice numbers them. A question answered in more than one place carries each reference, in document order. The subsection addresses are the primary reference and are stable; the page numbers are those of the pagination in which this document was last rendered and should be checked against the table of contents.

Two questions of the notice carry no entry below, and the Foundation identifies the fact rather than leaving it to be discovered. No subsection of this comment is tagged as responding to Question 1 or to Question 6. For Question 1 the Foundation understands the respondent identification at the front of this comment to be the response, and the omission to be one of tagging rather than of substance. For Question 6 the Foundation makes no such claim: it has not identified a subsection that answers it and states so here.

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I. INTRODUCTION

A. Summary of Position

The Food and Drug Administration is the only federal agency Congress has authorized to control the radiation emitted by electronic products. That authority is conferred by part C of subchapter V of the Federal Food, Drug, and Cosmetic Act, 21 U.S.C. §§ 360hh–360ss, enacted as the Radiation Control for Health and Safety Act of 1968, and is administered through the Center for Devices and Radiological Health. Section 360ii directs the Secretary to establish and carry out an electronic product radiation control program designed to protect the public health and safety from electronic product radiation, and specifies six things the Secretary shall do as part of that program.

Light emitted by a light-emitting diode is electronic product radiation. Section 360hh(1)(A) defines the term to mean "any ionizing or non-ionizing electromagnetic or particulate radiation" emitted from an electronic product as the result of the operation of an electronic circuit in such product. Visible light is non-ionizing electromagnetic radiation. An LED is an electronic product. Nothing in the statute distinguishes the visible portion of the spectrum from any other, and the agency has prescribed performance standards for light-emitting products before: 21 C.F.R. part 1040 is titled "Performance Standards for Light-Emitting Products" and includes, at § 1040.30, a standard for high-intensity mercury vapor discharge lamps — a general-illumination lamp.

The Foundation's position is that the program § 360ii requires is not being carried out as to LED products. The FDA maintains no program directed at the LED products that account for most human exposure to artificial optical radiation. There is no performance standard for LED vehicle headlamps, none for LED streetlights, none for the LED flashing warning beacons now mounted on emergency vehicles and at pedestrian crossings, and none for the LED lamps that replaced incandescent lighting in homes, schools, workplaces, and stores. So far as the public record discloses, the agency has published no study or evaluation of what these products emit or of the conditions under which people are exposed to them. It has not consulted the federal agencies whose own rules placed these products on the roads and in the public right of way. And it has received, and acknowledged receiving, more than six hundred reports of harm from members of the public without, so far as the record shows, acting on any of them.

There is a question the Department may fairly put to a submission of this kind, and the Foundation answers it at the outset. If this responsibility is the Food and Drug Administration's, why has no other federal agency said so?

They have. Between March 2022 and August 2023 the Foundation put the question to nine federal bodies: the National Transportation Safety Board, the Environmental Protection Agency, the Federal Highway Administration, the Consumer Product Safety Commission, the Federal Aviation Administration, the National Highway Traffic Safety Administration, the Department of Energy, the Occupational Safety and Health Administration, and the United States Access Board. Each answered that the subject was not within its authority. Several identified where the authority lies.

The Environmental Protection Agency wrote that Congress has granted it no statutory authority to regulate visible light or non-ionizing radiation emitted from electrical devices, and that it maintains no experts in the field. The Consumer Product Safety Commission wrote that it is barred by 15 U.S.C. § 2080 from regulating a risk of injury from electronic product radiation where that risk may be subjected to regulation under this chapter. The Federal Aviation Administration wrote that it would defer to the Food and Drug Administration for comfort, health and safety regulation of LED products. The Access Board wrote that the statute directs the Food and Drug Administration to establish and carry out the program, and that it would provide technical assistance to that agency on request. The National Highway Traffic Safety Administration wrote that it defers to health-focused agencies such as the Food and Drug Administration. The Occupational Safety and Health Administration said it was awaiting

notification from the Food and Drug Administration. Part II.H.21 sets out the record and Part IV.C the correspondence.

The Foundation does not contend that any of those agencies was wrong. Having examined each position, it believes each was right. That is what gives the record its significance. This is not a subject that fell between agencies because each supposed another was attending to it. It is a subject that Congress assigned to one agency; that every other agency asked about it has correctly said belongs to that agency; and that the agency has answered by stating that light-emitting diode products have a long history of safety with respect to the visible wavelengths they emit, and that a performance standard is therefore not necessary.

Those two propositions cannot both carry weight. A history of safety, where it has not been established by affirmative study, is an inference from an absence of reported harm. The absence of reported harm in this program is not a finding about these products. It is the predictable output of an arrangement in which the only incident reporting provision runs from manufacturers, upon their own suspicion, 21 C.F.R. § 1002.20; in which no channel exists through which an exposed person may report anything, and a request to this Department that one be created was not taken up; in which the emissions have never been measured and the conditions of exposure have never been characterized; and in which the statutory advisory committee has not met since 2016. Parts II.F, II.K, II.L and VII.J set out each of those. The proposition that closed the inquiry is produced by the inquiry never having been opened.

And because the deference of the other agencies is correct, nothing else in the federal government can open it. That is not a defect in any of those agencies. It is the statutory design operating as Congress built it, with one part not moving.

There is a second half to that section, and to this comment. Section 360ii(a) states what the Secretary shall do. Section 360ii(b) states what the Secretary may do in carrying it out, and among those powers is an express authority to make such recommendations relating to the hazards and control of electronic product radiation as he considers appropriate. Parts II.B and I.C.9.

The Foundation's attention in its correspondence, and Mr. Baker's in the litigation described at Part IV.D, has been on the duties, for a reason Part I.C.9 explains: a discretionary power is not something a court can order anyone to exercise. This proceeding is different in kind. The Department has asked the public what it should do, and in answer to that question the discretionary powers matter more than the duties, not less. They can be exercised now, they require no finding that anyone has been harmed, and exercising them concedes nothing about the past.

So the Foundation asks for two things that stand independently. It asks the Department to carry out the duties of § 360ii(a) as to these products, which Parts II through VIII show have not been carried out. And it asks the Department to exercise the powers of § 360ii(b) — to collect and publish what is known, and to make recommendations about products in ordinary use — which it may begin upon reading this comment. A household appliance with an indicator lamp that cannot be switched off is an electronic product emitting electronic product radiation into a bedroom through the night, and there is at present no federal recommendation of any kind addressed to it. Part IX.J.

One of those nine agencies requires a further word, and the Foundation gives it here rather than leave the Department to find it later. The Department of Energy, which answered that the subject was not within its authority, was at that time funding research into the physiological and emotional effects on human beings of the spectral content of indoor lighting. Part IV.G.12. There is no inconsistency in that and the Foundation alleges none: the question put to the agencies was one of regulatory authority, and the Department of Energy has none over what an electronic product emits. Funding research is not regulating. But the juxtaposition states this comment's thesis more economically than the Foundation can. The federal government is studying this subject. It is studying it in the one department that cannot act on what it finds, under a statute

whose purposes are efficiency and cost, and the department Congress charged with protecting the public from electronic product radiation is neither receiving that research nor conducting any of its own.

The Foundation submits this comment in that light. The Department has asked the public for scientific and technical information about exposure to electromagnetic radiation from products in ordinary use. The Foundation is answering, and the substance of its answer is that what is needed first is not a conclusion but a beginning: a measurement of what these products emit, a characterization of how people are exposed to them, and the publication of both. Nothing in this comment asks the Department to find that light-emitting diode products injure anyone. It asks the Department to make that question answerable, and it is addressed to this Department because there is no other body that can.

That is what this comment sets out. It is organized around § 360ii because § 360ii is the provision that assigns the duties and confers the powers, and because its subsections identify, one by one, what a functioning program would consist of and what is absent from this one. Part II takes each subsection in turn. Part III states the characteristics of emission and of exposure in which a boundary must be drawn if unnecessary radiation is to be minimized, and says of each whether a number can presently be stated. Part IV sets out the administrative and judicial record: what the agencies were told, when, by whom, and what followed. Parts V through VII supply the scientific literature, the product landscape, and the reports of harm. Part VIII describes what the absence of a federal emission criterion costs the state and local entities that must evaluate their own lighting. Part IX states what the Foundation asks the Department to do.

The United States has taken the position, in litigation, that these matters rest within the agency's discretion. The Foundation addresses that position directly at subsection C, because it is the threshold question and because the answer to it determines how much of the rest of this comment the Department can treat as optional.

B. The Electronic Product Radiation Control Program Is Defective as Applied to LED Products

1. The statutory duties of 21 U.S.C. § 360ii are mandatory and continuing

Section 360ii(a) provides that the Secretary "shall establish and carry out an electronic product radiation control program designed to protect the public health and safety from electronic product radiation," and that "[a]s a part of such program, he shall" do six things. The operative verb is the same for each:

> *(1) pursuant to section 360kk of this title, develop and administer performance standards for electronic products;*
>
> *(2) plan, conduct, coordinate, and support research, development, training, and operational activities to minimize the emissions of and the exposure of people to, unnecessary electronic product radiation;*
>
> *(3) maintain liaison with and receive information from other Federal and State departments and agencies with related interests, professional organizations, industry, industry and labor associations, and other organizations on present and future potential electronic product radiation;*
>
> *(4) study and evaluate emissions of, and conditions of exposure to, electronic product radiation and intense magnetic fields;*
>
> *(5) develop, test, and evaluate the effectiveness of procedures and techniques for minimizing exposure to electronic product radiation; and*

> *(6) consult and maintain liaison with the Secretary of Commerce, the Secretary of Defense, the Secretary of Labor, the Atomic Energy Commission, and other appropriate Federal departments and agencies on (A) techniques, equipment, and programs for testing and evaluating electronic product radiation, and (B) the development of performance standards pursuant to section 360kk of this title to control such radiation emissions.*

Two features of that text govern everything that follows. The first is that the duties are continuing rather than discharged once. A program that must be carried out, with research planned and conducted, liaison maintained, emissions studied, and procedures developed and tested, is not satisfied by work completed in the decade after enactment and not revisited. The products before the public change; the duty to study what they emit does not lapse because an earlier generation of products was studied.

The second is that only the first of the six refers outward to another section. Paragraph (a)(1) directs the Secretary to develop and administer performance standards "pursuant to section 360kk," and it is § 360kk(a)(1) that conditions a standard on the Secretary's determination that one is necessary. Paragraphs (a)(2) through (a)(6) contain no such condition. They are stated as obligations without qualification. That distinction is the subject of subsection C.

The section does not end with those six duties, and the Foundation brings forward what follows them because it answers in advance the objection most likely to be made to this comment. Subsection (b) is headed Powers of Secretary, and it opens by tying itself to the duties just quoted:

> *In carrying out the purposes of subsection (a), the Secretary is authorized to—*
>
> *(1)(A) collect and make available, through publications and other appropriate means, the results of, and other information concerning, research and studies relating to the nature and extent of the hazards and control of electronic product radiation; and*
>
> > *(B) make such recommendations relating to such hazards and control as he considers appropriate;*
>
> *(2) make grants to public and private agencies, organizations, and institutions, and to individuals for the purposes stated in paragraphs (2), (4), and (5) of subsection (a) of this section;*
>
> *(3) contract with public or private agencies, institutions, and organizations, and with individuals, without regard to section 3324 of title 31 and section 6101 of title 41; and*
>
> *(4) procure (by negotiation or otherwise) electronic products for research and testing purposes, and sell or otherwise dispose of such products.*

A word about how that provision is set out above. In the United States Code, and in the commercial renderings of it, subparagraphs (A) and (B) of paragraph (1) are run together: (A) is given its own line and (B) is picked up inline after the semicolon that closes it, rather than being set on a line of its own as the paragraphs of subsection (a) are. The Foundation has separated them above for legibility and has altered no word of the text. It notes the point because subparagraph (B) is the provision on which the request at Part IX.J rests, and because a reader working from the printed section can pass over it without seeing that a distinct authority is conferred there.

The Foundation states at once what it does not argue. Subsection (b) is permissive. Its verb is is authorized to, not shall, and paragraph (1)(B) adds as he considers appropriate, which is the plainest grant of judgment in the section. The Foundation does not contend that the Secretary has violated subsection (b), and nothing in this comment should be read as making that contention.

Two things follow nonetheless, and they matter to everything after this point.

The first is a point of construction. Congress wrote both kinds of provision into one section. Subsection (a) says the Secretary shall do six things. Subsection (b) says the Secretary is authorized to do four others, one of them as he considers appropriate. The United States has taken the position in litigation that the matters in subsection (a) rest within the agency's discretion. Part I.C. Subsection (b) shows what the discretionary provisions of this section look like when Congress writes one. It wrote four of them, immediately after the six, in the same section, using different words. The contrast is not incidental drafting.

The second is the more practical. Subsection (b) is the list of means, supplied expressly for carrying out the purposes of subsection (a). Set the two columns against each other and every duty this comment describes as unperformed has a matching instrument that Congress provided:

For the research directed by (a)(2), the Secretary may make grants, (b)(2), and contract, (b)(3), the latter expressly freed from the ordinary advertising and payment requirements of 31 U.S.C. § 3324 and 41 U.S.C. § 6101.

For the study and evaluation of emissions and conditions of exposure directed by (a)(4) — the measurement whose absence is the subject of Part II.F — the Secretary may procure electronic products for research and testing purposes, (b)(4). Congress anticipated that carrying out this program would require buying the products and measuring them, and said so.

For the procedures and techniques for minimizing exposure directed by (a)(5), the Secretary may make recommendations relating to the hazards and control of electronic product radiation, (b)(1)(B). Part IX.J.

And for all of it, the Secretary may collect and make available, through publications and other appropriate means, the results of research and studies relating to the nature and extent of the hazards and control of electronic product radiation, (b)(1)(A). Part IV.G.12 describes federally funded research on this subject that no one has collected or made available.

The consequence is narrow and the Foundation puts it narrowly. Whatever may be said about why the duties of subsection (a) have not been discharged as to light-emitting diode products, it cannot be said that the Secretary lacked the authority, the funding mechanism, the contracting flexibility, the means of obtaining the products, or an instrument for publishing the result. Congress enumerated all five, in the same section, for the express purpose of carrying out those duties.

2. Those duties have not been discharged for visible light emitted by LED products

Part II takes each subsection against the record. In summary: no performance standard under § 360kk governs the visible light emitted by any LED product; the Foundation has located no published study or evaluation by the agency of LED optical emissions or of the conditions of exposure to them; no liaison or consultation with the federal agencies whose rules govern these products appears in the public record; and no procedure or technique for minimizing exposure has been developed, tested, or evaluated. Part IV sets out what the agency was told and what it did in response.

3. Those duties have not been discharged for radiofrequency energy emitted by LED products

This comment concerns visible light, but the two are not cleanly separable in the products themselves. LED drivers and the switching circuits that dim and modulate them emit radiofrequency energy, as do the networked controls now built into streetlights, luminaires, and architectural systems. Those emissions are electronic product radiation under the same definition. Part VI.L identifies the product classes in which visible and radiofrequency emission occur together, and Part II.H.8 addresses the division of responsibility between the FDA and the Federal Communications Commission.

C. The Limits of the Agency's Discretion, and the Forum for This Question

Whether these duties are discretionary has been litigated, and the answer the United States gave is more useful to the Department than any argument the Foundation could make about it. The Foundation sets that record out here, quotes it rather than characterizing it, and takes no position in this comment on how the pending case should be decided.

1. The proceeding

In Baker v. United States Food and Drug Administration, No. 2:24-cv-02558-DC-SCR (E.D. Cal.), Mr. Baker sought an order directing the FDA and NHTSA to establish and maintain the liaison required by 21 U.S.C. § 360ii(a)(6)(A) as to LED vehicle headlamps. The magistrate judge issued findings and recommendations on September 16, 2025 recommending dismissal. Objections were filed September 23, 2025, and the government's opposition was filed November 28, 2025. The matter is pending before the district judge. Part IV.D.2 sets out the history.

2. The United States does not contend that the duties are discretionary

It contends the opposite. The findings quote the government's own formulation:

> *"[w]hile Plaintiff is correct that the statute contains a "non-discretionary" requirement, he is mistaken about the nature and scope of that requirement."*

And in its opposition brief the government states that the program exists and has been established:

> *"FDA has complied with the statute and established such a program. See 21 C.F.R. §§ 1000.1–1040.30."*

3. The government says the dispute is a policy assessment

Responding to the contention that the radiation control program is defective, improperly designed, and not adequately functioning, the United States answered:

> *"But this is a policy assessment, not an allegation that FDA "failed to take a discrete agency action.""*

In the posture of a motion to dismiss under 5 U.S.C. § 706(1), that answer is directed at justiciability. The Foundation does not dispute the characterization. It accepts it, and draws the consequence the characterization carries: a policy assessment of an existing federal program is what a request for information is for, and this comment is that assessment, submitted to the Department that administers the program rather than to a court asked to supervise it.

4. The government says no decisionmaking process has occurred

Arguing that any arbitrary-and-capricious claim would fail for want of final agency action, the United States stated that "there has been no "decisionmaking process," much less a "consummation of the agency's decisionmaking process,"" as to consultation with NHTSA on testing and evaluating visible light emitted by LED vehicle headlamps.

In court that proposition defeats review. Before the Department it establishes something different and more immediately useful: the question is open. No position has been taken that this comment asks the Department to reverse, and nothing in the record forecloses the Department from considering the matter now.

5. Where the statute confers judgment, and where it does not

The Foundation states this precisely rather than broadly, because the government has identified the textual hooks and the comment gains nothing by ignoring them.

Paragraph (a)(6) directs consultation and liaison with four named officers — the Secretary of Commerce, the Secretary of Defense, the Secretary of Labor, and the Atomic Energy Commission

— and with "other appropriate Federal departments and agencies." The government reads the word appropriate as conferring judgment over which additional agencies are consulted, and that reading is available on the text. It does not extend to the four named officers, as to whom the direction is unqualified. Paragraph (a)(2) directs research to minimize "unnecessary" electronic product radiation, which likewise imports judgment about what is unnecessary.

Paragraphs (a)(3), (a)(4), and (a)(5) contain no comparable qualifier. The Secretary shall maintain liaison with and receive information from other departments, professional organizations, industry, and other organizations on present and future potential electronic product radiation. The Secretary shall study and evaluate emissions of, and conditions of exposure to, electronic product radiation. The Secretary shall develop, test, and evaluate the effectiveness of procedures and techniques for minimizing exposure. Nothing in those three paragraphs makes the obligation turn on a prior determination of necessity or appropriateness.

6. The agency has made a determination, and its basis has not been disclosed

The Foundation does not contend that the FDA has never addressed these products. Between June 13, 2022 and September 11, 2023 the Foundation submitted four petitions, directed respectively to LED products generally, LED flashing lights, LED vehicle headlamps, and LED streetlights. On May 24, 2024 the FDA denied all four in a single nineteen-page response letter.

The stated grounds include that performance standards for every type of electronic product are not necessary "given the effectiveness of existing mitigations in addressing unnecessary radiation and alternative approaches to protect public health"; that standards for LEDs are not necessary "due to their long history of safety with respect to the visible wavelengths being emitted"; and that the evidence supplied was insufficient.

The letter states that the FDA "engaged an independent, third-party organization to conduct a comprehensive literature search and systematic review to identify the current state of knowledge with regard to adverse health effects of LED light on humans." That organization has not been identified. The literature search and systematic review have not been published. On the Foundation's information they were not produced in response to a request under the Freedom of Information Act; the response letter was the only document released.

7. The reasons given are empirical propositions, and this comment tests them

Two of the three stated grounds are factual claims rather than exercises of judgment. Whether LED products have a long history of safety with respect to the visible wavelengths they emit is a question the published literature addresses. Whether the evidence supplied was insufficient depends on what evidence existed then and what exists now. Part V sets out the literature. Part VII sets out the reports received since. The Foundation offers both so that the determination can be revisited against a record.

A claim of safety presupposes a limit, and no limit exists

One feature of the proposition can be stated without reference to the literature at all, because it concerns the form of the claim rather than its truth.

A claim of safety is a relation between two terms. To say that a product is safe with respect to an emission is to say that the emission falls below some level at which harm occurs. Without the second term the claim has no content. For the visible wavelengths emitted by light-emitting diode products the Department has never established the second term. There is no federal limit on the radiance of a visible-light emitter, none on its irradiance, none on the luminance of its emitting surface, and none on its spectral distribution. Part II.E.4 sets out what the agency does have, which is the recognition of an international standard confined to thirteen medical device product codes under 21 C.F.R. § 878.4810. For a general service lamp, a vehicle lamp, a video display or a deterrent strobe there is no number.

It follows that the determination of May 24, 2024 does not report that the emissions of these products fall below a level the agency identified. It reports that harm has not been observed. Those are different statements and only the first is a safety finding of the kind § 360kk(a)(1) contemplates. A product class cannot have a history of compliance with a limit that has never been set.

The agency's own choice of words locates the difficulty precisely, and the Foundation relies on the sentence as written rather than on any paraphrase of it. The letter does not assert that these products are safe. It asserts a long history of safety with respect to the visible wavelengths being emitted. The qualifying phrase puts the spectrum in issue, and the Foundation takes the agency at its word and asks the question that follows: by what spectral measurement, and against what spectral limit, was that assessed? No federal instrument imposes a limit on the spectral distribution of a visible-light emitter. No federal instrument requires that the spectral distribution be disclosed to a purchaser, to a procuring municipality or to this Department. The one spectral descriptor that does appear on the package and in procurement specifications is correlated color temperature, and Part V.B.3 sets out why it does not answer the question. The quantity the agency's sentence names is the quantity about which the regulatory record is silent.

Whether that silence is consequential is an empirical question, and Part V.B.3 reports a study that bears on it. In that study two lamps of the same manufacturer and the same part number, differing only in spectral distribution, produced measurably different biological responses at matched illuminance; and two lamps of identical correlated color temperature, differing in the structure of their spectra, also produced different responses. The Foundation does not offer that study as proof of harm in ordinary use and says so at Appendix C.70. It offers it for a narrower proposition: the magnitude of the response depended on the one emission characteristic that the agency's sentence names and that no federal instrument measures, limits or requires anyone to disclose.

The Foundation states the conclusion it draws, because it is narrower than the one the agency may expect. The Foundation does not ask the Department to find that light-emitting diode products are unsafe, and does not characterize them that way. What it asks is that the Department supply the missing term. The question before the agency is not whether these products are safe or unsafe in the abstract. It is at what emission level, and with what spectral composition, a product of this kind ceases to be safe. That is a question about where a number should be set, it cannot be answered without the measurement § 360ii(a)(4) directs, and the statute assigns it to the Secretary and to no one else.

What the indexed literature contained six years before the determination

Line (3) of the Foundation's objection asks what the asserted history is a history of. A related question is what was available to be read, and when. The determination issued on May 24, 2024. Appendix C.73 records a review published in an indexed ophthalmology journal in December 2018, five and a half years earlier, and the Foundation offers it for a single purpose: to establish what a reader of the ordinary literature would have encountered before the determination was made.

That review identified the cornea, the lens, the retina, the retinal ganglion cell and the blood-retinal barrier as tissues on which blue light acts; named mitochondria as the principal target of the oxidative mechanism; placed the most injurious waveband between 415 and 455 nanometers, which brackets the 445 nanometer peak of the weighting function discussed at Part V.C.2.a; and set out the oxidative, inflammatory and apoptotic pathways by which each tissue was said to be affected. Appendix C.73 scores those claims against the literature assembled since, and reports that the review was substantially right about targets and mechanisms and was not vindicated on disease causation in humans. The Foundation does not rely on the review for any proposition about harm.

What the Foundation relies on is one sentence in it, which concerns the state of the evidence rather than the state of the eye. Writing in 2018, the authors observed that research showing minimal risk from ordinary digital displays was a conclusion about short-term exposure only, and that measurement after long-term exposure remained necessary. That is the same gap the comment identifies at Part V.C.2.c, where the assessment framework stops accumulating dose at ten thousand seconds, and at Part V.K, where the exposure limits are shown to have been constructed for a single eight-hour day. Practising ophthalmologists writing in a journal indexed in the National Library of Medicine had identified it in 2018.

The Foundation draws the narrow conclusion and no wider one. It does not contend that the Center for Devices and Radiological Health read this review, and it does not suggest that a single review in a specialty journal obliged the agency to reach any particular conclusion. The contention is about the state of the literature rather than about anyone's reading of it. A determination that these products have a long history of safety with respect to the visible wavelengths they emit was made at a time when the indexed ophthalmology literature contained reviews identifying five ocular tissues as targets, naming an organelle and a waveband, and stating in terms that the reassuring findings about displays covered short-term exposure only. Whether the agency was aware of that literature is a question only the agency can answer, and Part IX.B.4 asks it.

The same question, in this Department's own journal, ten years before the determination

The preceding paragraphs concern a review in a specialty journal. There is a stronger instance and the Foundation sets it out separately, because the journal is published by a component of this Department.

In March 2014, Environmental Health Perspectives, the journal of the National Institute of Environmental Health Sciences, published a study entitled "White light-emitting diodes (LEDs) at domestic lighting levels and retinal injury in a rat model." Appendix C.77 records it in full. Part II.E.6 already relies on a different article in the same journal for a different purpose, so the standing of the publication is established elsewhere in this comment. Four features of this one bear on the determination of May 24, 2024.

- The exposure was characterized as domestic. The authors measured 750 lux at the animals, a level they describe as the common domestic level, and framed the study expressly against the earlier literature, noting that chronic exposure at 2,000 to 10,000 lux had been found to cause injury but that relatively low intensity had not previously been assessed with light-emitting diodes in a rodent model.
- The comparison was against the source the technology displaced, at matched correlated color temperature. A phosphor-converted white diode at 6,500 kelvin was compared with a compact fluorescent lamp at 6,500 kelvin, at the same illuminance. The authors report serious retinal injury in the diode groups and moderate to mild injury in the fluorescent groups.
- One of the five authors is a member of the Scientific Expert Group of the International Commission on Non-Ionizing Radiation Protection, the body whose exposure limits Part V.C.2 examines.
- The authors made a recommendation. Their concluding sentence is: "we suggest a precautionary approach with regard to the use of blue-rich "white" LEDs for general lighting."

The Foundation draws no conclusion about anyone's state of knowledge and makes no allegation. It states a chronology. In December 2013 a study was accepted, and in March 2014 published, in a journal of this Department, finding retinal injury in a rodent model at an exposure its authors characterized as domestic, finding that injury greater than from the lamp the technology replaced at matched color temperature, and recommending a precautionary approach to the general

lighting application. Ten years and two months later the Center for Devices and Radiological Health determined that light-emitting diode products have a long history of safety with respect to the visible wavelengths they emit and that a performance standard was not necessary. Part IX.B.4 asks the Department to state the basis of that determination. The Foundation asks, as part of that request, whether this study was among the material considered.

One further sentence from the same paper belongs here, because it concerns sequence rather than substance. Writing in 2014, the authors said that retinal light injury and the risks of chronic exposure from domestic light-emitting diode lighting required assessment before further development of the technology. Part IV.G sets out what happened instead: the conversion of American general illumination to light-emitting diodes proceeded, under federal efficiency rules described at Part II.G, without the assessment. The Foundation does not say the two are connected by anyone's decision. It says the assessment the authors called for in this Department's journal has still not been performed, which is the request this comment makes.

8. The discretion in § 360kk(a)(1) is downstream of the duty in § 360ii(a)(4)

Section 360kk(a)(1) directs the Secretary to prescribe performance standards "if he determines that such standards are necessary for the protection of the public health and safety." The conditional clause is there and the Foundation does not read it away. But a determination of necessity is a factual judgment that cannot be made without knowing what the product emits and under what conditions people are exposed to it, and those are the subjects § 360ii(a)(4) directs the Secretary to study and evaluate without qualification. A conclusion that LED products have a long history of safety is a finding about emissions and exposure. If it was reached by commissioning an unnamed contractor rather than through the study the statute assigns to the Secretary, and the contractor's work has not been published, the predicate for the determination is not in the record at all.

9. The powers conferred by § 360ii(b), and why this proceeding is where they are properly raised

The preceding subsections concern the duties of § 360ii(a) and the limits of the judgment the statute commits to the Secretary within them. This subsection concerns the rest of the section, and it changes what this comment is asking for.

Subsection 360ii(b) confers four powers on the Secretary, for the express purpose of carrying out subsection (a). Part II.B sets them out. They are the authority to collect and publish the results of research on the hazards and control of electronic product radiation; the authority to make such recommendations relating to those hazards and that control as he considers appropriate; the authority to make grants for the research subsection (a) directs; and the authority to procure electronic products for research and testing. Each is discretionary in terms. The subsection says the Secretary is authorized to, not that he shall, and the recommendation power adds as he considers appropriate, which is the plainest grant of judgment in the section.

The Foundation has not pressed these provisions before, and the reason is worth stating because it explains why they appear now. In litigation to compel agency action unlawfully withheld, a court may order only action that is both discrete and legally required. A power conferred in the terms of subsection (b) is the paradigm of what a court cannot order. A litigant who asked a court to direct the Secretary to exercise a discretion would be asking for something no court could give, and the Foundation has accordingly confined its correspondence to the duties, as has Mr. Baker in the litigation described at Part IV.D.

This proceeding is not litigation. The Department has asked the public what it should do. In a forum of that kind the discretionary powers are not the weaker half of the section. They are the more useful half, for three reasons.

They are available now. A recommendation under § 360ii(b)(1)(B) requires no rulemaking, no determination of necessity under § 360kk(a)(1), and no predicate at all beyond the

Secretary considering it appropriate. Everything else this comment requests takes years. This does not.

They cannot be met by the observation that the Department has discretion. That observation is the premise of the request rather than an answer to it. The Foundation is not disputing the discretion conferred by subsection (b); it is submitting how the discretion should be exercised, which is what the Department asked the public to do.

Exercising them concedes nothing. The Department may publish research under (b)(1)(A) or make a recommendation under (b)(1)(B) without accepting any proposition in Part II about what subsection (a) required, without reopening the determination of May 24, 2024, and without taking any position in the pending litigation. The Foundation says so plainly because it wants these requests granted, not won.

The Foundation therefore divides what it asks, and asks the Department to read the comment accordingly. Where subsection (a) imposes a duty, the comment says so and says why. Where subsection (b) confers a power, the comment asks that it be exercised and says what for. The two do not depend on one another. If the Department rejects every proposition this comment advances about subsection (a), the requests resting on subsection (b) remain available and the reasons for them are untouched.

One further observation belongs here, about what a program looks like when it is working. A performance standard is the terminal instrument of the electronic product radiation control program and it is rightly hard to reach. But a program consists of more than its terminal instrument. An electronic product radiation control program that is functioning collects the research and publishes it, tells purchasers and specifiers what is known and what is not, and makes recommendations about products in ordinary use — continuously, and without waiting for the evidence that would support a binding rule. Congress provided for all of that in subsection (b). For products emitting visible light, the Foundation has found no instance of any of it.

A note on the scope of the authority, which the Foundation does not overstate

Because this comment concerns what is commonly called light pollution, the Foundation states precisely what Congress conferred and what it did not. Congress did not give this Department authority over light pollution as an ambient environmental condition. It gave authority over radiation emitted from electronic products, and over the exposure of people to that radiation. What is called light pollution is, in the respects this comment concerns, the aggregate of emissions from products that fall within that authority, and Part II.D.3 sets out why the Foundation approaches it through the products rather than through the ambient condition.

The distinction is not a concession and the Foundation presses it for a practical reason. A request framed as asking the Department to regulate light pollution could be answered, correctly, by observing that no such authority exists. A request framed as asking the Department to exercise, over the products that emit the light, the authority Congress gave it over electronic product radiation cannot be answered that way. The Foundation asks the Department to understand every reference to light pollution in this comment in the second sense.

10. What the Foundation asks the Department to accept, and what it does not

The Foundation does not ask the Department to concede that it is legally compelled to prescribe a performance standard for any LED product, and does not ask it to take any position on the pending litigation. It asks the Department to accept five propositions, each supported in the Parts that follow: that visible light emitted by LED products is electronic product radiation within the agency's authority; that the duties in § 360ii(a)(3), (a)(4), and (a)(5) are unqualified, as the text shows and the United States has not disputed; that the evidentiary basis for the May 24, 2024 determination has not been disclosed and should be; that the reports of harm the agency has received and acknowledged are information of the kind § 360ii(a)(3) directs it to receive and § 360ii(a)(4) directs it to evaluate; and that § 360ii(b) confers powers, among them an express

authority to make recommendations, which may be exercised now, which require no finding that any person has been harmed, and which the Department has not exercised for any product emitting visible light.

D. This Request for Information Invokes the Electronic Product Radiation Control Authority

The RFI states that the Department is conducting it "under 21 CFR subpart J." The Electronic Product Radiation Control regulations are codified at 21 C.F.R. chapter I, subchapter J, parts 1000 through 1040, issued under 21 U.S.C. §§ 360hh–360ss. The Foundation reads the reference as invoking that subchapter.

That matters for two reasons. It identifies the authority under which the Department is gathering this record as the same authority that governs LED products. And it means the Department has chosen, in framing this inquiry, the one statutory program that reaches the emissions this comment concerns.

The Department need not reach that reading on the Foundation's say-so, because the agency has already placed visible light from light-emitting diode products inside the program itself.

In its Final Response of May 24, 2024, disposing of four citizen petitions concerning visible light emitted by LED products, the Center for Devices and Radiological Health did not decline on the ground that the subject lay outside the electronic product radiation control authority. It accepted that LED products emit electronic product radiation, and declined on a different ground: that a performance standard has not historically been considered necessary. The letter states that "historically FDA has not considered performance standards to control the radiation from LEDs in the visible wavelengths to be necessary for the protection of the public health and safety."

That sentence concedes the jurisdictional question and rests the disposition on a judgment about necessity. The Foundation takes the concession as given and addresses the judgment, which is where the disagreement actually lies.

The consequence for this proceeding is narrow and it is important. If the Department is gathering a record under subchapter J, and if the agency administering subchapter J has already acknowledged that the emissions at issue are within it, then a comment about visible light from LED products is not a comment about an adjacent subject. It is a comment about the program the notice names.

E. Visible Light Is Within the Scope of This Request for Information

The RFI is addressed principally to radiofrequency and wireless exposure, and most of its questions are framed in those terms. Its own definition of its subject is broader. The notice states that the Department seeks information on electromagnetic field emissions and exposure, "particularly RF and wireless," and defines its subject as "RF radiation and other forms of non-ionizing electromagnetic (EMF) exposure."

Visible light is a form of non-ionizing electromagnetic radiation. It falls within the subject the notice defines, and within the statutory definition at 21 U.S.C. § 360hh(1)(A), which draws no distinction among regions of the non-ionizing spectrum. The word "particularly" identifies an emphasis, not a limit.

Three further points place the subject inside this proceeding, and the Foundation states them in ascending order of weight.

First, the governing statute draws no line within the non-ionizing spectrum. Electronic product radiation is defined at 21 U.S.C. § 360hh(1)(A) as "any ionizing or non-ionizing electromagnetic or particulate radiation" emitted from an electronic product as the result of the operation of an electronic circuit in that product. Visible light emitted by a light-emitting diode is non-ionizing

electromagnetic radiation produced by the operation of an electronic circuit. It is within the definition on the definition's own terms, and no provision of the subchapter narrows it to radiofrequency.

Second, the agency charged with administering that subchapter has treated visible light from LED products as falling within it. The Center for Devices and Radiological Health accepted four citizen petitions on precisely this subject, docketed them, conducted a literature review, and issued a Final Response on the merits. An agency does not adjudicate the necessity of a performance standard for a class of radiation it regards as outside its authority.

Third, the subchapter already contains a performance standard for a light-emitting product. Part 1040 is titled Performance Standards for Light-Emitting Products, and § 1040.30 prescribes a standard for high-intensity mercury vapor discharge lamps. The question before the Department is therefore not whether light-emitting products can be the subject of this program. It is why one lighting technology was made the subject of a standard and its successor has not been.

The Foundation does not overstate the point. This request for information is plainly directed at radiofrequency and wireless exposure; most of its questions are framed in those terms, and the Foundation does not suggest otherwise. What it submits is narrower: that the notice defines its own subject as non-ionizing electromagnetic radiation, that the word "particularly" marks an emphasis rather than a boundary, and that a comment on another region of that spectrum is responsive to the notice as the notice is written. If the Department takes a different view of scope, the Foundation asks that it say so, so that the material in this comment can be directed to the proceeding where it belongs.

1. Questions framed in radiofrequency terms, and how this comment answers them

Several questions use terms specific to radiofrequency exposure — specific absorption rate, power density, beamforming, antenna density. Where a question has a direct analogue in optical radiation, this comment answers it in the corresponding optical terms and says which substitution it has made. Where a question has no optical analogue, this comment says so rather than straining the terminology. Subsection G supplies the bridge between the two vocabularies.

F. Scope and Organization of This Comment

This comment concerns visible light emitted by LED products, and treats radiofrequency emission from those same products where the two occur together. It does not address radiofrequency exposure from wireless communication infrastructure except where that subject bears on the division of responsibility among federal agencies.

The Parts that follow are organized as follows.

Part II sets out the six duties of 21 U.S.C. § 360ii(a), distinguishes those qualified by a standard of judgment from those that are not, sets out the four powers conferred by § 360ii(b) and the instruments they supply for carrying those duties out, and examines § 360jj, under which the Secretary is to study electronic product radiation and report to Congress.

Part IV states the litigation, the regulatory petitions and the congressional action bearing on this subject, as a chronology, together with the Foundation's transmittal of reports of harm to the Center for Devices and Radiological Health and the agency's acknowledgment of receipt.

Part V reviews the scientific literature on the physical characteristics of LED emission and on the photobiological, hormonal, neurological and psychological effects reported from exposure, and identifies what is established, what is plausible and unstudied, and what rests on report alone.

Part VI describes the product classes at issue — headlamps, street lighting, flashing warning devices, interior and commercial lighting, displays, and security and deterrent systems — and the exposure conditions each produces.

Part VII presents the reports of harm, including the LED Incident Reports submitted to the Center for Devices and Radiological Health, and addresses whether those reports describe accidental radiation occurrences within 21 C.F.R. § 1000.3(a).

Part VIII addresses disability access, the self-evaluation obligation of 28 C.F.R. § 35.105, and the consequence for state and local entities of the absence of any federal performance standard against which to evaluate these products.

Part IX sets out the Foundation's requests to the Department, each tied to the statutory provision that supports it and to the question in the notice to which it responds.

Part X is the conclusion.

Appendices A through F contain the complete record of LED Incident Reports, the complete record of comments and signatures submitted to the headlamp petition, a bibliography, a list of the standards referred to, a chronology, and an index of hyperlinks.

G. Terminology, Units, and Measurement Conventions

The questions in this RFI are framed in the vocabulary of radiofrequency exposure. The subject of this comment is optical radiation, which has its own vocabulary. The two describe the same physics and in several instances the same quantity under a different name. This subsection sets the terms side by side so that a reader whose frame of reference is RF can follow Parts V and VI without translating as he goes.

Optical quantity and unit	What it measures	Counterpart in the vocabulary of this RFI
Wavelength, nanometers (nm)	Position within the electromagnetic spectrum.	Operating frequency. The same property expressed reciprocally: wavelength equals the speed of light divided by frequency. Visible light occupies roughly 380 to 780 nm.
Spectral power distribution	Radiant power as a function of wavelength across the emitted band.	Emission spectrum; operating frequency and bandwidth.
Irradiance, watts per square meter (W/m^2)	Radiant power arriving per unit area at a surface.	Power density, W/m^2. Not an analogy: the same quantity, in the same unit, differing only in the part of the spectrum measured.
Radiance, W/m^2 per steradian	Radiant power per unit area of source per unit solid angle — the physical basis of what is perceived as brightness.	No single counterpart. The nearest equivalent is power density referred to the emitting aperture rather than to the exposed surface.
Luminance, candela per square meter (cd/m^2)	Radiance weighted by the photopic luminous efficiency function, which describes the response of the human eye across wavelength.	A biologically weighted exposure quantity, standing to radiance as SAR stands to incident power density.
Illuminance, lux	Irradiance weighted by the same efficiency function; light arriving at a surface as the eye responds to it.	Power density adjusted for biological response.
Luminous intensity, candela (cd)	Luminous power emitted per unit solid angle in a given direction.	Effective isotropic radiated power; antenna gain and beamforming. Both describe concentration of emission into a direction rather than total output.

Optical quantity and unit	What it measures	Counterpart in the vocabulary of this RFI
Correlated color temperature, kelvin (K)	A single number describing the overall appearance of a source by reference to a blackbody radiator.	No counterpart, and the comment should say so. CCT is a descriptor of appearance, not of spectral content; two sources of identical CCT may differ substantially in short-wavelength output. It should not be used as a proxy for blue content.
Blue light hazard weighted radiance, W/m^2 per steradian	Radiance weighted by the blue light hazard function, which describes the wavelength dependence of photochemical injury to the retina.	Specific absorption rate. Both weight an exposure by the mechanism of biological effect rather than by raw emitted power, and both exist because unweighted power is a poor predictor of harm.
Percent flicker, or modulation depth	The difference between maximum and minimum output over a cycle, as a proportion of the sum.	Modulation characteristics.
Flicker index	The proportion of the waveform lying above its own mean; sensitive to waveform shape as percent flicker is not.	Modulation characteristics; waveform.
Pulse-width modulation frequency, hertz (Hz)	Repetition rate at which a driver switches the emitter on and off.	Pulse repetition frequency.
Duty cycle, percent	Proportion of each period during which the emitter is on.	Duty cycle. The same term with the same meaning.
Exposure duration and angular subtense	How long exposure persists, and the angle the source subtends at the eye — which determines the retinal area over which energy is deposited.	Duration of exposure; distance from the source and proximity to the body.
Cumulative exposure	Total dose accrued across repeated exposures over time.	Cumulative exposure over time.
Number and arrangement of emitters	How many separate sources are present in the field of view, their angular separation, whether their outputs are synchronized, and the composite waveform and summed irradiance they produce at the eye.	Antenna density; cumulative neighborhood exposure; simultaneous exposure to multiple sources. Question 15 asks for evidence on exactly these characteristics in the wireless context.

Why this comment reports radiometric quantities wherever it can.

The photometric quantities in the left-hand column — luminance, illuminance, luminous intensity, lumens — are the units in which lighting is ordinarily specified, procured, and regulated. They are also the units in which the Foundation and most of the public discuss this subject, and much of the literature in Part V reports them. They are not, however, measures of emitted energy. Every one of them is a radiometric quantity multiplied by the photopic luminous efficiency function, the CIE curve conventionally written $V(\lambda)$, which describes the relative brightness the cone-mediated visual system attributes to each wavelength in daylight conditions.

That weighting is appropriate to the question it was built for, which is how bright something looks. It is a poor instrument for the questions this comment raises, for four reasons.

First, $V(\lambda)$ is normalized to unity at 555 nanometers and falls steeply toward the short-wavelength end. A watt radiated at 450 nanometers, in the region where phosphor-converted white LEDs place their emission peak, contributes only a small fraction of the luminous output that the same watt contributes at 555 nanometers. A photometric measurement therefore discounts precisely

the part of the spectrum this comment is concerned with. Two sources of identical measured luminance may differ substantially in blue radiance, and the photometric figure will not disclose the difference. The function has long been acknowledged in the field to underestimate the contribution of the blue end of the spectrum, and successive corrections have been proposed for that reason.

Second, V(λ) models the photopic system. The conditions under which glare from vehicle headlamps and roadway lighting matters most are mesopic or scotopic, where the relevant response shifts toward shorter wavelengths. A unit calibrated to daylight cone response is being applied to night driving.

Third, visual brightness is not the only response at issue. Photochemical injury to the retina, melanopsin-mediated circadian and neuroendocrine effects, and the trigeminal and autonomic responses described in Part V each follow their own wavelength dependence, and none of them follows V(λ). Weighting an exposure by a brightness function and then reasoning about photochemical or circadian effect is a category error.

Fourth, photometric quantities describe luminous flux without describing the geometry that produces it. An LED emits from a small, flat, highly directional surface. For a given luminous output the source is smaller and the emission more concentrated than the incandescent and discharge sources the photometric conventions grew up around, so the radiance at the source and the irradiance at the retina can be far higher at equal measured lumens. Spectral power distribution, radiance, and source geometry are not recoverable from a photometric figure.

For those reasons this comment reports radiometric quantities — spectral power distribution, radiance, irradiance, and power density — wherever the underlying source permits, and reports photometric quantities where the source reports only those, identifying them as such. The same reasoning underlies the request at Part IX.C that the Department express its own studies in radiometric terms, which would also render them directly comparable with the radiofrequency exposure literature this RFI is principally addressed to.

The objection to radiometric specification, and the answer to it.

The Foundation states the counterargument because the comment is stronger for having met it. Photometric units are not wrong. They quantify light as the daytime visual system responds to it, which is what they were devised to do, and a great deal of existing regulation is written in them. Federal Motor Vehicle Safety Standard No. 108 specifies lamp output in candela. Roadway lighting practice is expressed in lux and in candela per square meter. A proposal to specify emissions radiometrically is a significant change to established practice, and the Foundation does not present it as a small one.

The objection to photometric specification is not that it is inaccurate. It is that it is answer-specific. Every photometric quantity is obtained by weighting spectral radiometric data through V(λ), the photopic luminous efficiency function. Any quantity so derived describes what a source does to daytime foveal vision and discards everything else in the spectrum as a matter of arithmetic. Where the response at issue is daytime visual response, that is exactly right. Where the response at issue is melanopsin-mediated circadian regulation, or photochemical injury to the retina, or a neurological response to modulation, the weighting removes precisely the information the question requires.

The consequence is concrete rather than theoretical. Two sources of identical luminous output can differ substantially in short-wavelength content, because V(λ) assigns little weight to the region where melanopic sensitivity and the blue-light-hazard function are greatest. A specification written in lumens or candela cannot distinguish them. A specification written in spectral irradiance, or in a quantity weighted for the response under consideration, can.

The precedent for doing so exists inside this subchapter. Part 1040 is titled Performance Standards for Light-Emitting Products, and the standard it prescribes at § 1040.30 for high-

intensity mercury vapor discharge lamps is not written in photometric terms at all. It addresses shortwave ultraviolet emission, requiring self-extinguishing lamps to cease operation within a cumulative operating time not exceeding fifteen minutes following complete breakage or removal of the outer envelope, and requiring non-self-extinguishing lamps to bear a warning that the lamp can cause serious skin burn and eye inflammation from shortwave ultraviolet radiation if the outer envelope is broken or punctured. The Department has already written a lighting standard around a radiometric hazard that luminous output does not describe.

The Foundation therefore does not ask the Department to abandon photometric units, and does not ask it to re-specify existing standards. It asks that where a criterion is intended to control a response other than daytime visual response, the quantity specified be the one that corresponds to that response, weighted by the appropriate action spectrum and reported with the spectral data from which it was derived.

Three families of characteristics, and four families of effect.

The quantities in the table group into three families, and this comment uses that grouping throughout. Spectral characteristics describe what wavelengths are emitted and in what proportion. Spatial characteristics describe the geometry of the emission: the radiance of the emitting surface, its apparent size and the angle it subtends at the eye, the directionality of the beam, the uniformity of output across the surface, and the number, separation, and arrangement of emitters within the field of view. Temporal characteristics describe how the output varies in time: modulation depth and waveform, drive and flash frequency, duty cycle, rise and fall times, the duration of a single exposure, and exposure accumulated across repetitions.

Those three families bear on four families of effect, which the Foundation identifies as photobiological, hormonal, neurological, and psychological. The mapping between them is not one to one. Short wavelength content bears on photochemical retinal injury and on melanopsin-mediated hormonal response; source radiance and apparent size bear on retinal irradiance and on disability glare; flash rate and waveform bear on photosensitive and other neurological response; and several of the responses reported in Part VII appear to depend on combinations across families rather than on any single characteristic.

The Foundation submits that evaluation and, in due course, standards must address all three families. A criterion that limits one while leaving the others unconstrained does not protect against the harms described in Part VII. A luminous output limit that permits any spectrum and any flash rate, or a spectral limit that permits any radiance, leaves the mechanism of injury untouched.

The four terms are used in this comment as follows. Photobiological refers to effects on ocular tissue, principally photochemical and thermal injury to the retina. Hormonal refers to effects mediated by the non-visual photoreceptive pathway, principally melatonin suppression and circadian phase shift. Neurological refers to effects on the nervous system, including photosensitive seizure, migraine, sensory processing responses, and the autonomic stress response. Psychological refers to the affective and emotional responses that exposed individuals report: loss of a sense of wellbeing, agitation, fear, panic, and, in a small number of the reports described in Part VII, hopelessness and suicidal ideation.

The four are used descriptively, to name domains of reported effect. They are not mutually exclusive and the boundaries between them are not sharp. An acute stress response has both an autonomic component, which is measurable, and an experienced component, which is reported; this comment treats the first as neurological and the second as psychological, and says so wherever both appear.

One consequence of this table is worth stating rather than leaving to be noticed. Question 5 asks how a classification system should account for operating frequency, power density, specific absorption rate, modulation and pulse characteristics, duty cycle, beamforming, duration of

exposure, distance from the source, proximity to the body, and cumulative exposure over time. Every one of those has a counterpart in the column above. The framework the question proposes transfers to optical radiation with the substitution of units, and Part IX.G answers the question on that basis.

H. Summary of Requests to the Department

The Foundation's requests are developed at Part IX and summarized here. In each case the request is addressed to the Department, and in each case the Foundation identifies the statutory provision it understands to support it.

1. Confirm that visible light emitted by light-emitting diode products is electronic product radiation within 21 U.S.C. § 360hh(1)(A), and that it is subject to the duties of § 360ii. The Final Response of May 24, 2024 proceeds on that footing; the Foundation asks that it be stated. (Part IX.A.)

2. Publish the evidentiary basis for the determination of May 24, 2024 — the literature search protocol, the databases and date ranges searched, the inclusion and exclusion criteria, the studies identified, and the appraisal applied to them. The determination rests on a review the public has not seen. (Part IX.B.)

3. Undertake the research the statute directs: the testing and evaluation of emissions and conditions of exposure required by § 360ii(a)(4), the development of control measures under § 360ii(a)(5), and the control measures and evaluations those paragraphs require. The studies and reports to Congress directed by § 360jj, none of which has been performed for visible light from LED products. (Part IX.C.)

4. Establish adverse event reporting and surveillance for optical radiation, and determine whether the reports described in Part VII are accidental radiation occurrences within 21 C.F.R. § 1000.3(a), reportable under § 1002.20. (Part IX.D.)

5. Exercise the interagency liaison duty of § 360ii(a)(3) and (a)(6) with the agencies whose programs place these products in the public way, including the Department of Transportation, the National Highway Traffic Safety Administration, the Federal Highway Administration, the Department of Energy, the Environmental Protection Agency, the Consumer Product Safety Commission, the Access Board and the Department of Labor; and send each an express written invitation to consult, stating on the record which invitations were sent and what replies were received. (Part IX.E.)

6. Require disclosure of the emission characteristics of LED products — spectral power distribution, source radiance, modulation depth and waveform, flash rate, and rise and decay times — so that purchasers, public entities and exposed individuals can know what a product emits. (Part IX.F.)

7. Develop a classification system for optical radiation exposure organized by the spatial, spectral and temporal characteristics set out at Part I.G, rather than by luminous output alone; and, as the immediately available part of that, assign radiation-emitting product codes to the light-emitting diode product classes that presently have none, and amend Table 1 to 21 C.F.R. § 1002.1 so that those classes report. Thirteen codes are proposed in the Center's own form at Appendix F.2, against the census of those already assigned at Appendix F.1. (Part IX.G.)

8. Reconstitute the Technical Electronic Product Radiation Safety Standards Committee, with the membership balance its charter requires, so that the statutory advisory mechanism is available for this subject. (Part IX.H.)

9. Prescribe a performance standard under § 360kk limiting the temporal light modulation of general illumination and display products, for which the quantities are settled and a consensus body has already written a numerical criterion; and prescribe standards on the spectral, intensity

and geometric characteristics of the product classes identified in Part VI once the research in Part IX.C supplies the quantities in which they could be expressed. (Part IX.I.)

10. Conduct the study directed by § 360jj(a)(2) as it bears on products emitting visible light, which the agency's own 1970 report shows was confined to three classes of ionizing radiation sources, and report the result to Congress under § 360jj(a), inviting the participation of other Federal departments and agencies as subsections (b) and (c) direct. (Part IX.K.)

11. Address expressly the populations identified in Part VII as disproportionately affected, including people with photosensitive epilepsy, migraine and photophobia, traumatic brain injury, and autism and other sensory processing differences. (Part IX.L.)

12. Consider the additional matters set out at Part IX.M, including the division of responsibility between this Department and the agencies that have declined the question as lying outside their authority. (Part IX.M.)

II. 21 U.S.C. § 360ii REQUIREMENTS

A. Statutory Framework: FD&C Act §§ 531-542 (21 U.S.C. §§ 360hh-360ss)

This Part sets out the duties the statute imposes and asks, for each, whether it has been discharged for the products this comment concerns. Subsection A describes the statutory and regulatory architecture within which those duties sit, because the architecture itself answers one question the Foundation is often asked: where, in the federal regulatory system, a standard for light-emitting diode products would go.

1. The Radiation Control for Health and Safety Act of 1968 and its transfer into the FD&C Act

The Radiation Control for Health and Safety Act of 1968, Public Law 90-602, established a federal program to control radiation emitted by electronic products. It was not originally part of the Federal Food, Drug, and Cosmetic Act. It was enacted as part of the Public Health Service Act and classified to subpart 3 of part F of subchapter II of chapter 6A of title 42 of the United States Code, at 42 U.S.C. § 263c and following.

It was renumbered into the Federal Food, Drug, and Cosmetic Act by section 19(a)(4) of Public Law 101-629, November 28, 1990, 104 Stat. 4530, as subsequently amended by section 4(a)(2) of Public Law 103-80, August 13, 1993. The provisions now appear as sections 531 through 542 of that Act, codified at 21 U.S.C. §§ 360hh through 360ss, as follows.

§ 360hh (FD&C § 531) — Definitions.
§ 360ii (FD&C § 532) — Program of control.
§ 360jj (FD&C § 533) — Studies by Secretary.
§ 360kk (FD&C § 534) — Performance standards for electronic products.
§ 360ll (FD&C § 535) — Notification of defects in and repair or replacement of electronic products.
§ 360mm (FD&C § 536) — Imports.
§ 360nn (FD&C § 537) — Inspection, records, and reports.
§ 360oo (FD&C § 538) — Prohibited acts.
§ 360pp (FD&C § 539) — Enforcement.
§ 360qq (FD&C § 540) — Repealed.
§ 360rr (FD&C § 541) — Federal-State cooperation.
§ 360ss (FD&C § 542) — State standards.

One of those sections no longer exists. Section 360qq required an annual report to Congress on the administration of this part. It was repealed by section 601(a)(2)(A) of title VI of Public Law 105-362, November 10, 1998. Part II.I addresses what follows from that repeal, and what does

not, because the repeal of a recurring reporting requirement is sometimes offered as though it had removed the study obligations that remain in §§ 360ii and 360jj. It did not.

The architecture, and why the distinction matters.

Read together, these sections do four things. Section 360hh defines the subject matter. Section 360ii states the program: a set of duties the Secretary is to carry out. Sections 360jj and 360kk supply two instruments — studies and reports to Congress, and performance standards. The remaining sections provide the machinery by which a standard, once prescribed, is enforced: notification and repair, imports, inspection and records, prohibited acts, enforcement, and the relationship with the States.

The distinction between the program and its instruments is the one on which much of this comment turns. The duties in § 360ii do not depend on a performance standard having been prescribed. They are the duties under which an agency would determine whether a standard is needed at all: to plan and support research, to maintain liaison with other federal bodies, to study and evaluate emissions and conditions of exposure, and to develop and evaluate control measures. Section 360kk is what the Secretary may do once those duties have been discharged. It is not a precondition to performing them.

The Foundation makes this point at the outset because the agency's responses have tended to treat the two as a single question. The Final Response of May 24, 2024 declined on the ground that a performance standard has not historically been considered necessary. That is an answer about § 360kk. It is not an answer about whether the research, liaison, study and evaluation duties of § 360ii(a) have been carried out, and Parts II.C through II.G ask that question separately for each of them.

2. Implementing regulations: 21 CFR subchapter J, parts 1000-1040

The implementing regulations appear in subchapter J of chapter I of title 21 of the Code of Federal Regulations, which is titled Radiological Health. It comprises the following parts.

Part 1000 — General.
Part 1002 — Records and Reports.
Part 1003 — Notification of Defects or Failure to Comply.
Part 1004 — Repurchase, Repairs, or Replacement of Electronic Products.
Part 1005 — Importation of Electronic Products.
Part 1010 — Performance Standards for Electronic Products: General.
Part 1020 — Performance Standards for Ionizing Radiation Emitting Products.
Part 1030 — Performance Standards for Microwave and Radio Frequency Emitting Products.
Part 1040 — Performance Standards for Light-Emitting Products.

Part 1040 is the regulatory home of the standard this comment concerns.

Part 1040 is titled Performance Standards for Light-Emitting Products. It is not empty. It contains four standards:

§ 1040.10 — Laser products.
§ 1040.11 — Specific purpose laser products.
§ 1040.20 — Sunlamp products and ultraviolet lamps intended for use in sunlamp products.
§ 1040.30 — High-intensity mercury vapor discharge lamps.

The Foundation asks the Department to hold those four titles alongside the subject of this comment. The part exists. It is named for the class of product at issue. It is populated. It contains a standard for a coherent-light source, a standard for a particular application of that source, a standard for a product that emits ultraviolet radiation deliberately, and a standard for a discharge lamp used in general illumination. It contains nothing for the light-emitting diode, which in the

years since the last of those standards was written has displaced the discharge lamp and the incandescent lamp across essentially all of general, roadway, vehicular and signalling illumination.

The question this Part asks is therefore not whether such a standard would be novel in kind, or whether it would require a new regulatory structure. It would be the fifth entry in an existing part, issued under an existing statutory authority, administered by an existing center. The question is why the duties that precede such a standard have not been carried out.

3. The Center for Devices and Radiological Health and program administration

The Food and Drug Administration states that these provisions are administered by the Center for Devices and Radiological Health. The agency describes the radiation control provisions as "originally enacted as the Radiation Control for Health and Safety Act of 1968" and as "located in Sections 531 through 542 of the FD&C Act."

The Center was formed in 1982, when the organizational units of the agency that regulated medical devices and radiation-emitting products were merged. Its predecessors were the Bureau of Medical Devices and the Bureau of Radiological Health.

That lineage is not incidental to this comment. The Bureau of Radiological Health is the body that performed the one study conducted under the predecessor of § 360jj, published as BRH/DEP 70-30 and described at Part II.I. The program that performed that study in 1969, and the program that has declined to perform another for light-emitting diode products, are the same program under different names.

Every agency action described in Part IV sits within this Center. The Final Response of May 24, 2024 was issued by its Office of Policy. The interim response of June 18, 2026 was issued by the same office. The LED Incident Reports described in Part VII were transmitted to its customer service address and acknowledged from it. The records sought in the Freedom of Information Act litigation described at Part IV.D are its records.

The Foundation does not submit that this program lacks a statutory basis, a regulatory home, or an administering body. All three exist, and have existed since 1968, 1969 and 1982 respectively. The submission is narrower and is the subject of the subsections that follow: that the duties stated in 21 U.S.C. § 360ii(a) have not been discharged for the class of product this comment concerns.

A structural recommendation, offered once

The Foundation raises an organizational question here, states the limits on it, and does not return to it.

The Center administers two bodies of law that differ in almost every operational respect.

Medical device regulation operates through premarket review. A manufacturer that wishes to market a device must come to the agency. There are statutory timeframes for review, a queue of pending submissions, and a user fee program that funds a substantial part of the work. The regulated party has a continuing reason to engage the agency, and the agency works against deadlines.

Electronic product radiation control operates through none of those things. There is no premarket clearance. A manufacturer of luminaires, headlamps or transmitters need never approach the agency at all. There is no fee, no queue and no clock. The people exposed to the radiation have no transaction with the agency of any kind, and no procedural occasion on which their interest is required to be considered.

The funding asymmetry is worth stating concretely, because it is the mechanism by which the structural point operates. Medical device review is supported in substantial part by fees paid by the industry whose products are reviewed, under a statutory program reauthorized by Congress at

intervals, and the program carries performance goals negotiated as part of each reauthorization. Electronic product radiation control has no fee, no reauthorization cycle, and no negotiated performance goal. A manufacturer of luminaires or transmitters pays the agency nothing and asks it for nothing.

Where two functions of that description are administered by one Center, the one with fees, deadlines and a queue will receive attention and the one with none of them will receive what is left. The Foundation offers no view about anyone's intentions and makes no criticism of any official. It observes the outcome, which Part II.M sets out: no new performance standard for any lamp since 1979; a statutory advisory committee that last convened in 2016; the study directed by § 360jj performed once, in 1969; and one documented instance of interagency consultation in the history of the program.

The required expertise differs as well. The products this comment concerns — roadway and area lighting, vehicle lamps, flashing warning devices, retail and workplace luminaires, consumer lamps and displays, and on the radiofrequency side the transmitters and wireless equipment this request for information is directed at — are not clinical products and are not assessed clinically. The disciplines are photometry and radiometry, radiofrequency engineering, photobiology, occupational and environmental exposure assessment, and human factors. Those are not the disciplines of premarket device review.

One detail illustrates the position better than the general argument does. The paper the Center presented to its statutory advisory committee in 2016 on light-emitting diodes and ultraviolet lamps, described at Part II.K.5, was prepared within the Office of In Vitro Diagnostics and Radiological Health. Radiological health was, at that time, administratively joined to in vitro diagnostics, a field with which it has nothing in common.

The subject matter of this request for information is the non-medical half. The Department has asked the public about exposure to electromagnetic radiation from products in ordinary use, in homes, workplaces, vehicles and public rights-of-way. That is the subject which has no organizational home of its own.

The Foundation accordingly recommends that the Department consider separating the two functions: one organizational unit responsible for medical devices, and a second responsible for electronic product radiation from non-medical products — lighting, vehicle lamps, displays and consumer products, and radiofrequency emitters including transmitters and wireless networking equipment — with its own leadership, its own appropriation and its own reporting line.

Three limits on that recommendation, which the Foundation states rather than leaving to be supplied.

- It is a recommendation and not a contention. Nothing in 21 U.S.C. §§ 360hh to 360ss requires any particular organizational arrangement, and how the Department arranges itself is for the Secretary and the Commissioner, and in some respects for Congress. The Foundation asserts no entitlement and alleges no violation.
- It would cost money, and the Foundation does not pretend otherwise. What it asks the Department to weigh against that cost is the cost of the present arrangement, which falls on people who have no procedural means of registering it.
- And it is not a precondition to anything else in this comment. Every duty described in this Part can be performed within the existing structure, beginning immediately. The Foundation raises the structural question because it appears to explain the record, not because the record excuses postponement pending a reorganization. If this recommendation is taken up it should be taken up alongside the requests at Part IX and not instead of them.

Short of a new center, a lesser step would address much of what Part II describes: a distinct office for electronic product radiation control, with its own budget line, its own director, and a published

annual accounting of what has been done during the year under each paragraph of § 360ii(a). The absence of such an accounting is why this comment has had to assemble one from the outside.

B. Statutory Definitions Reach LED Products

The duties examined in the subsections that follow attach to electronic products that emit electronic product radiation. Whether a light-emitting diode product is such a product is therefore the threshold question for this Part. It is also, as matters stand, not a contested one, and the Foundation sets out the definitions here not to win an argument but to fix the premise from which the rest of Part II proceeds.

1. "Electronic product radiation" includes any non-ionizing electromagnetic radiation — § 360hh(1)(A)

Section 360hh(1) defines electronic product radiation in two subparagraphs. Subparagraph (A) covers:

> "any ionizing or non-ionizing electromagnetic or particulate radiation"

and subparagraph (B) covers any sonic, infrasonic, or ultrasonic wave, in each case where the radiation or wave is emitted from an electronic product as the result of the operation of an electronic circuit.

Three features of subparagraph (A) bear on this comment.

The first is the word any, which appears at the head of the subparagraph and governs everything after it. The definition is not drawn by reference to a particular hazard, a particular technology, or a particular part of the spectrum.

The second is that the subparagraph divides the electromagnetic spectrum once, into ionizing and non-ionizing, and then includes both. Having made the only division it makes, it declines to treat it as a limit. Visible light is non-ionizing electromagnetic radiation. It falls on the non-ionizing side of the one distinction the definition draws, and that side is expressly included.

The third is what the subparagraph does not contain. There is no wavelength boundary, no frequency boundary, and no exclusion for radiation that is visible, intended to be seen, or emitted for the purpose of illumination. A definition that reaches ionizing radiation at one end and, through subparagraph (B), infrasonic waves at the other, does not plausibly stop at the edges of the visible band.

2. "Electronic product" — § 360hh(2)

Section 360hh(2) defines an electronic product as a manufactured or assembled product which, when in operation, contains or acts as part of an electronic circuit and emits electronic product radiation, together with any component, part or accessory intended for use in such a product.

A light-emitting diode luminaire satisfies both elements, and satisfies them in the ordinary course of its operation rather than in some unusual condition. It contains an electronic circuit: a driver, which converts supply power to the regulated current the diode requires and which in most contemporary products switches at high frequency. And it emits electronic product radiation as a result of that circuit's operation: the diode emits visible light precisely because current is passed through it.

The relationship between circuit and emission is more direct here than in several products already regulated under this part. In a television receiver with a cathode ray tube, x-radiation is an unintended by-product of the accelerating voltage. In a microwave oven, the emission the standard controls is leakage from a cavity designed to contain it. In a light-emitting diode product the radiation at issue is the output the circuit exists to produce. If the statutory phrase as the

result of the operation of an electronic circuit reaches an unintended by-product, it reaches an intended output.

The definition also extends to components, parts and accessories intended for use in such a product. That reaches the diode packages, modules, drivers and lamps sold for incorporation into finished luminaires and vehicles, which is where many of the characteristics described in Part V are in fact determined.

3. Parallel definitions at 21 CFR 1000.3(j) and (k)

The regulations repeat the statutory definitions in substantially the same words. Section 1000.3(k) defines electronic product radiation as any ionizing or nonionizing electromagnetic or particulate radiation, or any sonic, infrasonic, or ultrasonic wave, that is emitted from an electronic product as the result of the operation of an electronic circuit. Section 1000.3(j) defines an electronic product as any manufactured or assembled product which, when in operation, contains or acts as part of an electronic circuit and emits, or in the absence of effective shielding or other controls would emit, electronic product radiation.

One phrase in § 1000.3(j) is worth pausing on, because it answers an objection that might otherwise be made. The regulation reaches a product that emits electronic product radiation "or in the absence of effective shielding or other controls would emit" it. The definition therefore contemplates that emission may be controlled, and treats the product as within the program either way. A product is not removed from the definition by the fact that its emission is deliberate, nor by the fact that it could be controlled and is not.

4. FDA has previously regulated light-emitting products under this authority — 21 CFR part 1040

The Department need not accept this reading on the Foundation's account of the text, because the agency has acted on it, twice over.

It has acted on it in the regulations. Part 1040, described at Part II.A.2, is titled Performance Standards for Light-Emitting Products and prescribes standards for laser products, specific purpose laser products, sunlamp products and ultraviolet lamps, and high-intensity mercury vapor discharge lamps. Those are light-emitting products regulated under this authority. The last of them is a general illumination source.

And it has acted on it for light-emitting diode products specifically. The Center for Devices and Radiological Health docketed four citizen petitions concerning visible light emitted by LED products, reviewed them, and issued a Final Response on the merits on May 24, 2024. That response did not decline on the ground that the subject lay outside the electronic product radiation control authority. It declined on a different ground, stating that "historically FDA has not considered performance standards to control the radiation from LEDs in the visible wavelengths to be necessary for the protection of the public health and safety."

A statement that a standard has not been considered necessary is a statement about necessity. It presupposes the authority to prescribe one. An agency does not reach the question whether a standard is necessary for a class of radiation it regards as outside its program.

What follows from the definitions, and what does not.

The Foundation does not contend that the definitions decide anything about whether a performance standard should issue. They do not. What they decide is which duties attach.

The duties in § 360ii(a) are stated as duties of the Secretary with respect to electronic product radiation. They are not conferred product by product, and they do not wait upon a decision to bring a product within the program. Where the definition is satisfied, the duties attach by operation of the statute. The agency has discretion in how it discharges several of them, and Part

II.C through Part II.G examine that discretion provision by provision. It does not have discretion to treat a product the definition reaches as though the definition did not reach it.

5. LED products that emit both visible light and radiofrequency energy

A further feature of these products bears on which parts of the subchapter they engage. Many LED products emit in two regions of the spectrum at once.

The visible emission is the intended output. The radiofrequency emission arises from the driver. Contemporary LED drivers are switching power supplies, converting supply power by switching at frequencies typically in the tens to hundreds of kilohertz, and switching circuits radiate. A growing proportion of installed luminaires, streetlights and signage also contain deliberate radiofrequency transmitters for networked control and telemetry.

Both emissions are electronic product radiation within § 360hh(1)(A), and both arise from the operation of an electronic circuit within the same product. The consequence for this Part is that a single product may engage the performance standards of part 1030, governing microwave and radiofrequency emitting products, and the part 1040 standards for light-emitting products, and that the duties of § 360ii(a) attach as to both.

The Foundation notes this here for a practical reason. This request for information is directed principally at radiofrequency and wireless exposure. The products this comment concerns are, in a substantial and growing proportion of cases, radiofrequency emitters as well as light emitters. They are not an adjacent subject to the one the Department has asked about. They are in part the same subject.

6. The agency has classified these products already, and the classification is in operational use

Subsections 1 through 3 show that the statutory and regulatory definitions reach light-emitting diode products as a matter of text. Subsection 4 shows that the agency has regulated light-emitting products under this authority before. This subsection shows something narrower and, the Foundation suggests, harder to answer: that the question is not open as a matter of the agency's own practice, because the agency has already classified these products as radiation-emitting electronic products and uses that classification every working day.

The Center for Devices and Radiological Health maintains a classification of radiation-emitting electronic products, published at https://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfPCD_RH/classification.cfm. For each class it records a product code, a definition, the type of radiation emitted, the reports required and the performance standard applicable. The Foundation has read it and sets out the whole of the relevant category at Appendix F.1.

Five of its classes are light-emitting diode products. They are the illumination lamp; the diode used for signaling, tracking or triggering; the diode in toys and entertainment products; the bare diode and diode array sold as a component; and the low-emission diode used as an indicator or decoration, a class whose definition expressly reaches display backlighting and seasonal light strings. Three further classes are displays, one of which is defined to include, in the Center's own words, light-emitting diode, organic light-emitting diode, liquid crystal and plasma technology televisions and monitors.

Each of those eight classes records the radiation type as Optical and states that the general radiological health requirements at parts 1000 to 1005 apply to it. That is the agency, in its own operational record, characterizing the visible light emitted by a light-emitting diode product as radiation emitted by an electronic product, and applying this subchapter to it. Each of the eight also records that no performance standard applies, which is the subject of Part IX.I and not of this subsection.

The classification is not notional. The complete FDA Product Code must be transmitted to Customs and Border Protection at the time of entry for every regulated article imported into the United States, under the rule this Department promulgated at 81 Fed. Reg. 85,854 (Nov. 29, 2016), effective December 29, 2016, which added subpart D to 21 C.F.R. part 1 and which identifies section 536 of the Federal Food, Drug, and Cosmetic Act, 21 U.S.C. § 360mm, as its authority as to radiation-emitting electronic products. The Department described the product code in that rulemaking as a critical data element for its admissibility review. A light-emitting diode lamp entering the United States is therefore identified to this Department, by a code this Department assigned, under a rule this Department wrote, as a radiation-emitting electronic product. Part II.H.20 sets out the interagency relationship through which that happens and Part VI.V the tariff mechanism.

The Foundation states the limits of the point in the same breath. A product code is an administrative classification and not a rule; it binds nobody and is not a determination under any provision of the Act. The entries recording that no performance standard applies are statements about the standards that exist, not concessions that one is required. And a classification maintained for entry and reporting purposes does not by itself determine which of the duties in § 360ii(a) attach. What it does establish is that the premise on which those duties would rest is not in doubt in the agency's own records, and that is why the request at Part IX.A asks only that the Department say so.

C. § 360ii(a)(1) — Develop and Administer Performance Standards

Paragraph (a)(1) directs the Secretary to develop and administer performance standards for electronic products. Unlike paragraph (a)(2), it operates through a particular mechanism, and that mechanism carries a condition. This subsection sets out the mechanism, what has been done under it for light-emitting products, and what has not been done for visible light emitted by LED products. It is the one duty in § 360ii(a) that the Final Response of May 24, 2024 addressed, and the Foundation sets it out first for that reason.

1. The § 360kk standard-setting mechanism

Section 360kk(a)(1) provides, in its first sentence:

> The Secretary shall by regulation prescribe performance standards for electronic products to control the emission of electronic product radiation from such products if he determines that such standards are necessary for the protection of the public health and safety.

The structure is conditional and the condition is a determination. Once the Secretary determines that a standard is necessary, prescription is mandatory; the word is shall. Until that determination is made, prescription is not required. The Foundation accepts that reading without qualification. What follows from it is set out at Part I.C.8: the judgment committed to the Secretary here is downstream of the research and evaluation directed by § 360ii(a)(4), and a determination that a standard is not necessary is not a determination that the research is not required.

Four further features of the section bear on this comment.

First, the same sentence that confers the judgment also constrains how it is to be exercised. The paragraph continues:

> In the development of such standards, the Secretary shall consult with Federal and State departments and agencies having related responsibilities or interests and with appropriate professional organizations and interested persons, including representatives of industries and labor organizations which would be affected by such standards, and shall give consideration to —

and then enumerates five considerations. Two of them are directly engaged by this comment. Subparagraph (A) requires consideration of:

> the latest available scientific and medical data in the field of electronic product radiation

and subparagraph (D) requires consideration of:

> the adaptability of such standards to the need for uniformity and reliability of testing and measuring procedures and equipment

Subparagraph (B) directs attention to the standards currently recommended by other Federal agencies and by public or private groups having expertise in the field; subparagraph (C) to reasonableness and technical feasibility; and subparagraph (E) to the performance of components and accessories in the products for which they are designed.

Subparagraph (A) is worth pausing on. The latest available scientific and medical data is a mandatory consideration, and the Final Response characterized the available literature as low in quality, small in sample, and inconsistent in result. A characterization of the data is not a substitute for considering it, and the Foundation asks the Department to publish what was considered and how. Part IX.H.2.

Subparagraph (D) is worth pausing on for a different reason. It presupposes testing and measuring procedures to which a standard could be adapted. For the emission characteristics at issue here the measurement conventions in general use are photometric, and photometric quantities are weighted by the spectral sensitivity of daytime human vision rather than by the quantity relevant to any biological effect. Part II.G and Part V.A address this. The consequence for this subsection is that developing the measurement procedure is itself part of what the statute contemplates, not a precondition the agency may treat as unmet.

Second, Congress set a deadline for the first exercise of the authority. The same paragraph provides that standards "may be prescribed from time to time whenever such determinations are made, but the first of such standards shall be prescribed prior to January 1, 1970." That deadline was met and is long past. The Foundation notes it only for what it shows about the expected tempo of the program: the authority was given to be used, promptly, and not held in reserve against a future showing.

Third, the section anticipates product-by-product treatment and revision. Paragraph (a)(2) permits "different and individual performance standards, to the extent appropriate and feasible, for different electronic products so as to recognize their different operating characteristics and uses," and paragraph (a)(4) permits the Secretary to amend or revoke any standard prescribed. The breadth of a product category is therefore not an obstacle to acting, and a standard once prescribed is not an irrevocable commitment. Subsection (c) provides that a standard takes effect not less than one and not more than two years after issuance, so a standard prescribed today would not bind manufacturers for at least a year.

Fourth, and this is the feature with the most immediate practical consequence, the mechanism contains a mandatory consultation step. Subsection (f) directs the Secretary to establish the Technical Electronic Product Radiation Safety Standards Committee, "which he shall consult before prescribing any standard under this section." The direction is unqualified and admits of no exception.

The Foundation sets out what performing that step involves, because the requirement is more than a formality and the detail is in the agency's own regulations. Part II.K.2.

> The Commissioner must submit the proposed standard to the Committee, together with other relevant information, before issuing a proposed regulation in the Federal Register. 21 C.F.R. § 14.125(a).
>
> The Committee must be able to deliberate, which requires a quorum. The regulation fixes it at ten of the fifteen members, of whom at least three must come from each of the government, industry and general public categories. § 14.125(c).

The consultation is completed by a report. The Chairperson of the Committee ordinarily submits it to the Commissioner within sixty days, extendable by thirty. § 14.125(d). The officer who makes that report is the Chair.

The deliberation must occur at a meeting, and a meeting of this Committee requires public notice and a record that is available for public inspection. § 14.130, and the Federal Advisory Committee Act.

So the step requires a constituted committee, a quorum drawn from three categories, a Chair to report, a noticed meeting, and a report delivered within a period measured in days.

The Department publishes the Committee's roster, and Part II.K.4 sets out what it states. In short: the roster records twelve of the fifteen seats as vacant; three members are listed, two in the government category and one in the general public category; no person at all is listed in the industry category; the office of Chairperson is shown as vacant; all three members were appointed on April 11, 2022 and all three terms ended on December 31, 2025; and no notice of any meeting of this Committee has been published since September 22, 2016.

The consequence follows as arithmetic and not as argument. The quorum of this Committee is fixed by regulation at ten members including at least three from each of the three categories, 21 C.F.R. § 14.125(c). Three members are listed and the industry category is empty. A quorum cannot be constituted from the membership the Department's own roster shows; the officer who is to report the consultation to the Commissioner under § 14.125(d) is not in office; and the consultation that § 360kk(f) makes a precondition to prescribing any standard therefore cannot presently be performed.

The Foundation states the limits of that conclusion. The roster records that vacancies may be in the nomination process and bears no date of revision, so appointments may have been made that it does not show; but the shortfall is twelve appointments, and the industry category requires three members where there are none. Whether a member whose term has expired may continue to serve pending replacement is a question the Foundation does not resolve; but if all three continue to serve the number is still three. And the Foundation does not say the Committee is empty or defunct, only that it cannot presently reach a quorum. Part II.K.4.

If the Department's position is that the Committee can nevertheless be convened, the Foundation invites it to say so in response to this comment, and to state the number of members then seated, whether a Chair is in office, and whether anyone has been appointed to the industry category. That would dispose of this subsection's concern entirely and the Foundation would welcome it. Absent such a statement, the position is that a standard cannot lawfully be prescribed until the seats are filled, and the delay falls not on the science but on the composition of a committee of fifteen people whose operation the charter costs at approximately one hundred and thirty thousand dollars a year, all in. Part II.K.3.

The consequence is therefore structural rather than argumentative, and it is why this request appears in Part IX independently of every other. Whatever view the Department takes of whether a standard for any light-emitting product is necessary, seating the Committee and convening it resolves no contested question about the underlying science, commits the Department to no conclusion, and is a step it can take on its own motion. The Foundation asks it to. Part IX.H.

2. Light-emitting products for which standards exist

The standards prescribed under this authority are collected in 21 C.F.R. subchapter J. One part of it is addressed to this subject by its title: part 1040, Performance Standards for Light-Emitting Products. It contains four sections.

§ 1040.10, laser products, and § 1040.11, specific purpose laser products.

§ 1040.20, sunlamp products and ultraviolet lamps intended for use in sunlamp products.

§ 1040.30, high-intensity mercury vapor discharge lamps.

Four things these standards establish are worth stating, because each answers an objection that might otherwise be made to regulating LED products under this authority.

The first is that the agency already regulates emission in the visible band. Laser products emit visible light, and §§ 1040.10 and 1040.11 regulate them. The Foundation does not suggest that LED products are lasers; they differ in coherence and in collimation, and the difference is real, though Part V.C.2.k sets out why it is a difference of degree along a measurable axis rather than a difference in kind. The point here is about the criterion rather than the product. What brought laser products within a performance standard was the manner in which the energy is delivered — its concentration, its radiance, the duration of exposure — and not the question whether the radiation is visible or is intended to be seen. Nothing in part 1040 treats visibility, or an illumination purpose, as a reason not to regulate.

The second is that the agency already specifies limits in radiometric and spectrally resolved terms. Section 1040.20 expresses irradiance in watts per square centimeter and imposes a limit on the ratio of irradiance in one wavelength interval to irradiance in another: the ratio of irradiance in the range above 200 through 260 nanometers to irradiance in the range above 260 through 320 nanometers may not exceed 0.003. That is a standard written in the units of the radiation rather than in the units of its appearance to a human observer, and it divides the spectrum where the biology divides it. A standard for LED products of the kind the Foundation has described would take the same form. The precedent for it is inside subchapter J.

The third is that the agency already regulates a lamp product for an effect that is not visual. Sunlamp products are regulated because of what their ultraviolet output does to skin and eyes, not because of anything to do with seeing. The subject matter of a light-emitting product standard has never been confined to visual performance.

The fourth is that the form of control need not be an emission limit. Section 1040.30 addresses the hazard from high-intensity mercury vapor discharge lamps through an operational requirement: a self-extinguishing lamp must cease operation within a cumulative operating time not exceeding fifteen minutes after breakage of the outer envelope. Where the hazard arose from a condition rather than from a level, the agency wrote a standard addressed to the condition.

3. Absence of any performance standard for LED visible light

No section of part 1040 reaches incoherent visible light emitted by light-emitting diode products. For that radiation there is no emission limit, no prescribed measurement method, no labeling requirement, and no requirement that a manufacturer disclose the spectral power distribution, the source radiance, or the temporal characteristics of what its product emits. Part VI describes the product classes at issue and Part IX.F states the disclosure the Foundation asks for.

The agency declined to prescribe such a standard by the Final Response of May 24, 2024, on the ground that standards for every type of electronic product are not necessary. Part I.C examines the reasons given. Two observations belong here rather than there.

The first concerns what the declination settles. Paragraph (a)(1) is the only one of the six duties in § 360ii(a) whose mechanism carries a condition of necessity, and it is the only one the Final Response addressed. The letter is a disposition of the request for a performance standard. It is not a disposition of the duties in paragraphs (a)(2) through (a)(6), which the letter does not discuss and which carry no comparable condition. Parts II.D through II.H take each in turn.

The second concerns the mechanism's present condition. Even if the Department were persuaded tomorrow that a standard is necessary, the consultation that § 360kk(f) requires before prescribing one could not be carried out, for the reasons set out at Part II.K. A determination of necessity would not, as things stand, produce a standard. That is worth the Department's attention independently of anything in this comment about LED products.

The Foundation is not asking the Department to prescribe a performance standard for LED products in response to this request for information, and it wishes to be clear about that. The request it makes under this paragraph, stated at Part IX.I, is that a standard be prescribed for the product classes identified in Part VI once the research and evaluation directed by § 360ii(a)(2) and (a)(4) have been carried out. The sequence is the substance of the request. A determination of necessity under § 360kk(a)(1) is to be made on a record, and the record the statute contemplates is the one paragraphs (a)(2) and (a)(4) direct the Secretary to produce. The Foundation asks for the record first.

4. A worked example: a product the agency has cleared, classified by a mechanism it does not use, and subject to no emission limit

The three preceding subsections state the position in the abstract: the mechanism exists, it has been used for other light-emitting products, and it has not been used for this one. A single product class shows all of it at once, and the Foundation sets it out because it is concrete, because the record is documentary, and because it is a product the agency already has in its hands.

Light-accelerated tooth whitening devices emit blue optical radiation from light-emitting diodes. The FDA classifies them at 21 C.F.R. § 872.6475 under product code EEG, in Class I, assigned to the dental panel. The regulation reads in full:

> § 872.6475 Heat source for bleaching teeth. (a) Identification. A heat source for bleaching teeth is an AC-powered device that consists of a light or an electric heater intended to apply heat to a tooth after it is treated with a bleaching agent. (b) Classification. Class I (general controls). The device is exempt from the premarket notification procedures in subpart E of part 807 of this chapter subject to the limitations in § 872.9.

Two features of that text matter and the Foundation takes them in turn. The identification expressly contemplates that the device may be a light, and then characterizes what the light does as applying heat. And the class is exempt from premarket notification. The agency has nevertheless recorded a series of premarket notification determinations under this product code, the earliest in 1979 and the most recent in 2012, all of them decided as substantially equivalent; more than a hundred establishments are registered to the code. The Foundation does not presently know whether those later clearances reflect devices bearing additional claims that removed them from the exemption, or devices combining this function with another, and it does not assert an explanation it cannot support. What is not in doubt is the position today: a product class that emits blue optical radiation, classified by reference to heat, and exempt from premarket review.

Three features of that record bear on paragraph (a)(1), and the Foundation takes them in order of increasing consequence.

First, what a clearance is. A premarket notification under section 510(k) of the Act is a determination that a device is substantially equivalent to a device already legally marketed. It is a comparison against a predicate, not an evaluation of an emission. The agency does not perform or commission a study of radiation hazard in that pathway, and Class I designation means the agency has determined that general controls alone suffice, so there is no special control, no performance standard and no mandated emission testing. The Foundation states this without complaint about the device program, which was not built to answer radiological questions. It states it because the public, and the Foundation's own correspondents, read the word cleared as a finding about safety, and it is not one.

Second, the classification names a mechanism the product does not use. The device name the agency assigned to this product code is Heat Source For Bleaching Teeth. The classification is framed on a thermal model, and the predicate chain bears that out: one of the early cleared devices, in 1983, is identified in the agency's own record as a hot probe. The manufacturer's own peer-reviewed research, described at Appendix C.45, reports that the active principle of a modern

device of this type is not heat. It is wavelength-specific photochemistry at a peak of 456 nanometers, operating in parallel to chemical oxidation and reaching compounds the chemistry does not reach. A light-emitting diode emitting in the blue was therefore admitted to the market by equivalence to a family of devices characterized by the heat they produce, and equivalence to a thermal device cannot evaluate a photochemical emission, because the predicate has no wavelength worth specifying.

Third, and this is the point of the example, the same agency reached this product under one authority and does not reach it under the other. Under the device provisions it has a classification, a product code, a panel and a clearance history. Under the electronic product radiation control provisions, which are the subject of this comment, it has nothing. No section of part 1040 applies to it, for the reason given at subsection 3 above. And the records and reports requirements do not apply to it either. Table 1 to 21 C.F.R. § 1002.1 assigns reporting obligations by product category, and the category headed OPTICAL contains laser products under §§ 1040.10 and 1040.11 in four classes, sunlamp products under § 1040.20, and mercury vapor R and T lamps under § 1040.30. A product emitting incoherent blue light from a light-emitting diode appears nowhere in the table. No product report, supplemental report, abbreviated report, annual report or test record is required of its manufacturer. The single radiological obligation that attaches is the one that attaches to every electronic product under § 1002.1(a): the duty to report accidental radiation occurrences under § 1002.20, addressed at Part II.L. The manufacturer must report an accident. Nothing requires it to characterize, measure, disclose or limit what the product emits in ordinary use.

The Foundation puts the consequence as a question rather than as an accusation. The agency has in its files a product class it has reviewed eleven times over thirty-three years, which it classified by reference to heat, which in fact emits blue optical radiation at a known peak wavelength and a known irradiance, and for which it holds no emission data because it has never required any. Paragraph (a)(1) directs the Secretary to develop and administer performance standards, and § 360kk(a)(1) conditions prescription on a determination of necessity informed by the latest available scientific and medical data. On what data concerning this emission was any such determination made?

The magnitude is calculable, and the Foundation sets out the calculation so that the Department can check it rather than accept it. The study at Appendix C.45 reports an irradiance of 190 milliwatts per square centimeter at a peak wavelength of 456 nanometers, which is 1,900 watts per square meter. The blue light hazard weighting function has a tabulated value of 0.90 at 455 nanometers and 0.80 at 460 nanometers; interpolated at 456 nanometers it is approximately 0.88, giving a blue-light-weighted irradiance of approximately 1,670 watts per square meter. The exposure limits for the retinal photochemical hazard, in the small-source irradiance formulation, are a weighted radiant exposure of 100 joules per square meter for exposures up to 100 seconds, and a weighted irradiance of 1.0 watt per square meter for longer exposures. On those figures:

> the 100 joule per square meter limit is reached in approximately 0.06 seconds; and
>
> continuous exposure would be approximately 1,670 times the permissible weighted irradiance.

Four qualifications apply and the Foundation states them before drawing any conclusion. The figure of 190 milliwatts per square centimeter is the irradiance delivered to the tooth, which is the target surface. It is not a measured ocular exposure; what reaches an eye depends on distance, angle and shielding, and no such measurement is reported. The weighting value at 456 nanometers is interpolated and should be taken from the published table. The irradiance formulation applies to sources of small angular subtense, and for an extended source viewed at close range the radiance formulation governs instead, which requires the emitting area and the viewing geometry; neither is reported. And the arithmetic is sensitive to none of this at the order of magnitude that matters: an emission three orders of magnitude above the continuous ocular limit is not brought within it by refinements of this kind.

The fourth qualification is the one the Foundation asks the Department to sit with. The limits used in the calculation above are not the Department's. They are the limits of an international commission and an international electrotechnical standard, described at Part I.E and at Part V.C.2. To ask whether a device the FDA has cleared exceeds an ocular exposure limit, the Foundation has to borrow a limit from a non-governmental body, because the Department has prescribed none that applies. That is the condition this comment describes, stated in the narrowest possible compass: a federal agency has reviewed a blue-light-emitting product eleven times, and the only yardstick against which its emission can be assessed was written by someone else.

D. § 360ii(a)(2) — Plan, Conduct, Coordinate, and Support Research to Minimize Emissions and Exposure

Of the six paragraphs of § 360ii(a), paragraph (2) is the one that answers the Department's inquiry most directly, because it is the one least encumbered by conditions. It directs the Secretary to:

> (2) plan, conduct, coordinate, and support research, development, training, and operational activities to minimize the emissions of and the exposure of people to, unnecessary electronic product radiation;

1. What the paragraph conditions, and what it does not

The paragraph contains four verbs — plan, conduct, coordinate, support — four objects — research, development, training, operational activities — and one purpose: to minimize the emissions of, and the exposure of people to, unnecessary electronic product radiation. It contains no finding, determination, or threshold that must be reached before the duty attaches.

The contrast with the neighboring paragraphs is the point. Paragraph (a)(1) directs the development and administration of performance standards, and operates through § 360kk, which conditions prescription of a standard on a determination that it "is necessary for the protection of the public health." 21 U.S.C. § 360kk(a)(1). Paragraph (a)(6) qualifies the residual class of agencies by the word appropriate. Paragraph (a)(2) carries no such qualifier. Its only limiting word is the adjective unnecessary, which describes the radiation to be minimized. It is not a precondition to acting. Part I.C.5 sets out the general distinction between the provisions of this section that confer judgment and those that do not.

Two consequences follow. The first is that discharging paragraph (a)(2) requires no rulemaking. Research, development, training and operational activities are not regulatory acts. The agency need not find anything, propose anything, or prohibit anything in order to comply.

The second is that the ground on which the agency declined the Foundation's petitions does not reach this paragraph. The Final Response of May 24, 2024 declined to prescribe performance standards, on the ground that standards were not necessary. Necessity is the condition in § 360kk(a)(1). It is not a condition in (a)(2). A determination that a performance standard is unnecessary is not a determination that research is unnecessary, and the letter did not purport to make the second.

One further feature of the text bears on the scope of this comment. The paragraph names people. Its object is "the exposure of people to" unnecessary electronic product radiation. This matters because the subject addressed in the next subsection is often discussed in ecological and astronomical terms. Those effects are real and they are not what paragraph (a)(2) addresses. The Foundation's submissions concern human exposure: glare in the visual field of drivers and pedestrians, light entering residences from street lighting and neighboring installations, and flashing devices in the public right-of-way. Each is a condition of exposure of people.

There remains the objection the United States has pressed, and the Foundation meets it here rather than leaving it to be raised. The objection is that paragraph (a)(2) identifies no product,

from which it is said to follow that the paragraph states a programmatic aspiration rather than a duty, and that nothing in it requires the agency to research any particular technology.

Two propositions have to be separated, because the first is sound and the second does not follow from it.

The first is that the paragraph commits judgment to the Secretary about which radiation is unnecessary. The Foundation concedes that, has conceded it at Part I.C.5, and does not retreat from it here. The adjective is in the text and it has to be given work to do.

The second is that the paragraph is therefore wholly discretionary, because it names no product. That does not follow, and the structure of the section and the agency's own conduct both refute it.

Begin with the structure. Subsection (a) opens:

> The Secretary shall establish and carry out an electronic product radiation control program designed to protect the public health and safety from electronic product radiation. As a part of such program, he shall—

The program is mandatory, its purpose is stated, and each of the six paragraphs that follow is introduced by the word shall as a component of it. Not one of the six names a product. Paragraph (a)(1) speaks of "performance standards for electronic products"; paragraph (a)(4) of "emissions of, and conditions of exposure to, electronic product radiation and intense magnetic fields". If the absence of a named product rendered a paragraph unperformable, the section would contain no performable duty at all, and the program the first sentence directs the Secretary to carry out would have no content.

Then consider what the agency has actually done. It has performed paragraph (a)(1) repeatedly, and in every instance by selecting products that Congress never named: diagnostic x-ray systems, microwave ovens, laser products, sunlamp products, and high-intensity mercury vapor discharge lamps, among the others collected in parts 1020 through 1040. Selecting the subject matter is how these paragraphs are performed. It is not a condition that must be satisfied before they impose anything.

The point is sharpest in the agency's own words. Asked in litigation whether it had complied with § 360ii, the United States answered:

> FDA has complied with the statute and established such a program. See 21 C.F.R. §§ 1000.1—1040.30.

That citation is a list of products the agency chose for itself. The proof of compliance offered is itself the demonstration that these duties are discharged by selection. An agency cannot establish that it has carried out a program by pointing to the products it selected under a paragraph that names none, and in the same breath maintain that a paragraph naming none imposes nothing.

The paragraph is also, on its face, indifferent to technology. It is defined by the radiation and by the people exposed to it, not by the means of emission. A technology that did not exist in 1968 is not outside a duty framed in those terms, and the breadth of the definition at § 360hh(1)(A) was deliberate for that reason. Part II.B.

The Foundation states what follows at its proper width, and no wider. It does not contend that paragraph (a)(2) obliges the agency to conduct research into every electronic product. It does not contend that a court could compel research into any particular one; that is a question about the availability of a remedy under 5 U.S.C. § 706(1), and Part I.C.1 describes the posture in which it has been litigated. The contention is narrower, and it is addressed to the Department rather than to a court.

The paragraph directs a program designed to minimize the exposure of people to unnecessary electronic product radiation. Visible light emitted by light-emitting diode products is now among

the most widely encountered forms of electronic product radiation in the country, placed there in substantial part by federal policy, as Part IV.G describes. The agency has conducted no research, no development, no training and no operational activity directed to it. Whatever latitude the word unnecessary confers in deciding which radiation to address, a program that has never examined this exposure is not, as to this exposure, a program that minimizes it.

One further observation forecloses an answer that might otherwise be made. Subsection (b) of the same section authorizes the Secretary to collect and disseminate the results of research, to make grants, to contract with public and private entities, and to procure electronic products for purposes of research and testing. Congress supplied the means along with the direction. Whatever obstacles may stand in the way of performing paragraph (a)(2) as to this radiation, want of authority to fund the work, to contract for it, or to obtain the products is not among them.

2. "Unnecessary electronic product radiation" is not a defined term

Section 360hh defines five terms: electronic product radiation, electronic product, manufacturer, commerce, and State. It does not define unnecessary. Neither does 21 C.F.R. § 1000.3.

An undefined statutory term is not a term without content. It is a term whose content the administering agency is charged with developing — here, through the research and evaluation that paragraphs (a)(2) and (a)(4) direct. The Foundation is aware of no published agency interpretation of unnecessary electronic product radiation as applied to optical radiation, and asks the Department to state whether one exists.

The legislative history treats the term as a category distinct from hazard. The Senate report describes the subject of the Radiation Control for Health and Safety Act of 1968 as "unknown, unnecessary and potentially hazardous radiation from electronic products." S. Rep. No. 90-1432, at 3 (1968). The three adjectives are disjunctive. Radiation may be unnecessary without having been shown to be hazardous, and the structure of paragraph (a)(2) reflects that: the activity it directs is research, which is what an agency undertakes when the effects are not yet established.

Two features of the drafting follow from that premise, and together they determine what paragraph (a)(2) requires.

The first is the word Congress chose. It could have written hazardous electronic product radiation. It wrote unnecessary. The two are not synonyms and the choice was available: the Senate report uses both words in the same phrase, as separate members of a list. Radiation that serves no purpose is to be minimized because it serves no purpose. Whether it has also been shown to injure anyone is a different question, and the paragraph does not ask it.

The second is the verb. Paragraph (a)(2) directs the Secretary to minimize emissions and exposure. Minimization is not a threshold concept. A limit can be satisfied by remaining beneath it, and once a party is beneath it there is nothing further to do; that is the architecture of § 360kk, which authorizes standards to "control the emission" of electronic product radiation and conditions them on a determination of necessity. Paragraph (a)(2) is written differently. It states a direction of travel rather than a ceiling, and it attaches no condition. The statute uses two different verbs because it is doing two different things.

The consequence for the Final Response of May 24, 2024 is direct. That letter rests in part on the proposition that LED products have a long history of safety with respect to the visible wavelengths they emit. Part I.C.7 sets out why the Foundation regards that proposition as unsupported. But the point here does not depend on its being wrong. Suppose it is accepted in full. It is still not an answer to paragraph (a)(2), because (a)(2) does not condition the duty to minimize on a finding of harm. An agency that has established a history of safety has answered the question § 360kk(a)(1) asks. It has not answered the question (a)(2) asks, which is what is being done to minimize emissions of, and the exposure of people to, radiation that serves no purpose.

This is why the Foundation characterizes the 1968 Act as resting on a premise about potential rather than demonstrated harm. The subject the Senate report identified was radiation that was unknown, unnecessary and potentially hazardous. A statute addressed to radiation whose effects are unknown cannot sensibly be read to require proof of effect before its research and minimization duties attach. The duties exist in order to resolve the unknown, and reading them to await its resolution would leave them with nothing to operate on.

That distinction bears on one of the stated grounds of the Final Response. The letter states that regulations prescribing performance standards for every type of electronic product are not necessary "given the effectiveness of existing mitigations in addressing unnecessary radiation and alternative approaches to protect public health," and in light of "the fact that most products do not produce types of levels of unnecessary radiation that pose a risk to public health." The second clause reads unnecessary as though it meant harmful. On the statute's own terms the two are separate categories, and the minimization directed by paragraph (a)(2) is not conditioned on a prior showing of risk.

a. Two senses of the word, and which one this subchapter uses

The word unnecessary carries a settled meaning in energy policy and a different one in this subchapter, and the difference turns out to be the subject of this comment.

In energy policy the meaning is straightforward, and the Foundation states it as that field states it rather than adopting it. Radiation that a lamp emits outside the band the eye uses to form images contributes no lumens. The governing metric is luminous efficacy, expressed in lumens per watt, and a quantity that adds to the denominator and not to the numerator is loss by the construction of the metric. Part IV.G.4. The standards described at Part IV.G are built on that metric, and the infrared output of an incandescent lamp is accordingly classified by them as waste.

What followed is a matter of record rather than of characterization. Those standards removed that component from American general illumination, and by the measure they employ they did so successfully: the lamps that replaced the incandescent lamp deliver far more lumens for each watt, and they do it substantially by not emitting outside the visible band. The Foundation does not dispute that arithmetic and does not suggest the program failed at what it set out to do.

What the Foundation disputes is the premise, and it says so here rather than leaving a reader to reach Part V.B.6 before learning that the premise is contested. A metric that counts only lumens can classify a wavelength as waste only because it is never asked whether that wavelength does anything for the person standing under the lamp. That is a question about human physiology and not about illumination. The published work set out at Part V.B.6 addresses it directly, in experimental studies on human subjects, several of them by Jeffery and colleagues and one of them funded by the Department of Energy itself, reporting measurable physiological and visual effects attributable to the long-wavelength component that the efficacy metric treats as valueless. The Foundation does not assert that this work is settled, and Part V.B.6 states the limits of each study in terms. It asserts only that the question the metric does not ask is a real one, and that the word unnecessary cannot be carried from the one context to the other as though it meant the same thing in both.

In paragraph 360ii(a)(2) the word does different work. It qualifies the radiation whose emission, and whose exposure of people, the Secretary is directed to minimize, in a subchapter whose stated purpose is to protect the public health and safety from electronic product radiation. The question the word asks there is not whether the radiation serves the lamp's purpose. It is whether it serves any purpose for the person exposed to it.

Those two senses can therefore point in opposite directions, and on the evidence described at Part V.B.6 they appear to do so here. What one federal program classified as waste and eliminated is the long-wavelength component for which a physiological function has now been reported in human subjects. What remains, concentrated in the short-wavelength region, is the component

about which the hazard literature exists. If that is right, then the one federal program that has addressed the spectral content of American lighting removed the part that may have been necessary and retained the part that may be unnecessary in the sense this subchapter uses. Two federal programs were applying the same word to the same radiation and meaning opposite things by it.

The Foundation does not assert that this is settled, and Part V.A.3 places the question among those that are open. It asserts something narrower and, it submits, unanswerable: the statute assigns this determination to the Secretary, the term was left undefined so that the administering agency would give it content through the research paragraph (a)(2) directs and the evaluation paragraph (a)(4) directs, and no such determination has been made.

Where necessary radiation fits in this scheme, and where it does not

The preceding paragraphs raise a question the Foundation should answer rather than leave open, because a reader will ask it. If some electronic product radiation is not merely permissible but affirmatively necessary, what does this subchapter do about that? The Foundation gives the answer it believes to be correct, including the part of it that is adverse to the Foundation.

The first point is textual and it is favorable. The subchapter already assumes that some electronic product radiation is necessary. Paragraph (a)(2) does not direct the Secretary to minimize electronic product radiation. It directs the development of criteria to minimize exposures to and emissions of unnecessary electronic product radiation, and the adjective is a limitation on the duty. A lamp must emit light in order to illuminate, and nothing in the paragraph asks the Secretary to reduce the light by which people see. Congress wrote a minimization duty that applies to part of the emission and not to the rest, which means Congress assumed the administering agency would be able to tell one from the other.

That assumption is the Foundation's point throughout this Part, and it is worth stating in its strongest form. The word unnecessary is doing limiting work. A limitation that nobody has ever applied is not a limitation; it is an unexamined word. The Department cannot know what is unnecessary in any emission without knowing what in that emission is necessary, and no determination of either kind has been made as to visible light from light-emitting diode products. Part II.D.2.

The second point is adverse and the Foundation states it plainly. Nothing in this subchapter empowers the Secretary to require a product to emit anything. Paragraph (a)(2) is a minimization provision. Section 360kk authorizes performance standards to control the emission of electronic product radiation, and while control is a broader word than limit, the Foundation does not contend that it authorizes a floor, and is aware of no standard prescribed under that section which has ever set one. A conclusion that near-infrared radiation benefits human beings would not, without more, give this Department authority to require that lamps emit it.

So the Foundation does not ask for that, and asks the Department to note that it does not. It makes no request that any product be required to emit any wavelength. Three things do follow, and each is within authority the Department already has.

- The research and evaluation duties reach the question directly. Paragraph (a)(2) directs research to minimize unnecessary radiation, which requires knowing what is necessary. Paragraph (a)(4) directs the Secretary to study and evaluate emissions of, and conditions of exposure to, electronic product radiation, without qualification as to hazard or as to direction of effect. The spectral composition of the light under which the American population now lives, including what that light no longer contains, is squarely within both. Part II.D and Part II.F.
- The recommendation power reaches it without a standard. Section 360ii(b)(1) permits the Secretary to make recommendations, and a recommendation about spectral composition requires no rulemaking, no finding of hazard and no exercise of the standard-setting power. Part IX.J asks for recommendations on that footing.

The liaison duties reach the agency whose program produced the change. Paragraphs (a)(3) and (a)(6) direct consultation with other federal departments, and the Department of Energy administers the efficacy standards described at Part IV.G. If the two meanings of unnecessary are in conflict, those paragraphs are the mechanism Congress provided for noticing it. Part II.H.4 records what consultation has occurred.

The Foundation accordingly frames its submission on this subject as narrowly as the record permits. It does not ask the Department to find that near-infrared radiation is necessary. It does not ask the Department to require it. It asks the Department to determine what in this emission is necessary and what is not, because paragraph (a)(2) cannot be administered without that determination, and because a term that has gone unexamined for fifty-seven years cannot be invoked to explain why no standard is needed. Part I.C.7.

b. Why a hazard model cannot reach the question

This bears on the method by which the agency has approached the subject, and the Foundation puts the point structurally rather than as a criticism of anyone's judgment.

A hazard model asks whether an emission exceeds a level at which injury occurs. It is the right model for the products for which this Department has prescribed standards, and the blue light hazard framework described at Part V.C.2 is a well-built instance of it. But its question has a fixed shape. It can ask whether there is too much of something. It cannot ask whether something that is absent was serving a purpose, because an absence produces no exposure to measure and exceeds no limit.

Paragraphs (a)(2) and (a)(4) are not framed that way. Paragraph (a)(2) is framed around necessity, which requires knowing what the radiation is for. Paragraph (a)(4) directs the Secretary to study and evaluate emissions of, and conditions of exposure to, electronic product radiation, without qualification as to hazard. Both can ask what a hazard model cannot, and Congress placed both before the standard-setting authority of § 360kk rather than after it. Part I.C.8.

The Foundation accordingly asks the Department to recognize that the hazard framework, however well constructed, is a subset of what subchapter C directs and not a substitute for it. A determination that no emission exceeds a hazard limit is not a determination that exposure to the radiation is necessary, that it has been minimized, or that the conditions of exposure have been evaluated.

c. The Department has prescribed a standard governing spectral composition before

One existing standard is worth identifying here, because it answers in advance an objection that might otherwise be made to anything that follows from this subsection.

The sunlamp standard at 21 C.F.R. § 1040.20 does not merely cap intensity. It limits the ratio of the shorter-wavelength to the longer-wavelength ultraviolet irradiance a product may produce. That is a requirement about the relative spectral composition of an emission rather than about its quantity. The Department has therefore already prescribed, under this authority, a performance standard that regulates what proportions of the spectrum a lamp may deliver.

The Foundation draws no request from that precedent in this comment. It identifies it so that the record is clear on one point: a performance standard addressed to the spectral composition of a general service lamp would not be a novel exercise of this authority. Whether any such standard is warranted is a question for after the research, and Part IX.I is framed accordingly.

d. What a determination of necessity would involve, and why none has been made

The preceding subsections establish that the term is undefined and that its content is for the administering agency to develop. This subsection states the operational consequence, which is more practical than it may first appear.

Paragraph (a)(2) directs the Secretary to minimize the emissions of and the exposure of people to unnecessary electronic product radiation. The adjective is not ornament. It identifies the subset to be minimized. A duty to minimize a subset cannot be performed by an agency that has not identified the subset, and the identification is therefore not a question the paragraph leaves open for later. It is the paragraph's first step.

The Foundation has found no determination of that kind for any product emitting visible light. Not a rule, not a guidance document, not a published interpretation, not a worked example in any agency document it has been able to locate. The agency has never stated, of any lamp, luminaire, display or indicator, which part of what the product emits is necessary and which part is not.

What such a determination would look like is not mysterious. Take a street luminaire, which Part VI.B describes. Its purpose is to deliver a stated illuminance to a roadway and footway for the visual tasks performed there. Measured against that purpose, the components of its emission divide:

Light reaching the roadway and footway at the specified illuminance. Necessary on any reading of the word. It is what the product is for.

Light emitted above the horizontal. This cannot reach the roadway. Whatever else may be said about it, it does not serve the purpose for which the luminaire was installed.

Light falling outside the area to be lit — into bedroom windows, gardens, watercourses, habitat. The same analysis applies, and Part VII contains first-hand accounts of it.

Output maintained during hours in which the area carries no traffic and no pedestrians.

Source luminance in excess of what is required to deliver the specified illuminance. The same illuminance can be delivered from a larger and dimmer emitting surface. The excess is a property of the source, not of the lighting it provides. Part V.B.2.

Short-wavelength content beyond what the visual task requires. This is the component the literature in Part V concerns.

e. Most of that determination requires no finding of harm

The Foundation asks the Department to notice what that list shows, because it bears on the objection that the evidence is not yet sufficient.

Five of the six items can be resolved without a single health study. Light emitted above the horizontal does not illuminate a roadway; that is geometry. Light falling on a bedroom window is not performing the function for which the luminaire was installed; that is also geometry. Output at an hour when no one is present serves no one. Luminance beyond what the specified illuminance requires is surplus by arithmetic. None of those propositions depends on knowing whether the radiation injures anybody.

That separation matters because the Final Response of May 24, 2024 ran the two questions together. Whether radiation is unnecessary and whether it is harmful are different questions, as subsection a sets out, and paragraph (a)(2) asks the first. A determination that a component of a product's emission serves no purpose for the person exposed to it is available on the engineering record alone. The Foundation is aware of no such determination having been made.

The sixth item is different, and the Foundation says so rather than claiming more than it can. Whether the short-wavelength content of a street luminaire exceeds what the visual task requires, and what follows for the people under it, cannot be settled without the research that paragraphs (a)(2) and (a)(4) direct. The Foundation does not ask the Department to decide that today. It asks the Department to begin the work by which it is decided, and in the meantime to make the determinations that do not depend on it.

The request is accordingly in two parts, and they are severable. First, that the Department state what it regards as necessary and unnecessary in the emission of the product classes described in Part VI, to the extent that question can be answered on the engineering record. Second, that it undertake the research by which the remainder is answered. Part IX.C. A Department that declined the second could still perform the first, and the Foundation would regard that as progress.

f. The objection that not every source need be addressed, and what follows from it

In the liaison litigation described at Part IV.D, the United States has argued that the Department is not required to address every source of electronic product radiation. The Foundation accepts that proposition. It does not contend that paragraph (a)(2) obliges the Secretary to reach every emitter of every wavelength, and nothing in this comment should be read as making that contention.

What follows from the proposition is narrower than its use suggests. A duty that need not be performed as to every source must still be performed as to some, or it is not a duty. The question is therefore not whether the Department was obliged to reach this source. It is on what basis this source was not reached. The Foundation asks the Department to supply that basis, and observes that the Final Response does not contain it.

The Foundation also identifies why it asks about this product class rather than asking about all of them, using criteria the Department can test. Light-emitting diode products account for the majority of human exposure to artificial optical radiation, Part VI. They displaced the technology they replaced through federal action rather than through the market alone, Part IV.G. The scientific literature assembled in Part V concerns them. And the Department has already accepted that what they emit is electronic product radiation within this authority, Part I.D. The Foundation is not asking the Department to begin everywhere. It is asking why it has not begun here.

One distinction remains, because the Final Response turned on it. Paragraph (a)(2) directs a program — research, development, training and operational activities — to minimize unnecessary radiation. Section 360kk authorizes performance standards to control emissions. They are different provisions with different predicates. A determination that a performance standard is not necessary under § 360kk(a)(1) does not discharge the duty at paragraph (a)(2), does not address it, and does not survive it. The letter of May 24, 2024 answered the standards question. The Foundation has found no answer to the other.

3. Light pollution is unnecessary electronic product radiation

Lighting engineering has a settled term for optical radiation emitted in excess of what the intended visual task requires, or directed where it serves no visual task. The term is light pollution. Its standard taxonomy divides it into glare, light trespass, uplight and the resulting skyglow, over-illumination, and clutter. CIE 150:2017, Guide on the Limitation of the Effects of Obtrusive Light from Outdoor Lighting Installations; Illuminating Engineering Society and International Dark-Sky Association, Model Lighting Ordinance (2011).

Each category describes radiation that serves no illumination purpose, and the first two describe radiation that defeats one.

Glare is radiation reaching the eye at an angle and intensity that reduces visual performance rather than supporting it. Disability glare raises the veiling luminance against which a target must be discriminated, so the contrast of the very object the installation was built to reveal is reduced. Part V.C.3.

Light trespass is radiation crossing onto persons who are not the intended beneficiaries of the installation and who cannot switch it off. That is exposure of people, in the paragraph's own words, and it is involuntary.

Uplight is radiation emitted above the horizontal, which reaches no task surface at all.

Over-illumination is radiation in excess of the illuminance the task requires.

The mapping between the two terms is therefore not an extension of the statute. Light pollution is the name that engineering practice gives, within the visible band, to the subject paragraph (a)(2) names in statutory terms. An installation that produces glare, trespass, or uplight is emitting electronic product radiation that is unnecessary by the standards of the discipline that designs such installations.

It follows that minimizing light pollution from LED products is a federal statutory duty assigned to the Secretary. The Foundation states plainly what that does not mean. It does not displace the authority of States and municipalities over lighting design, zoning, and roadway standards, and the Foundation does not ask the Department to assume that authority. What paragraphs (a)(2) and (a)(5) direct is the antecedent work: a definition of the quantity to be minimized, measurement methods referred to the point of human exposure, evaluation of the conditions under which people are exposed, and techniques for reducing that exposure. None of it has been done, and States and municipalities have been legislating in its absence.

The equivalence has been before the agency since the petition comments, which stated it in terms: "The FDA is required to limit the exposure to, and emissions of, unnecessary Visible Light radiation from LED products. 'Unnecessary' light is also known as light pollution." The agency acknowledged receipt of the comments. Part IV.B. The Final Response does not address light pollution.

a. The objection that this is an environmental matter, and why it does not arise

One objection to the whole of this comment is foreseeable and the Foundation answers it here rather than leaving it to be made. It would run as follows: the research set out in Part V is research into light pollution, or into artificial light at night; those are environmental subjects; environmental subjects belong to environmental agencies; and the authority of this Department over electronic products is therefore not engaged.

Each step of that argument fails, and the third fails on the record of this proceeding.

The vocabulary of a research field does not determine jurisdiction. The physical quantity these studies measure is optical radiation emitted by electronic products and received by people. Section 360hh(1)(A) defines electronic product radiation to include any electromagnetic radiation emitted from an electronic product, and Part II.B establishes that visible light emitted by an LED product falls within that definition. A study that measures that radiation is a study of electronic product radiation whatever its authors call it in the title.

The statute regulates the product, not the land. The Foundation does not ask this Department to regulate lighting design, fixture placement, mounting heights, curfews, zoning or the outdoor lighting ordinance of any jurisdiction, and it repeats here what it has already said in this subsection: those are matters for States and municipalities. What it asks is what subchapter C provides. That the Secretary study what these products emit, and, if the research supports it, prescribe what they may emit. A performance standard addressed to a lamp is not a land use regulation, and a manufacturer is not a municipality.

The deflection has already been tried, and it failed. The proposition that this subject belongs to an environmental agency was put to the environmental agency. The Director of the Radiation Protection Division of the Environmental Protection Agency replied that Congress has granted that agency no statutory authority to regulate visible light or non-ionizing radiation emitted from electrical devices, including LEDs, and that it does not maintain experts in the field. Part II.H.3. The Consumer Product Safety Commission is removed by statute rather than by choice: 15 U.S.C. § 2080 withholds from that Commission authority over any risk of injury associated with

electronic product radiation emitted from an electronic product where the risk may be subjected to regulation under this subchapter. Part II.H.9.

The Foundation puts the consequence plainly. If this subject is not within the authority of this Department, it is within the authority of no federal agency at all. The Foundation has asked, and Part II.H records the answers.

b. The claim the Foundation makes, and the one it does not

The Foundation is careful about the form of the equivalence it asserts, because a claim stated too broadly can be defeated by a single counter-example and would take the rest of the argument with it.

It does not contend that light pollution and unnecessary electronic product radiation are synonyms. They are not coextensive in either direction. Light pollution, as the term is used in astronomy and ecology, includes sky glow and effects on other species that involve no human exposure, and it includes light from sources that are not electronic products. Unnecessary electronic product radiation extends well beyond the visible band, including to the radiofrequency emissions to which this request for information is principally directed.

What the Foundation contends is narrower. Within the overlap of the two — visible light emitted by an electronic product and received by a person — the phenomena that lighting engineering calls light pollution are instances of what paragraph (a)(2) calls unnecessary electronic product radiation. Glare, light trespass, uplight and over-illumination are each radiation that serves no visual task or exceeds what the task requires, and that is what the word unnecessary describes. The narrower claim is sufficient for every purpose this comment has.

A practical consequence follows, and the Foundation states it because it removes an obstacle rather than raising one. The Department need never use the term light pollution. It is a colloquial expression, it has no statutory definition, and nothing in this comment asks the Department to adopt it or to defend it. Every action the Foundation requests can be described, performed and justified entirely in the language Congress enacted: the emissions of, and the exposure of people to, unnecessary electronic product radiation.

The term appears in this comment for two reasons only. It is the term by which the public, the press, and the state and local bodies described at Part VIII refer to this subject, so the Department should be able to see that the two are the same thing. And it is the term under which much of the scientific literature in Part V was published, so a reader searching that literature will not find it under any other name. If the Department prefers to carry out these duties and exercise these powers without ever using the phrase, the Foundation has no objection of any kind. What matters is the radiation, not the word.

c. Why light-emitting diode products are the class this comment addresses

The Foundation does not argue that the Department's authority over these products follows from their prevalence. The authority follows from the statutory definitions and would reach a single lamp sold to a single purchaser. Part II.B.

Prevalence bears on a different question, which is where a duty to minimize exposure should be directed first. Paragraph (a)(2) speaks of minimizing the exposure of people. Where one technology now produces the substantial majority of the artificial light to which the American population is exposed, as Part IV.G.3 describes, the exposure that paragraph names is, as a matter of fact, predominantly exposure to that technology. An agency ordering its work under a minimization duty would begin there.

The same reasoning governs how the research in Part V should be read. Those studies are studies of artificial light at night because that is the exposure people have. That exposure is now produced overwhelmingly by light-emitting diode products. A finding about the one is, in the present state of the built environment, largely a finding about the other. The Foundation does not ask the

Department to treat that as an identity, and Part V.J.4 sets out the measurement gap that prevents the literature from attributing effects to particular sources. It asks the Department to notice that the gap is itself a reason to conduct the research, not a reason to decline the subject.

d. Radiation emitted upward, and where it actually goes

The clearest instance of unnecessary electronic product radiation in this entire subject is also the easiest to detect, and it has been detected continuously from orbit for decades.

Light emitted above the horizontal reaches no task surface. Whatever purpose the installation below was built to serve, that radiation did not serve it. No judgment is required to reach that conclusion and no study is needed to support it; it follows from the geometry. That is what makes direct uplight the clearest instance of unnecessary radiation available to this Department.

The radiation does not leave, and it reaches people

It might be supposed that radiation directed upward escapes into space and exposes nobody, so that a public health statute has no occasion to address it. That supposition is false as a matter of physics, and the Foundation sets out why before reaching the statutory text, because the physical answer is the stronger one.

A substantial part of upward-directed light does not leave the atmosphere at all. It is scattered by air molecules and aerosols and, far more strongly, by cloud, and returns to the ground as diffuse illumination of the night sky. The effect is not marginal and it has been quantified.

Kyba, Ruhtz, Fischer and Hölker measured sky luminance under cloud and clear conditions and found that cloud cover amplified it by a factor of 10.1 at a location inside Berlin and by 2.8 at 32 kilometers from the city center. They also found that overcast nights inside the city were brighter than clear rural moonlit nights by a factor of 4.1. Cloud coverage acts as an amplifier for ecological light pollution in urban ecosystems, PLoS ONE 2011;6(3):e17307.

Kocifaj, Falchi and Kundracik, modeling a full range of cloud distributions, report that clouds can amplify zenith artificial radiance by more than fifteen times and, critically for this comment, the irradiance incident at ground level by more than four times compared with clear conditions. An all-sky light pollution model for global-scale applications that embraces a full range of cloud distributions, Proceedings of the National Academy of Sciences 2025;122:e2508001122.

The second of those quantities is the one the Department should attend to. Irradiance incident at ground level is exposure. It is what reaches a person standing outside, and what enters a window. A fourfold amplification of it under cloud means that the nocturnal optical exposure of a population is determined in substantial part by emissions from fixtures those people cannot see, do not control and may be miles away from, and that the exposure is greatest on the nights when the sky is overcast.

There is a second route by which upward emission reaches people, and it is more direct. A luminaire that sends light above the horizontal is, by the same defect in its distribution, sending light at high angles just below the horizontal. That near-horizontal light is the component that travels laterally at eye level, and it is the component that produces disability glare, discomfort glare and light trespass. Parts V.C.3 and V.C.4. The upward measurement is therefore an index of the sideways emission as well as a quantity in its own right. Light measured leaving a city is a proxy for light arriving at the eyes of the people in it.

Upward emission has a third consequence, in the atmosphere itself. Scientists at the National Oceanic and Atmospheric Administration reported in 2011 that artificial light destroys the nitrate radical, the oxidant that removes nitrogen oxides and volatile organic compounds from the air overnight, and that over Los Angeles city lights reduce nitrate radical concentrations by several percent. Part II.H.3 sets out the finding, its magnitude, and the limits of what the Foundation

draws from it. What belongs here is the cause the authors identify: the effect is produced by light projecting skyward, and shielded fixtures directing light downward would prevent it. The radiation at issue is again the radiation that served no one.

The text of paragraph (a)(2) reaches it in any event

The Foundation does not need the statutory text to answer the objection, having answered it on the facts. The text answers it again, and independently.

Paragraph (a)(2) directs the Secretary to support activities to minimize two things, not one: "the emissions of" and "the exposure of people to" unnecessary electronic product radiation. The two objects are coordinate. Emissions are named separately from exposure, and a reading that confines the paragraph to exposure deletes one of its two objects. Direct uplight falls within the first limb whether or not any person is exposed to it, and it falls there on the plainest possible facts, because it is emission that serves no purpose.

What the Foundation claims about satellite measurements, and what it does not

The Foundation states a limit on this argument before it is put to the Foundation, because the limit is real and a reader who found it unaided would discount the rest.

Not all of the light detected from orbit is direct uplight. A substantial part of it is light that was emitted downward, illuminated a road, a parking surface or a building as intended, and then scattered upward from those surfaces. That portion is the residue of illumination that did its work, and the Foundation does not contend that it is unnecessary in the sense paragraph (a)(2) uses. Reflected light is the price of lighting a surface at all.

What the Foundation contends is this. The direct uplight component — radiation emitted above the horizontal by a fixture that fails to control its distribution — is unnecessary by definition, is a distinct and estimable component of the total, and is the component that engineering practice has long known how to eliminate. Satellite radiance is an upper bound on it, not a measurement of it, and the comment uses it as such.

The split, and the impact of the half that is unnecessary, both now supplied

The preceding paragraph asserts a split between direct uplight and reflected ground light, and the Foundation would not leave an assertion of that kind unsourced. The measurement and modeling literature of observatory site protection has quantified it. Green R.F., Luginbuhl C.B., Wainscoat R.J. and Duriscoe D., The growing threat of light pollution to ground-based observatories, The Astronomy and Astrophysics Review, volume 30, article 1 (2022), open access. Described at Appendix D.7.

The reflectance first. Since the first physical model of skyglow was published in 1986, this literature has taken 15 percent as the representative reflectivity of illuminated surfaces: concrete, asphalt, vegetation. Of the light a fixture sends downward and which does the work the fixture was installed to do, about fifteen parts in a hundred come back up.

Then the direct fraction. Across an installed stock, direct upward emission averages about 10 percent. The arithmetic the review performs is simple and the Foundation reproduces it: ninety percent of the flux is sent downward and fifteen percent of that is reflected, which is 13.5 percent of the total; ten percent is sent upward directly. The flux propagating upward from a lit area is therefore divided roughly equally between radiation that illuminated something first and radiation that illuminated nothing at all. That is the proportion the note following this subsection asked for, and it now has a source.

The two halves are not equal in effect, and the inequality is the point. Neglecting angle, radiation that never strikes a surface avoids the fifteen percent reflectance and so carries about six and seven tenths times the consequence of an equal flux sent downward. Angle makes it far worse, because unshielded fixtures emit most of their uplight at small angles above the horizontal, where the path

through the atmosphere is longest. Modeling predicted that direct upward emission causes between 40 and more than 150 times the zenith skyglow impact of an equal flux directed downward, when observed at distance in an environment with little blocking. Measurement in the field gave a smaller but still large range, from about 1.5 to about 16 times, with the larger ratios at the greater distances. In real environments with buildings and vegetation the ratio falls, and it stays well above one.

The figure that bears most directly on a performance standard

The same modeling was applied to a lighting-design question, and the Foundation sets the answer out on its own because of what it implies for the form of a limit. A fixture emitting one percent of its flux directly above the horizontal was found to increase artificial sky brightness by 30 percent at fifty kilometers, and by 100 percent at two hundred kilometers, compared with the same fixture fully shielded. One percent, not ten.

The Foundation asks the Department to hold that figure against two others already in this comment. At Appendix C.134 a group of marine scientists, writing in an engineering journal and with no interest in this proceeding, recommended an upward light output ratio of zero percent. At Appendix C.130 volunteers walking German streets found that fifty-eight percent of floodlights were unshielded, rising to seventy percent in continuous urban fabric. The interval between zero and one percent is not a rounding difference, and the installed stock is not near either end of it.

Why that bears on the request this comment makes. Section 360kk requires that a performance standard prescribe a characteristic of the emission. The upward light output ratio of a luminaire is such a characteristic. It is a property of the product, measurable on a goniophotometer before the product leaves the factory, and it does not depend on where the product is installed, by whom, at what height or under whose ordinance. It is not a land-use question and it is not a lighting-design question. It is the kind of quantity subchapter C was written to govern, and the figures above establish that the quantity matters at values most people would round to zero.

What the Foundation says about skyglow, which is narrower than it may appear

Skyglow is not itself an emission of a product. It is that radiation after the atmosphere has scattered it, and the authority Congress gave the Secretary is over what a product emits rather than over what the atmosphere does with it afterwards. The Foundation therefore does not ask that skyglow be regulated, and the paragraph above says so. It asks for two things that do follow, and it states them separately because they rest on different grounds.

The first is that the emission which produces skyglow is electronic product radiation within section 360hh, is unnecessary by the standards of the discipline that designs lighting installations, and is accordingly within the first limb of paragraph 360ii(a)(2), which directs the Secretary to support activities to minimize the emissions of unnecessary electronic product radiation. That limb is satisfied without reference to any person and without reference to any finding of injury. A duty to minimize radiation that serves no purpose does not wait upon proof that the radiation is harmful, and the Foundation does not rely on such proof for this part of its case.

The second is that skyglow is the measurable indicator by which the magnitude of that emission, and the effectiveness of any technique for reducing it, can be established. Paragraph 360ii(a)(4) directs the Secretary to study and evaluate emissions of electronic product radiation, and paragraph (a)(5) to develop, test and evaluate the effectiveness of procedures and techniques for minimizing exposure to it. Neither duty can be discharged without a quantity that can be measured before and after. Skyglow is that quantity for this emission, and it is already being measured.

That sequence has been carried out once, in the United States, and the outcome was measured

In 1989 the City of Flagstaff, Arizona and the surrounding Coconino County adopted what this review describes as the first outdoor lighting code with standards based on limiting sky brightness at an observatory site, and, to the authors' knowledge, the only lighting codes anywhere with standards

designed to achieve a sky brightness management target. The target was to hold the increase in zenith sky brightness over the United States Naval Observatory Flagstaff Station to thirty percent above the then-current condition. Modeling converted that target into a prescribable quantity: 25,000 lamp lumens per acre within a radius of two and a half miles of the station, rising by factors of two in the outer zones. The authors record that the conceptual basis for the innermost cap was not lighting needs and not lighting industry recommendations.

Measurement in June 2015 found not an increase of thirty percent but a decrease of approximately ten percent against the late nineteen-eighties. The target was met and exceeded, which the authors attribute to the shift to low-pressure sodium, to improved shielding whose benefit the original modeling had understated, and to near-ground blocking that the original modeling had not included. The community has since adopted a stricter target of ten percent, converting the limits from lamp lumens to fixture lumens, tightening shielding in the innermost zone, halving the cap in the outermost zone, and eliminating the requirement for roadway lighting in residential areas.

The Foundation states the limit of that example before it states the use. Lumens per acre is a land-use quantity and not a characteristic of a product. Flagstaff is therefore not a template for a standard under section 360kk and the Foundation does not offer it as one. What it is, is a worked demonstration of the method that paragraphs 360ii(a)(4) and (a)(5) describe. A protected quantity was identified. A numerical threshold was set against it. A prescribable limit was derived from that threshold by modeling rather than by consulting the industry. The limit was imposed. The outcome was measured, and it was found to have been achieved. The Foundation is aware of no occasion on which a federal agency has performed that sequence for this emission, and it is the sequence Part IX asks for.

One comparison from the same measurements, made by the night sky team of the National Park Service, shows what the difference amounts to. Measured from 27 kilometers, the integrated artificial sky brightness of Flagstaff, population 70,320, is given as one eleventh and a little more — the authors write 1/11.9 — of that of Cheyenne, Wyoming, population 63,335, measured from 31 kilometers. Two cities of nearly the same size, one with a long history of lighting regulation and one without. The authors describe it as a single point comparison and the Foundation repeats that caution with it.

A claim the Foundation does not make, because this review says it is wrong

It is commonly said that the conversion to white light-emitting diodes worsens skyglow because short wavelengths scatter more strongly. These authors state that this is not the dominant mechanism and that the causes are commonly misunderstood. Within about ten kilometers of a source the increased scattering of short wavelengths is approximately balanced by the increased extinction that accompanies it; beyond that distance extinction dominates, and a white source of given luminous output has less impact on radiant skyglow than a yellow one. The increased visual impact of white sources is real and large — two to three times that of high-pressure sodium at equal lumens, near and far — but it arises from the greater sensitivity of the dark-adapted human eye to blue and green light, and not from scattering.

Three statements have to be kept apart there, and the Foundation keeps them apart because conflating them is what produces the incorrect version. Integrated radiant skyglow at distance: a white source may produce less of it than a yellow source of equal lumens. Visual skyglow: a white source produces two to three times as much. And radiant skyglow within the short-wavelength band itself, between 350 and 500 nanometers, where white diodes were found to increase it by a factor of about two or more against high-pressure sodium. The third is the one this comment is about, because the comment is about short-wavelength content and not about the visibility of stars. The Foundation records the correction because the incorrect version is in wide circulation, because a reviewer who knows the subject would notice it, and because nothing in this comment rests on it.

Why this bears on human health and not only on the night sky

The Foundation is advancing a health argument and does not ask this Department to take an interest in astronomy. The connection is through the fixture rather than through the sky, and it is direct.

The property of a luminaire that sends light above the horizontal is the same property that places a high-luminance emitting surface in the field of view of a person standing at ground level some distance away. A fixture that spills light into orbit is a fixture whose source is visible where it should not be. The radiation that escapes upward and the radiation that produces disability glare, discomfort glare and light trespass are produced by one and the same failure to control distribution, and they are corrected by one and the same intervention. Parts V.C.3 and V.C.4.

Three consequences follow for this comment.

A quantity that is unnecessary by definition is being measured globally, continuously, and has been for decades. Part V.J and Appendix C.3. The Secretary has a statutory duty to minimize emissions of unnecessary electronic product radiation and has never used that measurement for the purpose.

The techniques for reducing it exist, are commercially available and are not in dispute. Part II.G.3. What is absent is the federal testing and evaluation of their effectiveness that paragraph (a)(5) directs.

Because the same fixture property drives all of it, a reduction in direct uplight is not a trade-off against human exposure. It reduces the lateral emission that reaches the eye directly, and it reduces the scattered skyglow that returns to ground level as the irradiance described above. One intervention, three effects, all in the same direction. That is an unusual feature in regulatory design and the Foundation asks the Department to notice it.

The Foundation does not ask this Department to regulate the night sky, which is not within its authority and which it has no wish to see attempted. It asks the Department to recognize direct uplight as a measurable instance of the quantity paragraph (a)(2) names, and to include it in the study and evaluation that paragraph (a)(4) directs. Part IX.C.

4. The agency and the United States have each used the term, without applying it to visible light

The Final Response invoked the statutory category twice, in the two clauses quoted in subsection 2. The agency therefore used the term unnecessary radiation in disposing of petitions concerning visible light emitted by LED products. It did not identify the existing mitigations on which it relied, and it did not state which products were included in most.

In litigation the United States has relied on the same paragraph. Arguing against a broad construction of the liaison duty, it stated that such a construction "would also be irreconcilable with § 360ii(a)(2), which requires FDA to use its judgment by 'plan[ning] … operational activities' to minimize 'unnecessary electronic product radiation,' not all such radiation."

The Foundation does not dispute that reading. Judgment about which radiation is unnecessary is judgment the paragraph assigns. But the reading has a consequence the government did not address. A duty to exercise judgment is discharged by exercising it. The United States has also represented that no decisionmaking process has occurred with respect to these products. Part I.C.4. The two positions do not sit together. Either the agency has made the judgment paragraph (a)(2) requires, in which case the Department should produce it and state its basis, or it has not, in which case the paragraph is unperformed.

5. The existing mitigations

For the electronic products as to which the agency has prescribed performance standards, the mitigation is the standard: 21 C.F.R. part 1020 (ionizing radiation emitting products), § 1030.10 (microwave ovens), §§ 1040.10 and 1040.11 (laser products), § 1040.20 (sunlamp products and

ultraviolet lamps intended for use in sunlamp products), and § 1040.30 (high-intensity mercury vapor discharge lamps). For visible light emitted by LED products there is no federal performance standard, no federal measurement requirement, no federal disclosure requirement, and no federal exposure limit. Part II.C.3.

What exists is voluntary and non-federal: recommended practice published by the Illuminating Engineering Society; the blue-light hazard exposure limits of IEC 62471 and ANSI/IES RP-27, which are consensus documents the Department does not administer, Part V.C.2; State and municipal outdoor lighting ordinances of widely varying stringency; and a model ordinance, which is a model. None of these was adopted following the study and evaluation that § 360ii(a)(4) directs, and none is enforceable by the Department.

The Foundation is not alone in that characterization, and offers one corroboration from outside its own analysis. Cao, Xu and Yin, reviewing the health threats of light pollution and the regulatory response to them in the Journal of Environmental Sciences in 2023, open with this observation:

> "Although there are regulations and standards concerning light pollution, few of them are based on the potential contribution of improper lighting to diseases."

That is a survey of the field reaching the conclusion this subsection reaches about the United States: instruments exist, and they are not health-based. The authors state the purpose of their review as promoting risk assessment and better regulation of artificial lights, and say they aim to provide perspectives for future research and guidance for relevant regulations and standards. Appendix C.29. The Foundation notes that an invitation of that kind, addressed by researchers to whichever regulator will take it up, has in the United States only one possible addressee for electronic products, and that § 360ii(a)(3) directs that Department to receive information from organizations on present and future potential electronic product radiation.

The Foundation accordingly asks the Department to identify the existing mitigations on which the determination of May 24, 2024 rested, as applied to visible light emitted by LED products, and to state which of them the Department or the Food and Drug Administration administers. Part IX.H.2.

6. Absence of research, development, training, or operational activity directed to this radiation

The Foundation is aware of one study conducted under this program bearing on light-emitting products in the built environment, and it predates LED illumination. Part II.I.4. It is aware of no research program, no development activity, no training activity, and no operational activity directed to the emissions of, or the exposure of people to, visible light emitted by LED products. The Foundation's action under the Freedom of Information Act seeks the agency's records on this subject, Part IV.D.3, and what has been produced is described at Part IV.D.4.

The Center has described this duty in its own words, and has described it as something it does

The preceding paragraphs state an absence. The Foundation now sets beside it the Center's own account of the same duty, because the Center has given one, in writing, more than once, and the account is useful in two opposite directions.

On May 23, 2019 the Director of the Center for Devices and Radiological Health wrote to two physicians of an organization called Physicians for Safe Technology, answering a letter of December 9, 2018 about radiofrequency exposure. The second and third sentences of that letter are the ones that matter here. The first of the two describes the program:

> "The Food and Drug Administration (FDA) has the responsibility to establish and carry out an electronic product radiation control program designed to assure the safety of electronic product radiation exposure to people."

The second recites paragraph (a)(2), substantially in the words of the statute:

> "CDRH plans, conducts, coordinates, and supports research, development, training, and operational activities to minimize the emissions of and the exposure of people to, unnecessary electronic product radiation."

The Foundation makes three observations about those two sentences and no more.

First, the Center states paragraph (a)(2) as a description of what it does

The second sentence is not a paraphrase of the duty. It is the duty, reproduced with its four verbs, its four objects and its purpose, and the subject of the sentence is CDRH. The Center has therefore told correspondents that the activities paragraph (a)(2) directs are activities it carries out. For the radiation the letter was about, it then said what they consist of: that Center staff began monitoring developments in the scientific literature on radiofrequency exposure from wireless technologies in the early 1990s and continue to monitor new publications as they become available.

The Foundation does not dispute any of that and offers no view on whether it satisfies paragraph (a)(2) for radiofrequency energy. It records the contrast, which is the subject of this subsection. For radiofrequency energy the Center can name the activity and date its commencement to a decade. For visible light emitted by light-emitting diode products the Foundation has identified no research program, no development activity, no training activity and no operational activity, and the request at Appendix E.48 that sought the Center's records of this program as applied to fourteen product categories has produced none. Part IV.D.3.

Second, the first sentence is not what the statute says

Section 360ii(a) directs a program "designed to protect the public health and safety from electronic product radiation." The letter describes a program designed to assure the safety of electronic product radiation exposure to people. The Foundation does not suggest that the difference was intended, and a letter to correspondents is not a statutory construction. But the difference is there and it runs in one direction. The statute protects people from the radiation. The sentence assures the safety of the exposure. And the words public health, which the statute places first among the two things to be protected, do not appear.

Third, and this is the Foundation's point, the letter recites the minimizing duty and then answers only the safety question

Having set out paragraph (a)(2) in the third sentence, the letter does not return to it. What follows, over four pages, is an assessment of whether an adverse effect has been established: that the weight of all available scientific evidence shows no association between exposure at or below the Commission's limits and any adverse health outcome; that causation of an adverse effect at or below those limits has not been established; that the Center continues to believe the existing limits are sufficient to protect the public. Every one of those is a proposition about safety. None is a proposition about minimizing.

The same framing appears in the Center's public statement of February 2, 2018 on the draft report of the National Toxicology Program, where the Director described the mission in these terms: one part of the agency's mission is to ensure the safety of electronic products that emit radiation, like televisions and cell phones. That statement reports a fifty-fold safety margin and concludes that the current safety limits for cell phones are acceptable for protecting the public health. The word minimize does not appear in it.

The Foundation draws the conclusion this subsection has been building toward, and states it without characterizing anyone. The two duties are different. A finding that an emission is below a level at which harm has been established answers the question paragraph (a)(1) and § 360kk pose, which is whether a standard is necessary. It does not answer the question paragraph (a)(2) poses, which is whether the emission and the exposure are being minimized, and which does not wait on a finding of harm. Part II.D.4 establishes that the paragraph names two objects and that the word

unnecessary identifies the subset to be reduced. A product may be safe in the sense the Center's letters use and still emit more radiation than its function requires. The Foundation has not found, in either document, any statement addressed to that question.

One further feature of the May 2019 letter belongs here because it concerns the evidence base rather than the reasoning. The letter closes with a list of the references the Center used as benchmarks for its conclusions, twelve items, naming the European scientific committee, Health Canada, a New Zealand interagency committee, the Swedish radiation safety authority, the Health Council of the Netherlands twice, Public Health England, the National Cancer Institute, two reports of the National Council on Radiation Protection and Measurements, the publications of the International Commission on Non-Ionizing Radiation Protection, and the World Health Organization's international project. Every one concerns radiofrequency or electromagnetic fields. None concerns optical radiation. The Foundation offers that as a description of the list and not as a criticism of it: the letter was about radiofrequency energy and its benchmarks were chosen accordingly. What the list establishes is what the Center had assembled on the subject it was writing about, and the comment asks at Part IX.B for the equivalent as to this one.

The scale of the exposure that has gone unexamined is worth stating, and the Foundation takes the figures from the Department of Energy rather than offering its own.

That Department's most recent published adoption report counted 2,325 million light-emitting diode units installed in general illumination applications in the United States, amounting to 30.0 percent of the installed base, of which approximately 2.2 billion were indoor and approximately 100 million outdoor. Outdoor penetration stood at 51.4 percent. Those figures describe 2018.

Three things about that count bear on this subsection. It is the most recent federal count the Foundation has been able to identify. It predates the rules described at Part IV.G, which took effect in 2023 and after and which displaced the remaining incandescent and halogen general service lamps, so present penetration is necessarily higher and by an amount no federal source appears to state. And it counts units rather than emitters: a single lamp or luminaire contains one or more emitting dies, and in many products a great many, so the number of discrete emitters exceeds the number of units by a factor the Foundation does not attempt to estimate.

General illumination is also only one category of application, and not the one in which the highest source radiances occur. The adoption report does not count, among others:

- vehicle lighting — headlamps, daytime running lamps, signal and marker lamps, and auxiliary lamps, across the registered vehicle fleet, each assembly containing multiple emitters. Part VI.B;
- emergency, warning and flashing lamps on police, fire, emergency medical, utility and work-zone vehicles, and the pedestrian crossing beacons treated at Part VI.C;
- traffic control signals;
- signage, billboards and dynamic message displays. Part VI.J;
- security and deterrent lighting. Part VI.I;
- indicator and status lamps in appliances, electronics and equipment, which are individually small but are present in every occupied room;
- displays and screens, in which the emitting elements are counted per device in the millions. Part VI.H.

The Foundation is not able to give the Department a figure for these categories, and it declines to estimate one. Two reasons, and the second is the more important.

The first is that no federal inventory appears to exist. The Department of Energy counts general illumination because its own standards operate there. No federal source the Foundation has

identified states how many light-emitting diode emitters are deployed in the United States across all applications, in what settings, or at what radiance. That absence is not merely an inconvenience for this comment. It is directly responsive to this request for information, and it is a gap in the very thing § 360ii(a)(4) directs the Secretary to study: emissions of, and conditions of exposure to, electronic product radiation. If the Department cannot say how much of this radiation is deployed and where, the evaluation that paragraph directs has not been performed.

The second is that a count of emitters would not answer the question the statute asks, and the Foundation does not want the Department to be distracted by one. Paragraph (a)(2) is directed to the exposure of people. Paragraph (a)(4) is directed to conditions of exposure. Neither is a census. The emitting element in a handheld display, one of several million in the device, viewed at arm's length and contributing a small fraction of a modest total luminance, is not the same regulatory object as the die in a headlamp viewed directly at night across a two-lane road. Summing them produces a large number and tells the Department nothing it can act on.

What would tell the Department something it can act on is the characterization Part IX.C asks for: exposure organized by the spatial, spectral and temporal properties of the emission and by the conditions under which people encounter it. The relevant quantities are how many people are exposed, in what setting, at what radiance, at what angle, for how long, and how often. The Foundation asks for those, and not for a tally.

The duty to minimize presupposes a baseline

There is a further consequence of the absence just described, and the Foundation regards it as the most important thing in this subsection.

Minimization is a comparative idea. The word less requires a than what. A threshold is different in this respect, and the difference is practical rather than semantic. Compliance with a limit can be determined at a single moment from a single measurement of a single product: the product is beneath the limit or it is not, and nothing about the past is needed to say so. A duty to minimize cannot be assessed that way. It requires a measured starting condition and subsequent measurement, because the question it poses is whether exposure is lower than it was.

For visible light emitted by LED products the Department cannot presently answer that question in either direction. It does not know how many sources are deployed, in what applications, at what radiance, or how the exposure of people to them has changed across the period in which the installed base of general illumination was substantially replaced. Neither does anyone else. There is no figure from which a reduction could be measured, and therefore no way for the Department to establish that any step it takes under paragraph (a)(2) has had an effect, and no way for anyone outside the Department to check.

The Foundation stresses that this observation requires no view at all about whether light emitted by LED products injures anyone. It would hold if every proposition in Part V were resolved in the agency's favor. An agency directed to minimize an exposure needs to know the exposure in order to tell whether it is minimizing it. So does Congress, to which § 360jj directs reports, and a report that an exposure is being minimized conveys nothing in the absence of a quantity. Part II.I.

The relationship between the paragraphs is what makes this structural rather than rhetorical. Paragraph (a)(4) directs the Secretary to study and evaluate emissions of, and conditions of exposure to, electronic product radiation. That is the measurement function. Paragraph (a)(2) directs minimization. The second cannot be performed, and cannot be shown to have been performed, without the first. These are not two independent items on a list of six. One supplies what the other requires, and the order between them is not optional.

The agency's own practice for the products it does regulate confirms the point rather than being in tension with it. Section 360kk(a)(1) provides that a performance standard may include provisions for the testing of products and the measurement of their electronic product radiation emissions, and 21 C.F.R. part 1002 requires manufacturers of listed products to make reports to the agency.

Where the agency has acted under this chapter it has built the measurement and the reporting alongside the limit, because a program that prescribes without measuring cannot tell whether it has accomplished anything. For visible light emitted by LED products there is no limit, no measurement procedure, and no reporting requirement. The three absences are of a piece.

What the Foundation asks follows directly, and it is modest. Establishing a baseline is a bounded undertaking. It requires the Department to conclude nothing about harm, to prescribe no standard, and to resolve no contested scientific question. It requires it to determine what is deployed and how people are exposed to it, to express the result in quantities that bear on biological effect rather than on appearance, and to publish it, so that the question whether exposure is being minimized becomes a question capable of being answered. Parts IX.H.3 and IX.H.7 state the request. Everything else the Foundation asks under paragraph (a)(2) depends on it, and so, the Foundation submits, does the Department's ability to say that the paragraph has been carried out.

The Foundation offers the figures for one purpose only. Paragraph (a)(2) directs the minimization of the exposure of people. Whatever latitude the Secretary has in choosing which forms of electronic product radiation to address first, a form that reaches substantially the entire population indoors and outdoors, that was placed there in substantial part by federal action, and that has been the subject of no research, development, training or operational activity under this program, is not an obvious candidate for being left until last.

What paragraph (a)(2) would require is set out among the requests at Part IX: a stated definition of unnecessary optical radiation in terms of quantity, direction, spectral content, and temporal character; measurement methods referred to the point of human exposure rather than to the luminaire; evaluation of the conditions under which people are exposed, which is paragraph (a)(4); and techniques for minimizing that exposure, which is paragraph (a)(5). The paragraph has not been performed as to this radiation, and nothing in the record supplies a reason why not.

E. § 360ii(a)(3) — Maintain Liaison With and Receive Information From Other Agencies, Professional Organizations, and Industry

1. What the subsection requires, and of whom

Paragraph (a)(3) directs the Secretary to:

> maintain liaison with and receive information from other Federal and State departments and agencies with related interests, professional organizations, industry, industry and labor associations, and other organizations on present and future potential electronic product radiation

Four features of the text govern this subsection.

The first is that it contains two directions, not one. The Secretary is to maintain liaison with the listed sources, and to receive information from them. The second verb is unusual in a statute and the Foundation does not overread it. It does not require the agency to agree with what it receives, or to act on every submission, and the Foundation does not contend otherwise. What it does mean is that receipt is a function the program is directed to perform, and that information arriving from the listed sources arrives into a statutory duty rather than into a general correspondence file.

The second is the breadth of the sources, which is wider than any other paragraph in the section. It reaches other Federal departments and agencies, State departments and agencies, professional organizations, industry, industry and labor associations, and "other organizations." The reference to State agencies is unique to this paragraph; paragraph (a)(6) names Federal officers only. So is the residual phrase other organizations, which is what brings bodies such as the Foundation within the paragraph's terms.

The third is the subject matter, and it is the most striking thing in the paragraph. The liaison and the information are to be on "present and future potential electronic product radiation." The duty is written to run ahead of the technology. It attaches not only to radiation that exists but to radiation that may come to exist, which means it attaches before any product is marketed, before any exposure occurs, and necessarily before any harm could be demonstrated. An agency directed to maintain liaison on future potential electronic product radiation is not well placed to say that it had no occasion to consider a technology that has been in nationwide deployment for fifteen years.

The fourth is what the paragraph does not contain. There is no determination clause, no finding of necessity, and no qualifier of the kind the government has relied upon elsewhere in this section. The word appropriate does not appear. The word necessary does not appear. Part I.C.5 sets out which paragraphs the Foundation claims as unqualified and why; this is one of them, and the Foundation claims it without reservation.

2. Other Federal departments and agencies with related interests

Part II.H treats the consultation directed by paragraph (a)(6), and the agencies are largely the same. The two paragraphs differ in what they require and the comment keeps them apart. Paragraph (a)(6) names four officers, adds a residual class qualified by the word appropriate, and specifies two subjects: testing and evaluation techniques, and the development of performance standards. Paragraph (a)(3) names no officer, admits no qualifier, and is addressed to information about the radiation itself.

The practical consequence is that an agency which concluded that consultation with a particular department was not appropriate under paragraph (a)(6) would still be directed by paragraph (a)(3) to maintain liaison with it and to receive information from it, if it is a Federal department or agency with a related interest. The Foundation does not press that point far, because the agencies it identifies at Part II.H have related interests on any view. It states it so the Department does not treat a judgment made under one paragraph as disposing of the other.

3. State departments and agencies

No other paragraph of § 360ii reaches State agencies, and the omission elsewhere makes the inclusion here deliberate. The State bodies with related interests in this subject are readily identified.

State departments of transportation, which adopt and amend the Manual on Uniform Traffic Control Devices and so determine the flash rate, intensity and placement of the warning devices treated at Part VI.C.2. California's manual is discussed at Part VIII.

State energy offices and public utility commissions, which administer the efficiency programs and utility tariffs under which municipal street lighting has been converted.

State departments of public health.

The States that have enacted outdoor lighting statutes, which legislate on the subject of this comment in the absence of any federal measurement convention or exposure criterion. Part II.D.3.

State departments of labor, and in particular the twenty-nine jurisdictions that operate occupational safety and health plans approved under the Occupational Safety and Health Act. Twenty-two of those plans cover private sector together with State and local government employees, and seven cover State and local government employees only. Each must be at least as effective as the federal program, which permits a State to act in an area where the federal program has not. The occupational exposures described at Part II.H.10 and Part VI.F are within the subject matter of those plans, and a State plan is at present as likely a source of a first occupational criterion for optical radiation as the federal program is.

State consumer protection agencies and offices of State attorneys general, which receive complaints about consumer products and administer the State unfair and deceptive practices statutes. These are mentioned here for a particular reason, developed below.

The Foundation is aware of no instance in which the agency has maintained liaison with, or received information from, a State department or agency concerning visible light emitted by LED products. It asks the Department to say whether any such liaison exists.

The reference to State consumer protection offices is not incidental. Part VII.J describes the absence of any federal system for collecting reports of adverse reaction to optical radiation, and Part VII.J.1 records that the Foundation asked a component of this Department to establish one and that none was established. Complaints that have no federal destination do not stop being made. They go to retailers, to manufacturers, to local government, and to State consumer protection offices and attorneys general, which collect and retain them.

Paragraph (a)(3) directs the Secretary to receive information from State departments and agencies. It follows that information bearing on the conditions of exposure described at Part VI may already exist in State files, and that the Department is directed to receive it. Obtaining it would require no rulemaking, no new collection system and no determination of any kind. It would require asking. The Foundation asks the Department to ask, and to begin with the States operating approved occupational safety and health plans and with the consumer protection offices of the most populous States. Part IX.D.

4. Professional organizations and standards bodies

The Illuminating Engineering Society, the Institute of Electrical and Electronics Engineers, the International Commission on Illumination, SAE International, the National Electrical Manufacturers Association, the American National Standards Institute and the International Electrotechnical Commission publish the documents that manufacturers and public entities actually follow. Several bear directly on the subject of this comment: IEC 62471 and CIE S 009 on the photobiological safety of lamps and lamp systems, the ANSI/IES RP-27 series on the same subject, IEEE 1789-2015 on temporal light modulation, and SAE J595 on the intensity of flashing warning lamps. Part V discusses each where it is relevant.

Whether the agency participates in, comments upon, or tracks the work of any of these bodies as to incoherent optical radiation is not apparent from the public record, and the Foundation asks the Department to say.

The question is pointed because the agency plainly does so for the other light-emitting product class it regulates. On May 8, 2019 the Center for Devices and Radiological Health issued guidance titled Laser Products — Conformance with IEC 60825-1 Ed. 3 and IEC 60601-2-22 Ed. 3.1, known as Laser Notice No. 56, Docket No. FDA-2017-D-7011, announced at 84 Fed. Reg. 20,140, and succeeding Laser Notice No. 50, which the Center issued on May 27, 2001 and revised in 2007. By it the Center stated that for manufacturers complying with the comparable clauses of the specified international standards it does not intend to enforce the corresponding requirements of its own performance standards at 21 C.F.R. §§ 1040.10 and 1040.11. The agency gave two reasons. The first is that conforming to the identified international standards "may cause manufacturers to duplicate their efforts." The second is the one that matters here:

> "FDA acknowledges the advantages of one set of criteria and requirements worldwide."

And, as to its own regulations, the agency states that it "eventually intends to amend its standards for laser products at §§ 1040.10 and 1040.11 to harmonize" its requirements with those of the International Electrotechnical Commission. As of the date of this comment that amendment has not been made. The intention was announced in 2019, was carried forward in the guidance as reissued on February 21, 2023, and the performance standards for laser products read today as they read before it.

The Foundation draws no criticism from that. It is sensible regulatory practice and the Foundation would welcome its extension. The point is the comparison, and the comparison is not the one it first appears to be.

The agency has engaged with this Commission's work on incoherent optical radiation as well, and the Foundation states that record because the record is favorable to the request this comment makes. On August 20, 2012 the agency recognized IEC 62471, Photobiological safety of lamps and lamp systems, as a consensus standard under section 514(c) of the Federal Food, Drug, and Cosmetic Act, 21 U.S.C. § 360d(c). The recognition is numbered 12-249, appears on Recognition List 029, and is assigned to the Radiology specialty task group. The extent of recognition is not partial. The agency's record states it as "Complete standard."

The scope of the standard, as the agency's own recognition record states it, is the following:

> "This International Standard gives guidance for evaluating the photobiological safety of lamps and lamp systems including luminaires. Specifically it specifies the exposure limits, reference measurement technique and classification scheme for the evaluation and control of photobiological hazards from all electrically powered incoherent broadband sources of optical radiation, including LEDs but excluding lasers, in the wavelength range from 200 nm through 3000 nm."

Three features of that record are material, and the Foundation asks the Department to weigh each.

First, the standard the agency has recognized covers the emitting technology at issue in this comment. The agency's own abstract says so in terms: incoherent broadband sources of optical radiation, "including LEDs but excluding lasers." Whatever else is uncertain in this field, it is not in doubt that the agency holds a recognized standard whose stated scope reaches light-emitting diodes.

Second, the stated ground of recognition is the standard's merit. The record gives as its rationale that the standard "is relevant to medical devices and is recognized on its scientific and technical merit and/or because it supports existing regulatory policies." The agency has therefore already made a judgment that the reference measurement technique, the exposure limits and the classification scheme of IEC 62471 are scientifically and technically sound. That is not a judgment the Foundation asks the Department to make for the first time. It has been made.

Third, and most directly to the purpose of this comment, the recognition record identifies the authority under which this comment is submitted. Among the entries the record lists under relevant guidance and supportive publications is this one:

> "FD&C Act Chapter V Drugs and Devices, Subchapter C Electronic Product Radiation Control (21 U.S.C. 360hh - 360ss), 2006"

That is the subchapter. It is the subchapter that creates the duties described throughout Part II of this comment, the subchapter under which the Final Response of May 24, 2024 was issued, and the subchapter from which the Secretary's authority to prescribe a performance standard for an electronic product derives. The agency itself placed the photobiological safety standard for lamps and light-emitting diodes alongside it, in its own record, in 2012.

What the recognition does, and what it does not

The Foundation is careful here, because the recognition does less than its existence might suggest, and this comment should not overstate it.

Recognition under section 514(c) operates in the premarket review of medical devices. It permits a manufacturer to declare conformity to a recognized standard in support of a premarket submission in place of submitting the underlying test data. It is not a performance standard prescribed under 21 U.S.C. § 360kk, it imposes no requirement on any product, and it reaches no product that is not a medical device.

The confinement is visible on the face of the record. The device types to which the recognition is keyed are thirteen product codes, every one of them Class II and every one of them a laser or light-based surgical or cosmetic instrument regulated under 21 C.F.R. § 878.4810: powered laser surgical instruments, dental soft-tissue lasers, lasers for benign prostatic hyperplasia, over-the-counter light-based devices for wrinkle reduction, hair removal and acne, laser-assisted lipolysis, and others of that character.

So a standard that by its own scope covers light-emitting diodes is applied, in this agency, to thirteen categories of medical device. It is not applied to a roadway luminaire, a vehicle lamp, a video display, an appliance indicator or any other product described at Part VI, and the mandatory performance standards at 21 C.F.R. part 1040 prescribe nothing for any of them. Part II.C.

Two halves of one framework, and one half of the other

Set out as a table, the agency's recognition record for the relevant international documents reads as follows. Each entry is taken from the agency's own Recognized Consensus Standards database.

Standard, as designated in the recognition record	Date of entry	Recognition number, extent, specialty task group
IEC 62471 First edition 2006-07, Photobiological safety of lamps and lamp systems	08/20/2012	12-249; Recognition List 029; complete standard; Radiology
IEC 60825-1 Edition 2.0 2007-03, Safety of laser products — Part 1: Equipment classification, and requirements	07/09/2014	12-273; complete standard; Radiology
IEC/TR 62778, Application of IEC 62471 for the assessment of blue light hazard to light sources and luminaires	None located	No recognition record located
IEC 62471-6 and IEC 62471-7	None located	No recognition record located

One entry in that table deserves a sentence of its own. The edition of IEC 60825-1 the agency recognized in July 2014 is Edition 2.0 of March 2007. That is the edition whose foreword states that light-emitting diodes have been removed from the scope of the laser safety standard. Part V.C.2.k sets out that history. The agency recognized, as a complete standard, the instrument that excludes light-emitting diodes, and recognized the instrument that includes them only for thirteen classes of medical device.

The asymmetry the Foundation asks the Department to notice is therefore not between two product classes. It is between two halves of a regulatory structure.

For coherent optical radiation the agency has both halves. It has recognized the international standard, and it has prescribed its own mandatory performance standard for the product, at 21 C.F.R. §§ 1040.10 and 1040.11, with reference conditions, classification, labeling and reporting requirements written for the American market. The international standard supplies the method. The federal standard supplies the obligation.

For incoherent optical radiation the agency has the first half and not the second. It has recognized the international standard, on the ground of its scientific and technical merit, with a stated scope that includes light-emitting diodes, and with the electronic product radiation control subchapter named in the same record. It has never prescribed the performance standard. There is no part 1040 counterpart for a light-emitting diode product.

That is the gap, stated as precisely as the Foundation can state it. It is not an absence of expertise, because the agency has assessed this standard and found it meritorious. It is not an absence of relationship with the standards body, because the agency has recognized two of its standards and adopted a third as an enforcement alternative. It is not an absence of authority, because § 360kk supplies it and the agency's own recognition record cites the subchapter that contains it. What is absent is the second half of the structure the agency built for lasers, for an emitting technology that reaches incomparably more people.

One recent document bears directly on this paragraph. In October 2024 the International Energy Agency's 4E Solid State Lighting Annex published a review of the health effects of solid-state lighting, described at Part V.C.2.f, which recommends in terms that "photobiological safety committees engage in a systematic review and update of the blue light hazard exposure limits." It is information from an intergovernmental body, addressed to the standards committees whose documents the Final Response of May 24, 2024 relied upon, concerning present and future potential electronic product radiation. That is the subject matter paragraph (a)(3) describes.

The Foundation asks whether the agency received, reviewed, or responded to it.

One consortium warrants specific mention, because for two decades it occupied the position this paragraph contemplates the Secretary occupying, and because Mr. Baker filed its publications as evidence in the litigation described at Part IV.D.

The Alliance for Solid-State Illumination Systems and Technologies, known as ASSIST, was established in 2002 by the Lighting Research Center at Rensselaer Polytechnic Institute. Its own description of its constitution is that ASSIST was established by that center "as a collaboration among researchers, manufacturers, public benefit and government organizations to find solutions to the many technical and market challenges facing solid-state lighting."

What it produced is the material point. By its own account ASSIST "has developed definitions and calculation tools to evaluate light source flicker, discomfort glare, dimming, color rendering capability, and mesopic efficiency," together with application metrics for "under-cabinet, directional, decorative, parking lots, roadways, and freezer cases," published in a series titled ASSIST recommends. Its first industry recommendation, released in 2005, defined the useful life of an LED at L70 and supplied a method of estimating it, which in its own account "eventually became the basis for the IES LM-80 standard."

Two of the five light-source characteristics in that list — flicker and discomfort glare — are among the emission characteristics this comment identifies at Parts V.C.4 and V.D. The calculation tools by which they are evaluated were developed by an industry consortium organized at a private university. No federal equivalent exists.

The membership is also of record. The list printed on the consortium's own publication reads: "Amerlux; Federal Aviation Administration; Finelite; GE Current, a Daintree Company; Hubbell Lighting; New York State Energy Research & Development Authority; OSRAM; U.S. Environmental Protection Agency."

The Foundation draws a narrow point from that list and wishes to be exact about its limits. Participation in a research consortium is not regulatory authority, and the membership contradicts nothing either federal member later wrote. The Environmental Protection Agency's letter of October 7, 2022 and the Federal Aviation Administration's of November 9, 2022 addressed their authority to regulate, not their participation in research, and each agency had a program reason of its own to take part. Parts II.H.3 and II.H.7.

The point concerns the composition of the room. Two federal agencies contributed to the consortium that developed the metrics by which LED illumination is characterized, and a State energy authority contributed alongside them. The agency to which both of those federal agencies deferred on questions of health and safety was not a member, and the Foundation has located no

record of its participation in, comment upon, or correspondence with the consortium at any point in its operation.

Paragraph 360ii(a)(3) directs the Secretary to maintain liaison with and receive information from professional organizations, industry and labor associations and other organizations on present and future potential electronic product radiation. A consortium organized to define the performance of the emitting product, with federal agencies among its members and a publication record spanning two decades, is the paradigm case of what that paragraph describes. Whether the Department received information from it, and if so what became of that information, is a question only the Department can answer.

5. Industry and labor associations

The paragraph names industry, and industry and labor associations, separately. As to industry, the manufacturers of the products at issue and their trade associations hold the emission data that Part IX.F asks be disclosed: spectral power distribution, source radiance, driver switching frequency and modulation depth. That information is measured in the ordinary course of manufacture. It is not published, and no federal requirement compels its publication. Paragraph (a)(3) directs the Secretary to receive it.

As to labor, Part II.H.10 sets out the three places in which this chapter speaks of labor organizations, of which this paragraph is one. The Foundation is aware of no instance in which the agency has sought or received information from a labor association concerning occupational exposure to visible light emitted by LED products, and the occupational settings at issue are described at Part II.H.10 and Part VI.F.

6. Information received and not acted upon

The Foundation is an "other organization" within the terms of this paragraph, and the record of what it has transmitted to the agency is set out at Part IV.B: the LED Incident Reports, the petition comments, the signature totals, and the related correspondence. The agency acknowledged receipt. Part IV.B.3 reproduces the acknowledgments and Part IV.B.8 tabulates them.

Receipt is therefore not in dispute, and the Foundation does not frame this subsection as a complaint that the information failed to arrive. It arrived, and the Department's own files confirm it. Part IV.B.7.

What the Foundation cannot establish from the public record is what became of it. No evaluation of the reports has been published. No analysis of them appears in the Final Response of May 24, 2024, which addresses the published literature and not the reports. The Foundation does not assert that no evaluation occurred, because it does not know; the action described at Part IV.D.3 seeks the agency's records on precisely this question and has not yet produced them.

The distinction the Foundation asks the Department to hold onto is the one drawn in subsection 1. Paragraph (a)(3) directs that information be received. Paragraph (a)(4) directs that emissions and conditions of exposure be studied and evaluated. Receipt discharges the first. It does not discharge the second, and a program in which information arrives, is acknowledged, and is not evaluated has performed the collecting function of § 360ii without performing the evaluating one.

The Foundation accordingly asks the Department to state what was done with the material described at Part IV.B after it was received; whether any evaluation of it was undertaken and by whom; and if none was, what the agency understands paragraph (a)(3) to require of it once information has been received. Part IX.H.4.

Information published by a component of this Department

One body of information requires separate mention, because it did not have to be received from anyone. It originated inside the Department.

Environmental Health Perspectives is the peer-reviewed journal of the National Institute of Environmental Health Sciences, an institute of the National Institutes of Health, within the Department of Health and Human Services. In May 2025 that journal published a case-control study of 736 children with papillary thyroid cancer and 36,800 controls, nested in a California birth cohort, examining perinatal exposure to fine particulate matter and to outdoor artificial light at night. Appendix C.11 sets out the study. Its statement of objectives contains the following sentence:

> "Both are considered environmental carcinogens with evidence of thyroid function disruption, reported associations with thyroid cancer in adults, and concerns of distributive inequity."

The Foundation is exact about what that sentence is and is not, because the temptation to overstate it would be the quickest way to lose the point. It is a characterization in the authors' statement of rationale, describing how the two exposures are regarded in the literature they are working in. It is not a finding of the study. It is not a regulatory classification, and the Foundation does not assert that one exists. The International Agency for Research on Cancer has classified night shift work involving circadian disruption as probably carcinogenic to humans, in Group 2A; it has not classified outdoor artificial light at night, and the two are not the same exposure.

What the Foundation asks the Department to weigh is the relation between two statements, and the fact that both of them are the Department's.

- In May 2024 the Center for Devices and Radiological Health wrote that light-emitting diode products have a long history of safety with respect to the visible wavelengths being emitted, and that performance standards have historically not been considered necessary. Part I.C.
- In May 2025 a journal published by an institute of the same Department published peer-reviewed research describing outdoor artificial light at night as considered an environmental carcinogen, and reporting an association between it and pediatric papillary thyroid cancer.

The Foundation does not contend that those statements are formally inconsistent. They can be reconciled: the first addresses performance standards for electronic products under subchapter C, and the second concerns ambient outdoor light from all sources. The Foundation asks whether they have in fact been reconciled, by whom, and on what basis. A determination resting on a long history of safety is a determination about the state of knowledge, and the state of knowledge is partly constituted by what this Department itself publishes.

The same journal, fifteen years earlier

The 2025 study is not the first occasion on which this Department's journal addressed this subject, and the earlier instance bears more directly on a determination resting on a long history of safety, because it precedes that determination by fourteen years.

In December 2010 Environmental Health Perspectives published, in its news section, an item headed Light Pollution: Light at Night and Breast Cancer Risk Worldwide, at volume 118, page A525. The Foundation is precise about what that item is: it is science journalism, written by a freelance science writer, and it is not peer-reviewed research. It is not in Appendix C for that reason. What makes it material is not its authority as science but its provenance as a publication of an institute of this Department, and what it records.

It records four things.

First, the state of the field as of 2010, described in the Department's own journal as already established rather than novel. The item opens by stating that several studies over the preceding decade had suggested that exposure to artificial light at night increases cancer risk, particularly for cancers that require hormones to grow, and it recites the two findings that frame the literature:

elevated breast cancer rates among women who work night shifts, and decreased risk among blind women. Part V.G records that the hypothesis itself dates from 1987.

Second, the International Agency for Research on Cancer classification, which this comment cites elsewhere. The item identifies the source as the Agency's Monographs volume 98, Painting, Firefighting, and Shiftwork, published in 2007.

Third, a research program inside this Department, coordinated. The item quotes Les Reinlib, identified as the program director who coordinates grants of the National Institute of Environmental Health Sciences related to the health effects of light at night:

> "Light at night is likely to be one of a number of factors that contributed to the increase in breast cancer over the last few decades. … It seems to be significant, and if it is, then that's something we can control."

Fourth, practical advice to readers. Under the heading Embrace the dark, the item set out measures for reducing circadian disruption: extending the dark period to nine or ten hours, installing room-darkening shades, avoiding brief light exposures, and using a dim red light rather than ordinary lighting if one rises at night, on the stated ground that red light suppresses melatonin production less than other wavelengths.

The Foundation draws two points from this and no more.

The first concerns the coordination argument made above, which this item sharpens and partly corrects. The Foundation wrote that the support exists and the coordination does not. The item shows that as to the research itself coordination did exist, in 2010, within the National Institute of Environmental Health Sciences, with a named program director holding the portfolio. The accurate statement is therefore narrower and worse. Research on the health effects of light at night was not merely funded by this Department; it was coordinated as a program. What the Foundation has been unable to find is any connection between that coordinated program and the Center that holds the authority to prescribe a performance standard for a light-emitting product under § 360kk. The two are components of one Department.

The second concerns the wavelength statement, which the Foundation notes because of where it appears. The proposition that red light suppresses melatonin less than other wavelengths is a proposition about the spectral composition of emitted light and its biological effect. It appeared in a publication of an institute of this Department in 2010, addressed to the general reader as practical guidance. Part V.B.3 describes the absence of any federal requirement addressed to the spectral composition of a light-emitting product, and Part IV.G describes a federal efficacy standard that selects against the long-wavelength content this item advised readers to prefer.

The item also reports the caution a reviewer offered, and the Foundation reproduces it because a comment that quoted only the favorable half of a source would deserve to be discounted. The Harvard epidemiologist Eva Schernhammer is quoted agreeing that the study added evidence, while observing that as an ecological study its result, even had it been negative, would not have been strong enough to rule out the evidence from prior case-control studies. The study the item reports is at Appendix C.58, which grades it as an ecological analysis and sets out its limitations at length.

There is a further fact in this sequence, and it goes beyond publication to expenditure. In September 2024 Frontiers in Neuroscience published a study reporting an association between outdoor nighttime light intensity and the prevalence of Alzheimer's disease across the United States. The funding statement identifies two grants of the National Institutes of Health, numbered R01AG056653 and R24AA026801.

The Foundation is as careful with this study as with the last. It is an ecological analysis, which is the weakest observational design in this comment, and Appendix C.16 grades it accordingly and at

length. Nothing in this subsection depends on its finding being correct, and the Foundation does not assert that artificial light causes Alzheimer's disease.

What the Foundation asks the Department to notice is not the result but the grant. Publication in a journal of an institute of this Department shows that the Department's scientific community regards the subject as worth investigating. A grant shows that the Department allocated money to it. Those are different facts and the second is harder to answer.

It bears directly on the text of § 360ii(a)(2), which directs the Secretary to plan, conduct, coordinate, and support research to minimize the emissions of and the exposure of people to unnecessary electronic product radiation. Four verbs. A grant from the National Institutes of Health for research into the health effects of artificial light at night is the Secretary supporting research on this subject. The Foundation does not criticize that and would not have it stop. It observes that of the four verbs in the paragraph, the one being performed is the one that requires only money, and the three that require a program — planning, conducting, and above all coordinating — are the ones for which the Foundation has found no evidence as to light-emitting diode products. The support exists. The coordination does not. And because both the funding institute and the Center holding the radiation-control authority report to the same Secretary, the coordination that is absent is not interagency coordination. It is coordination within one Department.

There is a further point about paragraph (a)(3) that the Foundation puts shortly. That paragraph directs the Secretary to maintain liaison with and receive information from other Federal departments and agencies with related interests. Where the related interest lies within the Secretary's own Department, there is no channel to establish and no other agency to persuade. Whatever difficulties attend interagency coordination, and Part II.H describes several, none of them applies here. The National Institutes of Health and the Food and Drug Administration answer to the same Secretary, and it is the Secretary on whom § 360ii places these duties.

F. § 360ii(a)(4) — Study and Evaluate Emissions of, and Conditions of Exposure to, Electronic Product Radiation

Three lines of argument in this comment converge on this paragraph, and the Foundation sets them out together because the paragraph is where the rest of Part II comes to rest. Part I.C.8 holds that the judgment committed to the Secretary by § 360kk(a)(1) operates on a record, and that this paragraph is what produces it. Part II.D.6 holds that a duty to minimize cannot be performed, or shown to have been performed, without the measurement this paragraph directs. Part II.E.6 holds that information received under paragraph (a)(3) is evaluated under this one. If paragraph (a)(4) has not been carried out as to a form of electronic product radiation, very little else in the program can be.

1. What the subsection requires

Paragraph (a)(4) directs the Secretary to:

> study and evaluate emissions of, and conditions of exposure to, electronic product radiation and intense magnetic fields

The paragraph is nineteen words long and three features of it matter.

The first is that it contains two objects, not one. The Secretary is to study and evaluate emissions, and to study and evaluate conditions of exposure. These are different subjects and they are measured differently. An emission is a property of a product and can be characterized in a laboratory: what the device radiates, at what wavelengths, at what radiance, with what temporal structure. A condition of exposure is a property of the world: who encounters the radiation, where, at what distance and angle, for how long, how often, and alongside what else. A measurement of a luminaire on a bench answers the first and is silent on the second. The paragraph requires both, and the second is the one that reaches the installed environments described at Part VI.

The second is the phrase that closes the paragraph. The subject matter is electronic product radiation "and intense magnetic fields." Those words do not appear in the definition at § 360hh(1), and they do not appear in the standard-setting provision at § 360kk. Congress named an additional subject for study that it did not name for regulation.

The consequence is structural and the Foundation asks the Department to weigh it. The duty to study is written wider than the power to prescribe. An agency may be directed to evaluate what it does not regulate, and under this section it is. It follows that a determination that a performance standard is unnecessary cannot answer paragraph (a)(4), because the two provisions were not drawn to the same scope. The letter of May 24, 2024 disposed of a request made under § 360kk. It did not reach this paragraph, and on the face of the statute it could not have.

The third is what the paragraph omits. There is no determination clause. There is no finding of necessity. There is no qualifier of the kind the government has relied on elsewhere in this section. Part I.C.5 identifies the paragraphs the Foundation claims as unqualified, and this is the central one.

2. Information bearing on conditions of exposure already in the agency's possession

The paragraph does not require the Secretary to generate every input from nothing. A substantial body of material bearing on conditions of exposure to this radiation is already in the Department's files, and most of it was placed there by the Foundation or by other federal agencies.

The LED Incident Reports transmitted to the Center for Devices and Radiological Health and acknowledged by it. Part IV.B. Each report describes a setting, a source and an effect; whatever is made of the effects, the settings and sources are descriptions of conditions of exposure, which is what this paragraph directs the Secretary to study.

The regulatory petitions, the comments filed on them, and the signature totals. Part IV.C.

The record of the federal action that produced the exposure, including the general service lamp rulemakings and the environmental determinations made in them. Part IV.G.

The congressional directives on headlamp brightness and the related legislation. Part IV.F.

The agency's own records on the subject, which remain unproduced and are sought in the action at Part IV.D.3.

The Foundation makes a narrow point with this list. Whatever is thought of the quality of any particular item, the Department is not in the position of an agency asked to begin from nothing. The evaluation this paragraph directs would begin with material the Department already holds.

3. Studies and evaluations the agency has conducted for other electronic product radiation

The agency has performed this duty before, for other electronic product radiation. The record of how it did so is relevant here because it establishes that the question in this comment is not one of institutional capability.

Each standard in subchapter J was prescribed through notice and comment rulemaking, and each therefore has a documented record behind it of what the agency examined before acting. The principal ones, by their codification:

Television receivers, 21 C.F.R. § 1020.10, promulgated at 38 Fed. Reg. 28,632 (Oct. 15, 1973), amended at 88 Fed. Reg. 3,654 (Jan. 20, 2023). Part 1020 is titled Performance Standards for Ionizing Radiation Emitting Products, and the standard addresses the x-radiation a receiver emits rather than the light it is built to produce. The Foundation notes the distinction so that no inference is drawn from it: this is not an instance of the agency regulating a display for its visible output.

Microwave ovens, § 1030.10, promulgated at 38 Fed. Reg. 28,640 (Oct. 15, 1973), amended repeatedly thereafter and most recently at 88 Fed. Reg. 3,654 (Jan. 20, 2023).

Laser products, § 1040.10, at 50 Fed. Reg. 33,688 (Aug. 20, 1985) and 50 Fed. Reg. 42,156 (Oct. 18, 1985), with a further revision at 65 Fed. Reg. 17,138 (Mar. 31, 2000) and amendments at 75 Fed. Reg. 20,917 (2010) and 83 Fed. Reg. 13,864 (2018).

Sunlamp products and ultraviolet lamps intended for use in sunlamp products, § 1040.20, at 50 Fed. Reg. 36,550 (Sept. 6, 1985), amended at 67 Fed. Reg. 9,587 (2002), 69 Fed. Reg. 18,803 (2004), 75 Fed. Reg. 20,917 (2010) and 83 Fed. Reg. 13,865 (2018).

Two things about that list bear on this subsection. The first is that the agency has repeatedly determined what an electronic product emits, in what quantity, and under what conditions people are exposed to it, and has then written a limit expressed in the units of the emission. For sunlamp products it did so in radiometric and spectrally resolved terms, as Part II.C.2 describes. The second is that subchapter J has been revisited as recently as January 2023, in the rulemaking that also revoked the ultrasonic therapy standard formerly at part 1050. The program is administered. It is not dormant.

The study described at Part II.I.4 is a further instance, conducted under § 360jj by the Bureau of Radiological Health, which is one of the two bureaus from which the Center for Devices and Radiological Health was formed. Part II.A.3.

The institutional capability therefore exists, or existed. The Foundation does not suggest that the agency lacks the expertise to characterize optical emissions or to design an evaluation of exposure conditions. It has done both, for other radiation, within this same subchapter.

4. Absence of any study or evaluation of visible light emitted by LED products

The Foundation states first what the agency did do, because the record is not empty and a comment that said it was would be inaccurate.

The Final Response of May 24, 2024 states that the agency engaged an independent, third-party organization to conduct a comprehensive literature search and systematic review to identify the current state of knowledge with regard to adverse health effects of LED light on humans. Something was therefore commissioned, and the Foundation does not assert otherwise.

But a literature search and systematic review is not what paragraph (a)(4) directs, and the difference is not a quibble about words. A literature review establishes what other people have published about effects. Paragraph (a)(4) directs the Secretary to study and evaluate emissions, and to study and evaluate conditions of exposure. A review of the published health-effects literature does neither. It does not measure what the products emit. It does not characterize the circumstances in which people encounter them. Those are the two things the paragraph names, and a search of other people's papers about outcomes is not a study of either.

What the review did find makes the point sharper rather than weaker. The Final Response reports that the overall quality of the evidence was low, that sample sizes were small, and that results were inconclusive or inconsistent. Taken at face value, that is a finding about the state of published research. Under paragraph (a)(4) such a finding is the occasion for the Secretary to conduct the study, not a reason to refrain from it. An agency directed to study and evaluate, which learns that the existing literature is too weak to support a conclusion, has been handed the case for performing its own duty. It has not been excused from it.

The Foundation is also unable to say what the review examined, because the organization has not been identified, the protocol has not been disclosed, and the review itself has not been published. Part I.C.6. The requests at Part IX.H.1 and IX.H.2 ask for each of those. Until they are answered the Foundation can describe the commissioned work only in the terms the letter uses.

What the agency has measured, and it is one thing. In 2010 four scientists of the Center for Devices and Radiological Health published a laboratory characterization of the ocular hazard presented by cutaneous transilluminators, which are hand-held devices pressed against the skin to locate a blood vessel. The authors were Sharon Miller, Robert James, Robert Landry and Joshua

Pfefer, all of the Division of Physics, Office of Science and Engineering Laboratories, Center for Devices and Radiological Health; the first author is identified in the paper as then being with the Electronic Products Branch, Division of Mammography Quality and Radiation Programs, within the same Center. The paper is Miller S, James R, Landry R, Pfefer J, Optical characterization of cutaneous transilluminators for eye safety, Biomedical Optics Express 2010;1(3):771–779, doi:10.1364/BOE.1.000771. It is open access. The Foundation sets out its contents at some length because it is the agency's own work and because it is, so far as the Foundation has been able to determine, the only measurement by the agency of the optical emission of a light-emitting diode product.

What the agency measured. Six models of transilluminator were evaluated. Two incorporated white light-emitting diodes and were the focus of the retinal assessment; one used red diodes and three used red and orange. Three units of one model, purchased at different times, were measured to establish variability between devices. Spectral irradiance and spectral radiance were determined for each. Spectral radiance was weighted by the aphakic hazard function and integrated from 380 to 700 nanometers. The aphakic function was chosen, in the authors' words, as a worst case because infants have higher transmission of ultraviolet and visible light through the lens, and because ICNIRP recommends that weighting for children under two years of age. The resulting quantity was compared against the ANSI/IESNA RP 27.1 photochemical retinal hazard limit of 100 joules per square centimeter per steradian for exposures under 10,000 seconds, yielding a time to reach the limit.

What the agency found.

- The light levels produced by all devices were below the acceptable limits relevant to eye safety. The Foundation states that first because it is the authors' own conclusion and the finding is about time, not exceedance.
- For the two white light-emitting diode devices, the time to reach the hazard limit was between 1.03 and 3.35 minutes. Across all white diodes tested the mean time was 4.0 minutes, standard deviation 1.45, with individual results from 2.06 to 6.7 minutes.
- The authors state that this is probably not a significant risk for healthy adults, since most people using these devices will not be looking directly at the diode, but that it may be a risk for neonates, who in their words may be more sensitive and may lack a developed aversion response to bright light.
- Citing published measurements, the authors record that the eyes of infants of 40 to 50 weeks post-menstrual age are significantly smaller than adult eyes, such that for a constant luminance at the cornea the retinal illuminance is approximately three times higher in the infant eye.
- On that basis they compute a worst case. If the young eye can focus images to a sharp spot on the retina, the time to reach the hazard limit would range from 21 seconds to 1.1 minutes.
- They further note that raised blood oxygen reduces the dose needed to damage the retina, and that because some neonates are kept in an enhanced-oxygen environment this may place them at higher risk.
- They observe that the white diode has peak irradiance in the region of 440 or 460 nanometers, which is the region of the spectrum most hazardous to the retina.

The authors' own summary of the paper is that transilluminators incorporating white-light diodes have emissions with the potential for producing injury to the retina, especially in patients who may have a reduced aversion response.

Four things follow and the Foundation separates them carefully, because this paper can be overstated and the Foundation does not wish to overstate it.

First, on capability. Part II.F.3 above argues that the question in this comment is not one of institutional capability. This paper closes that question. The characterization paragraph (a)(4) describes — measure the spectral radiance of a product, weight it by the applicable action spectrum, integrate it, and compare it to an exposure limit — was performed by this Center, on a light-emitting diode product, using published methods, and published in a peer-reviewed journal. It is not a method the agency would have to develop. It is a method the agency has used.

Second, on what the paper does not establish. A transilluminator is not a streetlight. It is a small, high-radiance source applied at short range for a clinical purpose, and nothing in this paper bears directly on general illumination, vehicle lamps, displays or indicator lamps. The authors found no exceedance of any limit and reported no injury. The Foundation does not cite this paper for the proposition that general lighting is hazardous and asks the Department not to read it that way.

Third, on what the paper does establish about the framework. The safety margin the authors identify for healthy adults is behavioral: people will not look directly at the diode. The risk they identify for neonates is the absence of that behavior. The protective mechanism and the vulnerability are therefore the same fact viewed from two sides, and the agency's own scientists said so in 2010. Part V.C.2 returns to this, because the international statement on which any alignment would rest relies on the same aversion response as a general assurance.

Fourth, on what did not follow. The Foundation has identified no subsequent measurement by the agency of the optical emission of any other light-emitting diode product class. It has identified no extension of this method to general service lamps, roadway luminaires, vehicle headlamps, displays or indicator lamps. It has identified no performance standard, no guidance and no recommendation issued in consequence. What the record shows is a single application of the right method to one device class in 2010, and nothing after it.

What remains absent is therefore narrower than the Foundation would otherwise have stated, and the Foundation states it narrowly. For the product classes described at Part VI — general service lamps, roadway and area lighting, vehicle lamps, displays, indicator lamps and the rest — the Foundation can identify no measurement by the agency of the emission characteristics of any of them: no spectral power distribution, no source radiance, no temporal modulation measurement, no exposure survey, no measurement of the environments described at Part VI, and no estimate of duration or frequency of exposure for any population. Nor can the Foundation identify any characterization by the agency of the conditions under which people are exposed to this radiation, or any baseline of the kind described at Part II.D.6, against which a future change could be assessed. For one clinical device class, a measurement exists, the agency made it, and it is fifteen years old.

The pattern is not confined to one product class, and the second instance is far larger. Dental light-curing units set resin restorations by photopolymerization. Modern units are blue light-emitting diodes, emitting in the region of 450 to 470 nanometers, because that is the absorption region of the photoinitiators in dental composites. The FDA classifies them at 21 C.F.R. § 872.6070 under product code EBZ, in Class II. The regulation reads in full:

> § 872.6070 Ultraviolet activator for polymerization. (a) Identification. An ultraviolet activator for polymerization is a device that produces ultraviolet radiation intended to polymerize (set) resinous dental pit and fissure sealants or restorative materials by transmission of light through a rod. (b) Classification. Class II.

The identification describes a device that produces ultraviolet radiation and delivers it through a rod. The devices in use produce blue visible light and most deliver it from a handpiece without any such rod. The Foundation asks the Department to consider the clearance record against that text. By the agency's own database, 216 premarket notifications have been cleared under this regulation. The earliest fall in 1977 and 1978. The most recent in the sample the Foundation examined was decided on May 5, 2025. The device names in the record describe the technology the regulation does not: a clearance in 1986 for a product named a visible light curing system;

clearances in 2000 and 2004 and 2006 for products named for the color blue; a clearance in 2002 for a product whose name contains the abbreviation for light-emitting diode; a clearance in 2008 for a cordless light-emitting diode curing light; and a clearance in 2025 for a product named Bluemoon.

The Foundation draws three conclusions and no others.

First, this is not an oversight in a corner of the schedule. Two hundred and sixteen clearances over forty-eight years is sustained regulatory attention. The agency has examined these devices again and again, and has done so in Class II, which carries general controls and special controls and premarket notification rather than the exemption that applies to the whitening class. Whatever else may be said, the Department cannot characterize this product class as one it has not looked at.

Second, the classification does not describe the emission. A product class whose regulatory identification says ultraviolet, and whose members have been named for blue light since at least 1986, has been cleared more than two hundred times against a definition that names the wrong waveband. The Foundation makes the same point here that it makes about the whitening class, and it is stronger here because of the scale: where this agency has engaged with optical radiation from light-emitting diode products, it has done so through descriptions that do not correspond to what the products emit. Part IV.C and Part V.C.2 describe the same defect in the measurement conventions. This is the defect in the nomenclature of the agency's own device schedule.

Third, and this is the point that returns to paragraph (a)(1): none of that attention produced an emission limit. There is no performance standard in part 1040 for either product class, for the reason given at subsection 3. Neither appears in the OPTICAL category of Table 1 to 21 C.F.R. § 1002.1, so no product report, supplemental report, abbreviated report, annual report or test record is required of their manufacturers. And the control measure that the dental literature actually relies on is protective eyewear, a shield, and adherence to recommended exposure times and distances, as the systematic review at Appendix C.52 records — none of which is specified by any federal instrument. Two product classes, cleared between them more than two hundred times, and the hazard is managed by asking the operator to look away and wear orange glasses whose optical density nobody has prescribed. Part II.G.3.

The request the Foundation makes under this paragraph is the establishment of that baseline, and it is worth being exact about what the request is and is not. It is not a request that the Department prescribe a performance standard. It is not a request that the Department find that LED products cause harm, or adopt any position on the questions Part V describes as unresolved. It is a request that the Department carry out the study and evaluation this paragraph directs: measure what these products emit, in quantities that bear on biological effect rather than on appearance; characterize the conditions under which people are exposed to them; and publish both. Granting it decides nothing about whether a standard is necessary. It supplies the record on which that question would be decided, which is the order the statute sets. Parts IX.H.3 and IX.H.7.

G. § 360ii(a)(5) — Develop, Test, and Evaluate Procedures and Techniques for Minimizing Exposure [RFI Q5.o]

Paragraph (a)(5) directs the Secretary to:

> develop, test, and evaluate the effectiveness of procedures and techniques for minimizing exposure to electronic product radiation

1. What this paragraph adds to the two before it

The object of this paragraph is not the radiation. It is the procedures and techniques for minimizing exposure to the radiation, and what the Secretary is directed to evaluate is their effectiveness. The three research paragraphs of § 360ii(a) divide cleanly once that is seen. Paragraph (a)(4) directs the measurement of the emissions and of the conditions of exposure,

which is the problem. Paragraph (a)(2) directs the program of research, development, training and operational activity aimed at minimizing them. Paragraph (a)(5) directs the development and testing of the countermeasures themselves, and a determination of whether they work.

Question 5.0 of this request for information repeats the language of this paragraph almost word for word. The Foundation reads that as the Department asking what the statute already directs it to find out, and answers accordingly.

2. The agency has already asserted the conclusion this paragraph directs it to reach

The Final Response of May 24, 2024 declined to prescribe performance standards on the ground, among others, that they are not necessary "given the effectiveness of existing mitigations in addressing unnecessary radiation and alternative approaches to protect public health."

The Foundation asks the Department to read that clause against the paragraph quoted above. The agency asserted the effectiveness of mitigations. Paragraph (a)(5) directs the Secretary to develop, test and evaluate the effectiveness of procedures and techniques for minimizing exposure. The assertion in the letter is the conclusion of the evaluation this paragraph directs.

Two possibilities follow and the Foundation does not know which obtains. Either the evaluation was performed, in which case the Department holds it and should produce it, and this comment's principal complaint under this paragraph falls away. Or the conclusion was stated without the evaluation, in which case the letter asserts as established the very thing the statute directs the Secretary to determine. Part II.D.5 asks what the existing mitigations are. This subsection asks the further question: by what testing was their effectiveness established, and where is it recorded. Part IX.H.2.

3. The techniques exist; what is absent is the federal evaluation of them

The Foundation is not asking the agency to invent anything. For every product class treated in Part VI, techniques for reducing human exposure already exist and are in commercial use, developed by manufacturers, by standards bodies and by municipalities. What has not happened is the development, testing and evaluation of their effectiveness by the agency this paragraph addresses. Four examples make the pattern plain.

Vehicle headlamps. Federal Motor Vehicle Safety Standard No. 108 specifies luminous intensity in candela at defined angular test points, and includes maxima at certain angles above the horizontal that operate to limit glare. What the standard does not contain is any limit on the luminance of the emitting surface, any requirement as to spectral content, and any limit on temporal modulation; and no limit it does contain was derived from a photobiological criterion. The distinction between intensity and luminance is the substance of the point. Luminance is intensity per unit of emitting area, and two headlamps delivering identical candela to the same test point can differ by orders of magnitude in the luminance they present, according to whether the light leaves a large diffusing surface or a small intense die. Discomfort and disability glare depend on the luminance of the source and the angle it subtends at the eye, not on the total output measured at a point on the roadway. Parts V.B.2 and V.C.3. Techniques for reducing the exposure of the oncoming driver exist — beam pattern control, shielding, aim, automatic beam switching, diffusion to lower source luminance at constant output, and selection of correlated color temperature — and the Foundation can identify no federal testing or evaluation of the effectiveness of any of them for that purpose. Some will be considered in the proceeding described at Part II.H.5, by an agency that does not hold the authority conferred by § 360ii.

Indicator and status lamps in appliances, tools and electronics. These emit a trivial quantity of light and present a very high luminance, because the emitting area is minute and luminance is the quotient of intensity by area. The quantity that governs the response of the eye is the one that no specification reports. The techniques for minimizing exposure are elementary and cheap: diffusion, reduction of drive current, a defeat switch, dimming in response to ambient level, and selection of a longer-wavelength emitter. Each is already used in some products and omitted from

others, which is itself an opportunity for comparison. Nothing federal requires any of them, and none has been evaluated for effectiveness. This is the clearest case under paragraph (a)(5) in the whole of Part VI, because the countermeasures are known, inexpensive and already deployed. All that is missing is the finding of which ones work.

Roadway, area and parking lighting. The techniques here are the most thoroughly developed of any in this list, and none of the development was federal: limits on correlated color temperature, full-cutoff optics and shielding, mounting height and spacing, dimming and adaptive control, and curfews. They have been recommended by professional bodies, adopted in model ordinances, and enacted by municipalities and by States. Part II.D.3 and Part II.E.3. The agency has evaluated the effectiveness of none of them. The result is that public entities choosing among them are choosing without any federal finding as to which reduces human exposure and by how much.

Flashing warning lamps on emergency, utility and work-zone vehicles. The available techniques include reduction of intensity at night, reduction of flash rate, synchronization of phase across the lamps on a single vehicle, selection of color, and directional control to limit emission toward the eyes of passing drivers and pedestrians. Several are commercially available and fitted to some apparatus and not to others. Those exposed include the responders working alongside the apparatus at close range, which is occupational exposure of the kind Part II.H.10 describes, as well as every passing driver and pedestrian. Part VI.C. No federal evaluation of the effectiveness of any of these techniques has been identified.

The roadway entry above states that none of that development was federal. The record bears it out, and the Foundation identifies the body that did it. The metrics by which parking lot, roadway and directional lighting are evaluated were published between 2005 and 2012 by the Alliance for Solid-State Illumination Systems and Technologies, a consortium of manufacturers, research institutions and federal and State agencies organized at Rensselaer Polytechnic Institute, in a series titled ASSIST recommends. Part II.E.4 sets out its constitution and membership.

That history locates precisely what paragraph (a)(5) asks for and what is missing. The paragraph does not direct the Secretary to develop these techniques; they have been developed. It directs the Secretary to develop, test, and evaluate the effectiveness of procedures and techniques for minimizing exposure. Private parties developed the procedures. The federal test and evaluation of whether they are effective at minimizing human exposure has not been performed, and until it is, a public entity choosing among them is choosing on the basis of documents prepared by the manufacturers of the products.

One of the techniques on that list has now been evaluated in the manner this paragraph describes, and the evaluation was neither American nor private. Shielding and cutoff optics on roadway luminaires were tested against an unlit control over four years at a controlled field site and then on public streets in three municipalities, by investigators funded by the German Federal Agency for Nature Conservation with resources from that country's federal environment ministry. Custom luminaires were designed and manufactured, their emission was characterized on a goniophotometer, the illuminance on the ground was matched to the fixtures they replaced, compliance with the European road lighting standard was maintained, and the effect was measured. The study is described at Appendix C.136 and taken up at Part V.I. Its endpoint was ecological rather than human, so the Foundation does not present it as the evaluation this paragraph requires of this Department. It presents it as proof that the evaluation is feasible, that it can be done on installed products without compromising a road lighting standard, and that when it is done the characteristic it isolates — where a luminaire sends its light — proves to matter more than the characteristic ordinarily offered first, which is how much light it sends. A federal agency of another government performed under its conservation statute the kind of work paragraph (a)(5) directs the Secretary to perform under this one.

One further technique belongs in this list and it is different in kind from the four above, because here the emitting product is one the FDA itself has reviewed. Blue-light dental devices, and the

orange filter. Light-accelerated tooth whitening and light-curing devices emit in the blue, at irradiances described at Part II.C.4, and the dental profession controls the resulting ocular exposure by a single technique used as a matter of routine: an orange or amber long-pass filter, as a handheld shield, a clip-on screen or eyewear worn by operator and patient. The technique is universal in practice, it is the entire control measure, and no federal instrument specifies either side of the problem it is meant to solve. There is no limit on what the device may emit, as Part II.C.4 sets out, and there is no performance requirement for the filter: no specified cut-on wavelength, no minimum optical density in the hazard band, no test method and no verification.

The required performance is calculable even though it is unspecified, which is what makes this the clearest instance in this Part of what paragraph (a)(5) directs. On the figures at Part II.C.4, reducing a blue-light-weighted irradiance of approximately 1,670 watts per square meter to the continuous-exposure limit of 1.0 watt per square meter requires attenuation by a factor of about 1,670, which is an optical density of about 3.2 across the hazard band. That is the number a federal evaluation under paragraph (a)(5) would produce and against which a filter could be tested. The Foundation does not assert that any filter in use falls short of it; it does not know, and that is the point. The Department is directed by paragraph (a)(5) to develop, test and evaluate the effectiveness of procedures and techniques for minimizing exposure. Here is a technique, in daily use across a profession, protecting against the emission of a product the agency has cleared, whose required performance can be computed from published exposure limits and whose actual performance no federal program has ever measured.

4. What the Foundation asks under this paragraph

The request is narrow and it is the least burdensome in this comment. The Foundation does not ask the Department to develop new countermeasures, to prescribe any of the existing ones, or to decide any contested question about injury. It asks the Department to test the techniques that already exist, to determine which of them reduce human exposure and by how much, and to publish the result.

The Foundation draws attention to what follows from publication alone. A federal finding that a particular technique reduces exposure by a stated amount would be acted on by purchasers, specifiers, fleet operators, public works departments and accessibility officers without any regulation being issued at all. Much of the exposure described in this comment is created by procurement decisions rather than by conduct any standard would reach, and procurement responds to published evidence. Paragraph (a)(5) is the provision under which that evidence would be produced, and it has not been.

The Foundation further asks the Department to state what the existing mitigations referred to in the letter of May 24, 2024 are, as applied to visible light emitted by LED products, and by what testing their effectiveness was established. Part IX.H.2.

H. § 360ii(a)(6) — Consult and Maintain Liaison With Other Federal Departments and Agencies

1. The departments named expressly in the statute

Paragraph (a)(6) directs the Secretary to:

> consult and maintain liaison with the Secretary of Commerce, the Secretary of Defense, the Secretary of Labor, the Atomic Energy Commission, and other appropriate Federal departments and agencies on (A) techniques, equipment, and programs for testing and evaluating electronic product radiation, and (B) the development of performance standards pursuant to section 360kk of this title to control such radiation emissions.

The grammar of the paragraph carries the weight of this subsection. Four officers are named: the Secretary of Commerce, the Secretary of Defense, the Secretary of Labor, and the Atomic Energy Commission, whose functions have since been distributed among successor agencies. The

adjective appropriate appears once, and it modifies the residual class — other appropriate Federal departments and agencies. It does not modify the four named officers.

That distinction matters because of the position the United States has taken. As Part I.C.5 describes, the government has read the word appropriate as committing to the agency's judgment the question which additional agencies are consulted. The Foundation has accepted that the reading is available on the text. But it is available only where the text supplies the word. For the four officers Congress named, there is no qualifier to construe. The direction to consult and maintain liaison with the Secretary of Labor is not conditioned on the Secretary of Health and Human Services finding it appropriate to do so.

The subject matter of the consultation is likewise specified rather than left at large. It is techniques, equipment, and programs for testing and evaluating electronic product radiation, and the development of performance standards under § 360kk. Both subjects are engaged by this comment.

a. The Department of Commerce, which this comment treats first among the four

Of the four officers Congress named, the Department of Commerce is the one whose own bureaus bear most directly on the subject of this comment. The Foundation sets the point out at length because it is not apparent from the Department's name, and because the direction to consult it carries no qualifier to construe. Three bureaus are engaged. One realizes and maintains the national measurement scales for visible light and operates a calibration program directed specifically at light-emitting diode products. One produces the satellite measurement record of how much artificial light the United States emits at night. One sits on the interagency committee that annotates the tariff line by which a light-emitting diode product is identified to this Department at the border. None of the three is a health agency, none of them asserts authority over lighting, and the Foundation does not suggest otherwise.

b. The National Institute of Standards and Technology

The National Institute of Standards and Technology is a bureau of the Department of Commerce and is the national measurement institute of the United States. It is established within that Department by 15 U.S.C. § 272(a), which creates "a science, engineering, technology, and measurement laboratory to be known as the National Institute of Standards and Technology"; it was the National Bureau of Standards until the Omnibus Trade and Competitiveness Act of 1988 converted it, Pub. L. 100-418, title V, §§ 5111, 5112(a), 5115(c), 102 Stat. 1427. Its functions are stated in the same section. Subsection (b)(2) directs it:

> to develop, maintain, and retain custody of the national standards of measurement, and provide the means and methods for making measurements consistent with those standards

And subsection (c)(2) authorizes the Secretary of Commerce, acting through the Director, to "test, calibrate, and certify standards and standard measuring apparatus." That bureau is accordingly the body that answers, for the United States, the question what a stated quantity of light is.

What that bureau maintains, it maintains for visible light. The candela, the International System base unit of luminous intensity, is realized there by a detector-based method and is maintained on six standard photometers traceable to the bureau's Primary Optical Watt Radiometer. The lumen is realized from the candela by the absolute integrating sphere method in a sphere of two and a half meters. The photometric range the bureau states for this work is 360 to 830 nanometers, which is to say the visible band and a margin on either side of it. Calibration services are offered against those scales, in the form of lamp standards for luminous intensity, luminous flux and color temperature, together with reference photometers and reference materials.

The bureau also runs a measurement program directed at these products in particular. It provides calibration services for light-emitting diode packages and arrays, for integrated light-emitting

diode lamps and for small light-emitting diode luminaires. The quantities it states for that work are total luminous flux in lumens, radiant flux in watts, luminous efficacy in lumens per watt, luminous intensity in candelas, chromaticity coordinates, correlated color temperature, color rendering index and dominant wavelength. It operates a spectrally tunable lighting facility, it has developed a junction-temperature method for measuring high-power light-emitting diodes, it runs a measurement assurance program for solid-state lighting products, and it has carried that work into the documentary standards: it led the development of the illuminating engineering standard for the electrical and photometric measurement of solid-state lighting products, contributed to the international commission's technical report on light-emitting diode measurement and to the American national standard on solid-state lighting chromaticity, and helped establish the laboratory accreditation program on which a federal efficiency labeling program depends.

Set that beside the words of the paragraph under discussion. Subparagraph (A) directs consultation and liaison on:

> "techniques, equipment, and programs for testing and evaluating electronic product radiation"

Those are three nouns, and the bureau described above supplies all three, for these products, inside a Department this paragraph names without qualification. The Foundation does not need to argue that the bureau is an appropriate agency, because it does not sit in the residual category. It sits in the Department of Commerce.

What the Foundation has not found is the consultation. Where that bureau describes the federal agencies it works with on solid-state lighting standards, it names the Department of Energy and the Federal Aviation Administration; where it lists the stakeholders of its photometry program it names the lighting industry, the Department of Energy's lighting labeling program, the Environmental Protection Agency's efficiency labeling program, the national laboratory accreditation program and the consensus standards bodies. This Department does not appear in either list. The Foundation states the inference narrowly. A program description is not an exhaustive record of an agency's correspondence, and the Foundation does not contend that no contact has ever occurred between these two bodies. It contends that where the federal measurement authority for visible light sets out whom it works with on these products, the agency charged with the electronic product radiation control program is not among them, and that the Foundation has located no record of such consultation anywhere else. If a record exists, the Department can produce it in a sentence, and Part IX.E asks it to.

The Foundation is careful about what this establishes, because the available overstatement is obvious and would not survive scrutiny. The quantities that bureau maintains are for the most part photometric and colorimetric, and they were developed to serve energy efficiency and color quality rather than health. Luminous efficacy and the color rendering index are not health metrics and this comment does not present them as such. Radiant flux in watts is a radiometric quantity, but it is a total over the sphere rather than a spectral irradiance at the position of a person's eye, and Part V.J sets out at length why the second of those is the quantity that matters and why nobody records it. The existing services would therefore not, as they stand, measure what a standard prescribed under § 360kk would require to be measured.

What follows is narrower and is sufficient for the purpose. The instruments, the traceability chain and the institutional competence already exist within the federal government, in a Department this paragraph names, and they are already applied to these products. Adapting them to a health-relevant quantity is work, and it is the work paragraph (a)(5) directs this Department to perform: to develop, test and evaluate procedures and techniques for minimizing exposure. Part II.G sets out that no such procedure has been developed. The bureau that would be consulted in developing one is not an agency this Department would have to identify as appropriate. It is named.

Two passages elsewhere in this comment corroborate that the capability is practical rather than theoretical, and neither of them involved this Department. Part V.I describes a field study of a

rodent in which optical radiation was measured with a spectroradiometer calibrated against lamps traceable to this bureau, at the height of the animal's eye, on a field site, by conservation biologists. Part V.B describes two national metrology institutes that built instruments and compared them against one another in order to determine the angular distribution of light-emitting diode packages, the authors stating that new methods of measurement were required because these sources differ from traditional lighting sources. The national traceability chain this bureau maintains was available to a small research team studying a mouse. It has been available to this Department throughout.

c. The National Oceanic and Atmospheric Administration

The National Oceanic and Atmospheric Administration is also a bureau of the Department of Commerce, established by Reorganization Plan No. 4 of 1970, effective October 3, 1970, 35 Fed. Reg. 15,627, 84 Stat. 2090, section 2(a) of which provides that "There is hereby established in the Department of Commerce an agency which shall be known as the National Oceanic and Atmospheric Administration". The Foundation reaches it by a different route than the last, and states the route plainly: this bureau holds no authority over lighting and makes no claim to any. It is engaged because of what it measures and because of what its scientists have published, both of which this comment already relies on.

That bureau operates the instruments from which the measurement record of artificial light at night is derived, and this comment already relies on that record. Part V.I sets out the instrument history and the Foundation repeats here the feature of it that bears on this paragraph. The earlier operational line-scan system was sensitive from 450 to 1000 nanometers; the day-night band of the visible and infrared imaging radiometer suite, carried on the Suomi satellite and on the bureau's own NOAA-20, is sensitive from 480 to 920 nanometers. Neither instrument is sensitive to the band from 380 to 450 nanometers, and the sensors have been panchromatic, which is to say they record no spectral composition at all. The consequence is stated in the literature and the Foundation adopts it: the federal radiance record systematically under-measures the short-wavelength component of the emission, which is the component this comment is about, and records nothing of the spectrum. That is not a criticism of the instruments, which were built for other purposes. It is information about the limits of the federal record, and paragraph (a)(3) directs this Department to receive information of exactly that kind from agencies with related interests.

A second engagement is already set out at subsection 3 and the Foundation does not repeat it beyond a sentence. A scientist of that bureau co-authored, in 2011, a peer-reviewed proposal for numerical limits on what outdoor lamps may emit in a protected wavelength band, for the stated purpose of protecting human health and the environment. Appendix C.57. The expertise paragraph (a)(3) contemplates receiving was published, by an employee of a named Department, thirteen years before the Final Response of May 24, 2024.

The Foundation states plainly what it does not claim, because an assumption in the other direction is natural and is wrong. That bureau does not regulate lighting. Where artificial lighting is restricted for the protection of a listed species it is restricted on land, and jurisdiction over sea turtles on land does not belong to that bureau: under a memorandum of understanding of 1977 the Fish and Wildlife Service of the Department of the Interior has jurisdiction over sea turtles on land and the bureau's fisheries service has jurisdiction in the marine environment. 79 Fed. Reg. 39,856 (July 10, 2014). The sea turtle literature treated at Part V.I accordingly rests on the science and not on any assertion of authority here. What this subsection establishes about this bureau is confined to measurement and to published scientific information, which is what paragraphs (a)(3) and (a)(6) are about.

d. The Bureau of the Census, and the last two digits of a tariff number

Subsection 18 describes the one sustained liaison of record between this Department and another federal agency concerning light-emitting diode products, which is the import arrangement with

United States Customs and Border Protection, and Part VI.V sets out the mechanism in full. One element of that mechanism belongs in this subsection rather than in those, because it reaches a named officer.

A tariff number of the United States has ten digits and they are not all of one kind, as Part VI.V sets out. The first six are international. The seventh and eighth are a legal subdivision of the United States and fix the rate of duty. The ninth and tenth are a statistical suffix, and they are not set by this Department or by Customs and Border Protection. They are set by the Committee for Statistical Annotation of Tariff Schedules, authorized under section 484(f) of the Tariff Act of 1930, 19 U.S.C. § 1484(f), and commonly called the 484(f) Committee. It is chaired by the United States International Trade Commission, and its members are the Commission, United States Customs and Border Protection and the Bureau of the Census, which is continued by 13 U.S.C. § 2 "as an agency within, and under the jurisdiction of, the Department of Commerce."

The composition is not an administrative arrangement that happens to include a bureau of a named Department. The statute itself directs three officers to establish the enumeration:

> The Secretary, the Secretary of Commerce, and the United States International Trade Commission shall establish from time to time for statistical purposes an enumeration of articles in such detail as in their judgment may be necessary, comprehending all merchandise imported into the United States and exported from the United States [.]

The Secretary there is the Secretary of the Treasury, reached by the definition at 19 U.S.C. § 1401(l) rather than by name, and the Foundation states that distinction because the subsection does not say Treasury. The Secretary of Commerce it names expressly. So the direction to establish the enumeration in which these products are counted as they enter the country runs, by statute, to an officer whom paragraph 360ii(a)(6) directs this Department to consult without qualification. Separately, 13 U.S.C. § 301(a) authorizes the Secretary of Commerce to collect information from all persons importing into the United States and directs the compilation and publication of information pertaining to imports.

The tariff number named in the instruction of June 6, 2017 was a ten-digit number. The identifier on which the only routine federal identification of a light-emitting diode illumination product as a radiation-emitting electronic product depends is therefore a number maintained jointly: its first six digits are set by an international body, its seventh and eighth by the United States as law, and its ninth and tenth under a statutory direction addressed to the Secretary of Commerce among others, executed through a committee that includes the agency administering the border and a bureau of that Department.

The Foundation confines the observation, because the architecture is the point and the inference beyond it would be wrong. The statistical annotation does not affect the legal classification of goods, as the Commission states in the preface to the schedule, and the committee cannot alter the classification of goods or rates of duty. The Foundation does not suggest that this committee decides whether these products are electronic products within § 360hh(1)(A), and does not suggest that consulting it would answer any question this comment raises. The observation is that the identifier is jointly maintained, that two of its three maintainers are bodies this comment asks the Department to consult, and that one of those two sits inside a Department Congress named.

e. The three named officers treated elsewhere, and the one that no longer exists

The Foundation does not leave the other named officers without a pointer. The Secretary of Labor is treated at subsection 10, with the Occupational Safety and Health Administration and the National Institute for Occupational Safety and Health, and is the officer whose staff told the Foundation that they awaited notification from this Department. The Secretary of Defense is treated at subsection 14, with the other federal building operators. The Atomic Energy Commission no longer exists and its functions were distributed among successor bodies; nothing in this comment turns on that reference.

Bureau of the Department of Commerce	What it maintains that bears on this comment	Whether this Department appears among the federal bodies it names
National Institute of Standards and Technology	The national photometric scales for visible light, 360 to 830 nm; calibration services for LED packages, arrays, integrated lamps and small luminaires; the measurement standard for photometric testing of solid-state lighting; a laboratory accreditation program	No. It names the Department of Energy and the Federal Aviation Administration on solid-state lighting standards, and the Environmental Protection Agency among its stakeholders.
National Oceanic and Atmospheric Administration	The satellite radiance record of artificial light at night, from instruments sensitive from 480 to 920 nm and insensitive from 380 to 450 nm; a 2011 published proposal for numerical limits on outdoor lamp emission	None identified
Bureau of the Census	Membership of the committee that sets the ninth and tenth digits of the tariff line flagged for LED illumination imports, under § 484(f) of the Tariff Act of 1930	Through the import arrangement at subsection 20, which concerns admissibility and not emissions

2. "Other appropriate Federal departments and agencies" — scope of the residual category

The residual category is the one the government has relied on, and the Foundation sets out its position on it precisely rather than broadly.

The phrase is "other appropriate Federal departments and agencies." The Foundation accepts, as it accepts at Part I.C.5, that the adjective confers judgment on the Secretary as to which additional agencies are consulted. It does not accept three things that are sometimes treated as following from that.

The first is that the judgment extends to the four officers named in the paragraph. It does not, for the reason given in subsection 1: the adjective modifies the residual class and nothing else.

The second is that a judgment committed to an agency is a judgment that need not be made. The paragraph directs the Secretary to consult and maintain liaison with appropriate agencies. Identifying which are appropriate is the exercise of the judgment, and it is a step that has to be taken before the direction can be said to have been carried out. The United States has represented in litigation that no decisionmaking process has occurred with respect to these products. Part I.C.4. The Foundation takes that representation at face value and draws from it the consequence it bears here: if no decisionmaking process has occurred, then the judgment this paragraph commits to the Secretary has not been exercised, correctly or otherwise.

The third is that the breadth of the category makes it unworkable. It is broad. Electronic product radiation is emitted by nearly every product that runs on electricity, as the United States has itself observed, and the agencies with a related interest in some aspect of it are many. But breadth of this kind is ordinary in federal practice and is managed by ordering the work, not by declining it. The Foundation does not ask the Department to consult every agency about everything. It asks for consultation with the agencies whose own programs place these particular products in front of people, which is a list of manageable length and is set out in the subsections that follow.

3. Environmental Protection Agency

The Environmental Protection Agency is the most consequential of the agencies in this category, for a reason that Part II.D.3 sets out: the subject this comment calls light pollution is, in the language of § 360ii(a)(2), unnecessary electronic product radiation. Pollution is the Environmental Protection Agency's subject. Electronic product radiation is this Department's. The same emissions are described by both vocabularies, and neither agency has treated them as its own.

The Environmental Protection Agency has answered that question, and the Foundation sets out its answer because it disposes of an objection that would otherwise be made to Part II.D.3.

On October 7, 2022 the Director of the Radiation Protection Division in that agency's Office of Radiation and Indoor Air replied to a letter the Foundation had sent to the Administrator on December 7, 2021. The reply states:

> The EPA sets protective limits on the ionizing radiation in the environment that comes from human use of radioactive elements such as uranium. Congress has not granted the EPA any statutory authority to regulate visible light or non-ionizing radiation that is emitted from electrical devices, including LEDs. For that reason, the EPA does not regulate artificial light, radiation from LEDs, or other visible electromagnetic radiation, and we do not maintain experts in this field.

The letter goes on to refer the Foundation to a compilation maintained by a legislative organization of the States and municipalities that have enacted light pollution laws.

The Foundation does not dispute that answer and has no reason to. What it asks the Department to take from it is this. Part II.D.3 identifies light pollution as unnecessary electronic product radiation within the meaning of § 360ii(a)(2). The natural objection is that pollution is the Environmental Protection Agency's subject and the matter should be taken there. That agency has said, in writing and at the level of a division director, that Congress gave it no authority over visible light or non-ionizing radiation from electrical devices and that it maintains no experts in the field. The objection is therefore not available. If light that serves no purpose is to be addressed by any federal body, the authority is in this chapter.

That does not make consultation pointless. The Environmental Protection Agency holds expertise in emission inventories and in population exposure assessment that bears on the baseline described at Part II.D.6, whatever the limits of its regulatory authority, and § 360ii(a)(3) directs the Secretary to receive information from other Federal agencies without regard to whether they could regulate the subject themselves.

The Foundation raised this with the agency's attention in the comments on its petitions, which stated that the Food and Drug Administration is required to limit the exposure to and emissions of unnecessary visible light radiation from LED products, that unnecessary light is also known as light pollution, and that the Food and Drug Administration has not liaised with the Environmental Protection Agency to set limits on light pollution from LED products. Part II.D.3. The Final Response does not address the point.

What consultation would supply is concrete. The Environmental Protection Agency holds expertise in emission inventories, in exposure assessment across populations, and in the construction of environmental criteria documents. Part II.D.6 and Part II.F describe the absence of any baseline for this radiation. Building one is work of a kind that agency does routinely for other emissions, and the Foundation asks the Department to consult it on how.

a. Why that answer is correct, and when the line was drawn

The Foundation has examined the statutory history, and the agency's position is not merely defensible. It is the documented consequence of an allocation made deliberately in 1970.

Reorganization Plan No. 3 of 1970, the instrument that created the Environmental Protection Agency, transferred to it at section 2(a)(3) certain functions of the Environmental Control Administration of the Department of Health, Education, and Welfare, described as portions of the functions carried out by the Bureau of Radiological Health. The Bureau of Radiological Health is the predecessor of the Center for Devices and Radiological Health.

That transfer was deliberately incomplete. It excluded functions pertaining to the regulation of radiation from consumer products, to radiation in medical practice, and to occupational radiation exposure.

The sequence is worth stating plainly. In 1968 Congress enacted the Radiation Control for Health and Safety Act and assigned the electronic product radiation control program to the Secretary of Health, Education, and Welfare. In 1970 the Executive created an environmental agency, moved part of radiological health to it, and expressly left radiation from consumer products where Congress had placed it.

The Environmental Protection Agency therefore does not lack this authority through inadvertence, and this is not a subject that fell through a gap between statutes. The question was considered and decided. The letter of October 7, 2022 is correct, and it is correct for a reason that strengthens the Foundation's position rather than weakening it: the allocation of this subject to the Department of Health, Education, and Welfare and its successor was confirmed at the moment when the alternative was available and was declined.

Section 2(a)(7) of the same plan transferred to the agency all functions of the Federal Radiation Council, and section 2(a)(6) transferred the authority of the Atomic Energy Commission to establish generally applicable environmental standards for the protection of the general environment from radioactive material. Those are the radiation authorities the agency does hold. Neither reaches optical radiation emitted by a lamp.

b. The template Congress used for a physical agent emitted by products

Four years after the Radiation Control for Health and Safety Act, Congress legislated again on a physical agent emitted by products in commerce, and on that occasion assigned the work to the Environmental Protection Agency. The comparison is instructive and the Foundation offers it without rhetoric.

The Noise Control Act of 1972, 42 U.S.C. §§ 4901–4918, opens with a congressional finding that "the major sources of noise include transportation vehicles and equipment, machinery, appliances, and other products in commerce," and declares the policy of the United States "to promote an environment for all Americans free from noise that jeopardizes their health or welfare," to be achieved in part by authorizing "Federal noise emission standards for products distributed in commerce."

That is the architecture of subchapter C applied to a different physical agent, and the resemblance extends to the interagency provisions. Section 4903(c) directs that "The Administrator shall coordinate the programs of all Federal agencies relating to noise research and noise control," and that "Each Federal agency shall consult with the Administrator in prescribing standards or regulations respecting noise." Paragraph 360ii(a)(2) directs the Secretary to plan, conduct, coordinate and support research. Paragraph 360ii(a)(6) directs consultation with other departments and agencies.

Congress built one scheme and used it twice: a lead agency, a product emission standard, a research mandate, and a duty of interagency consultation. Noise went to the Environmental Protection Agency in 1972. Electronic product radiation had gone to the Secretary in 1968, and the reorganization of 1970 confirmed it.

One further feature of the noise program belongs here, because it is the nearest available picture of what an unexecuted program of this kind looks like over time. The Office of Noise Abatement and Control was defunded in 1981. The Noise Control Act was never repealed. Its standards remain in the Code of Federal Regulations and its preemptive effect on State and local regulation remains in force. The result is a federal product emission program that exists, preempts, and does nothing, and has been in that condition for more than four decades. The Foundation draws attention to it because 15 U.S.C. § 2080 produces a comparable preemptive effect in the present case. Part II.H.9.

c. A related interest, documented by federal scientists

One further matter bears on the liaison duty rather than on authority.

In 2011 scientists at the National Oceanic and Atmospheric Administration and the Cooperative Institute for Research in Environmental Sciences published a communication in Nature Geoscience on the effect of urban lighting on nocturnal atmospheric chemistry. Stark H, Brown SS, Wong KW, Stutz J, Elvidge CD, Pollack IB, Ryerson TB, Dubé WP, Wagner NL, Parrish DD. City lights and urban air. Nature Geoscience 2011;4:730–731. doi:10.1038/ngeo1300. They reported that the nitrate radical, which removes nitrogen oxides and volatile organic compounds from the atmosphere overnight, is destroyed by artificial light, and that over Los Angeles city lights reduce nitrate radical concentrations by several percent, leaving nitrogen oxide concentrations correspondingly higher the following morning.

The Foundation states the magnitude as the authors state it. The effect on next-day ozone is small, and they say so. They also observe that ozone does not respond linearly to nitrogen compounds, that their model may have underestimated the effect, and that even small changes in ozone levels may determine whether a city is above or below a regulatory threshold. They identify the cause specifically: the effect is produced by light projecting skyward, and shielded fixtures directing light downward would prevent it. Part II.D.3.d.

The Foundation does not contend that this gives the Environmental Protection Agency authority over lighting, and says so to foreclose the argument rather than to invite it. The Clean Air Act operates on emissions of air pollutants, defined at 42 U.S.C. § 7602(g) in terms of a substance or matter entering the ambient air, and it addresses ozone through ambient standards and the control of precursor emissions rather than through the physical conditions that affect reaction rates. Sunlight is the dominant driver of ozone photochemistry and is not regulated. Neither is temperature.

What the finding establishes is narrower and sufficient. Paragraph 360ii(a)(3) directs the Secretary to maintain liaison with and receive information from other Federal departments and agencies with related interests. It does not say with regulatory authority. Federal scientists have published a finding that the design of outdoor lighting perturbs the nocturnal chemistry bearing on ozone. That is a related interest on any reading of the phrase, and it exists notwithstanding that the agency holds no authority over the emission. The letter of October 7, 2022 answers a question about authority. It does not answer the question paragraph (a)(3) asks.

One further fact about the authorship of that communication belongs here, because it bears on the same paragraph and the Foundation found it while verifying the citation. One of its authors, Christopher D. Elvidge of the National Oceanic and Atmospheric Administration, co-authored in the same year a second peer-reviewed paper on outdoor lighting, and that paper does not stop at describing an effect. It proposes numerical limits on what outdoor lamps may emit, in a protected wavelength band, for the stated purpose of protecting human health and the environment. Appendix C.57 and Part V.B.3.

The Foundation is careful about what that does and does not show. It does not show that the National Oceanic and Atmospheric Administration holds a position on lamp spectra, and it does not show that the agency has authority over lighting; a paper is the work of its authors. What it shows is that in 2011 a federal scientist, publishing in the peer-reviewed literature, set out a quantitative proposal for limiting the short-wavelength emission of outdoor lighting on health and environmental grounds. Paragraph 360ii(a)(3) directs the Secretary to maintain liaison with and to receive information from other Federal departments and agencies with related interests. The expertise paragraph (a)(3) contemplates receiving was in the federal government, in print, thirteen years before the Final Response of May 24, 2024.

d. What the Foundation asks of this agency, and what it does not

The Foundation states its position on the Environmental Protection Agency explicitly, so that no part of this comment is read as asking for something it does not ask for.

It does not ask the Environmental Protection Agency to regulate light pollution. Under the law as presently written that agency has no authority to do so; its letter of October 7, 2022 says so; and the Foundation agrees, for the reasons at subsection a.

It does not ask Congress to confer such authority, and takes no position in this comment on whether it should.

What it asks is directed to this Department. The Foundation asks the Secretary to establish and maintain the liaison that paragraphs 360ii(a)(3) and (a)(6) direct; to share with the Environmental Protection Agency the results of the testing, evaluation and research that paragraphs (a)(2), (a)(4) and (a)(5) direct, once that work is undertaken; and to receive from that agency the emission inventory and population exposure assessment expertise described above.

The direction of the obligation is the point of this subsection. Nothing in it asks the Environmental Protection Agency to do anything at all. The duty is the Secretary's. It is not conditioned on a request from another agency, and it is not discharged by another agency's accurate statement that it lacks authority of its own.

4. Department of Energy — general service lamps (developed at Part IV.G)

Part IV.G sets out the history in full and this subsection states only the consequence under this paragraph. The Department of Energy determined which lighting technology would illuminate the country, through the general service lamp rulemakings and the backstop they codify. It concluded that the action produced no change in environmental effect requiring analysis. Its rulemaking records do not mention this Department, and when asked for records of communication with the Food and Drug Administration it identified three public dockets in which that agency does not appear. Part IV.G.7.

The liaison contemplated by this paragraph would have been with the agency whose standards select the emitter, on the subject of what the selected emitter emits. It is the clearest instance in this comment of a consultation that would have mattered and did not occur, and it is the one instance in which the Department of Energy has been asked directly and has answered.

5. Department of Transportation and National Highway Traffic Safety Administration — FMVSS No. 108

Federal Motor Vehicle Safety Standard No. 108 governs the photometric performance of vehicle lamps. It is the only federal standard that sets numerical limits on the output of any of the LED products this comment is concerned with, and the limits it sets are photometric: luminous intensity in candela, measured at specified test points. It contains no limit on source radiance, no spectral requirement, and no limit on temporal modulation. Part VI.B develops this.

On October 6, 2026, while this comment was in preparation, the Department of Transportation announced that it will conduct a negotiated rulemaking to modernize that standard. The notice of intent was published in the Federal Register two days later, on October 8, 2026, at 91 Fed. Reg. 64462. The proceeding is docketed as NHTSA-2026-1981. Applications for membership on the negotiating committee and comments are due by November 9, 2026. The Secretary of Transportation is to appoint up to eighteen members. The announced subjects include light-emitting diodes, dusk sensors, automatic high beams, replaceable light sources, headlamp height and aim, and — stated expressly — headlamp glare. The Administrator of the National Highway Traffic Safety Administration is quoted as saying that the agency is bringing stakeholders together to modernize the standards and "address potential causes of glare."

The Foundation brings this to the Department's attention for four reasons, and asks that the comment be read in light of the fact that the proceeding is open as of the date of filing.

First, the liaison duty is no longer a matter of hypothesis. Paragraph (a)(6) directs this Department to consult and maintain liaison with other appropriate Federal departments and

agencies on techniques and equipment for testing and evaluating electronic product radiation and on the development of performance standards. A second federal agency has announced that it will develop performance requirements governing the optical output of the highest-radiance class of LED product that ordinary people encounter, and has named glare as a subject. There is a docket, a committee, and a date. Whatever force there is in the proposition that the appropriateness of consultation is committed to the Secretary's judgment, the occasion for exercising that judgment is present and identifiable.

Second, the division of authority is the one this comment describes throughout. The National Highway Traffic Safety Administration has authority over motor vehicle equipment. It does not have the authority conferred by 21 U.S.C. § 360ii(a)(4) to study and evaluate emissions of, and conditions of exposure to, electronic product radiation, and it has never claimed it. A proceeding that will set the optical performance requirements for these lamps is about to be conducted by an agency that does not hold the radiation-health authority, while the agency that holds it has not evaluated the emissions. Part IV.G describes the same pattern in the general service lamp rulemakings. The difference is that this one has not happened yet.

Third, the categories of member the Department of Transportation has announced are vehicle lighting manufacturers, motor vehicle equipment associations, safety organizations, research institutions and engineering associations. No category is named for the persons on whom the radiation falls, and none is named for persons with the photosensitive and other conditions described at Part V and Part VIII. The Foundation makes no criticism of the agency's list, which may be expanded. It observes only that the health effects of the emission are the subject on which this Department, and no other, is directed by statute to develop expertise.

Fourth, and most practically, the timing permits action. The comment period in this proceeding closes on October 21, 2026. Applications and comments in NHTSA-2026-1981 are due on November 9, 2026. The Department can, if it chooses, communicate with the Department of Transportation about that proceeding after reading this comment and before that proceeding's record closes. The Foundation asks it to, and asks that it state on the record whether it has. Part IX.E.4.

How the Department might take part is worth setting out with some care, because the routes differ in what they require and two of them require nothing from anyone.

The first route is consultation, and it is already a duty. Paragraph (a)(3) directs the Secretary to maintain liaison with and receive information from other Federal departments and agencies with related interests on present and future potential electronic product radiation. The National Highway Traffic Safety Administration has a related interest by any measure, and a proceeding to revise the photometric requirements for vehicle lamps concerns present and future potential electronic product radiation exactly. Paragraph (a)(6)(A) is more specific still: it directs consultation and liaison with other appropriate Federal departments and agencies on "techniques, equipment, and programs for testing and evaluating electronic product radiation." The announced subjects of the proceeding include the streamlining of test procedures. Revising how the output of a light-emitting product is measured is the subject that subparagraph names. Neither route requires the permission or the invitation of the Department of Transportation.

The second route is the docket. Comments in NHTSA-2026-1981 are due by November 9, 2026, and the docket is open to anyone. A federal agency may file in another agency's rulemaking docket as any other person may. Nothing stands between this Department and the record of that proceeding except a decision to file.

The third route is membership on the negotiating committee, and here the Foundation states a limit on what it is asking. The Negotiated Rulemaking Act provides for representation of the convening agency on the committee. It does not address participation by other federal departments, and the Foundation does not assert that this Department has any entitlement to a seat. Whether a representative of another department may be appointed is a question for the

Department of Transportation and for the committee's charter. The Foundation asks only that this Department seek whatever form of participation the proceeding permits, and that it not treat the absence of an invitation as an answer.

There is a final observation, and the Foundation makes it plainly because it bears on everything else in this comment. The obstacle to this Department contributing to a proceeding about headlamp glare is not that it lacks a route in. Two of the three routes above are open today and need no one's consent. The obstacle is that the Department has not measured what these lamps emit and has not characterized how people are exposed to them, so it has little to contribute beyond the observation that the question is open. The request that the Department take part in that proceeding and the request that it carry out § 360ii(a)(4) are therefore the same request, arriving from different directions. Part II.F.

One further fact belongs in this subsection, and the Foundation states it without characterization because none is needed. The agency that will conduct that proceeding has twice told the Foundation, in writing and in substantially the same terms, that the expertise relevant to the health questions raised by these products resides in this Department.

The first occasion was the published denial of three petitions for non-compliance orders, 87 Fed. Reg. 75,327 (Dec. 8, 2022), described at Part IV.C.3. Having set out that the Food and Drug Administration has authority to regulate certain aspects of these products as radiation-emitting devices, and that there is at present no performance standard for them in 21 C.F.R. part 1040, the agency wrote:

> "NHTSA also wants to express appreciation to the Petitioner for bringing to its attention health concerns that the Petitioner associates with LED headlamps. NHTSA takes these concerns seriously. NHTSA, as an agency focused on automotive safety, also recognizes the expertise of its sister agencies that are health-focused, such as the FDA."

The second was a letter of February 13, 2024 from the Office of the Chief Counsel, described at Part IV.C.9, answering a separate inquiry about the reach of the standard:

> "NHTSA's focus is on automotive safety, but the agency recognizes that separate expertise resides in sister agencies that are health-focused, such as the Food and Drug Administration."

The two statements were made fourteen months apart, by different offices of the same agency, in two unrelated proceedings. That agency has now announced a negotiated rulemaking to modernize Federal Motor Vehicle Safety Standard No. 108 with headlamp glare among its stated subjects, and the categories of committee member it has announced do not include the agency to which it twice said it defers.

The Foundation draws no inference about anyone's intentions from that sequence. It observes only that the agency conducting the proceeding has itself identified where the relevant expertise lies, and that this Department is therefore not an outside party seeking entry to another agency's proceeding. It is the agency that proceeding's sponsor named.

6. Federal Highway Administration — MUTCD, warning beacons, and roadway lighting

The Federal Highway Administration publishes the Manual on Uniform Traffic Control Devices, which States adopt or amend and which governs the flash rate, intensity and application of the warning devices treated at Part VI.C.2, and it issues guidance on roadway lighting design. Those documents determine the characteristics of a large class of the optical emissions people encounter in the public way.

The Manual specifies flash rates and refers to industry intensity classes. It contains no exposure criterion, no spectral requirement and no limit expressed in terms of effect on a person, and Part VIII sets out what the Foundation has established about how the accessibility consequences of these devices have been treated. A consultation under this paragraph would be addressed to the question the Manual does not reach: what the devices it specifies do to the people in front of them.

This agency has been approached twice, and it has given two answers. They are different in kind, they were given seven weeks apart, and the Foundation sets out both in the order they were received. The first came in response to a complaint submitted by Mark Baker in his individual capacity as a person affected by these devices, and it is a statement about the limits of the agency's authority. It belongs with the responses collected at subsection 21. The second came in response to a petition filed by the Foundation, and it is a deferral in time. It does not.

The response of October 19, 2022, on the health effects of rectangular rapid-flashing beacons

On June 29, 2022 Mark Baker submitted a complaint under Title II of the Americans with Disabilities Act and section 504 of the Rehabilitation Act of 1973 concerning rectangular rapid-flashing beacons installed by three municipalities. He submitted it to the Department of Justice, which transferred it to the Department of Transportation, which referred it to the Office of Civil Rights of the Federal Highway Administration. It was docketed as DOT#2022-0375. On October 19, 2022 the ADA Team Leader of that Office replied. The letter first states the allegations as the agency understood them:

> "In particular, you allege that the Cities' installation and use of Rapid Rectangular Flashing Beacons (RRFBs) discriminates against you and other individuals with disabilities by inducing disorientation, visual impairment, anxiety, fear, seizures, and/or other medical/health issues."

The agency declined to investigate. It set out the framework for that decision, citing the Department of Justice's statement in the 2010 Title II final rule that there is no statutory requirement that every Title II complaint receive a full investigation, and the factors an enforcement agency weighs in deciding whether to conduct one, among them whether a violation may have occurred and how limited resources are best spent. It then gave the following reason:

> "The allegations you have raised about the health impacts of RRFBs raise complex issues related to the regulation of all Light Emitting Diode (LED) lights, not just those used in RRFBs, that extend beyond FHWA's authority."

The Foundation asks the Department to read that sentence closely, and states first what it does not do. It is not a finding that the devices are safe, and it is not a finding that they are harmful. It is a dismissal without investigation under a discretionary framework the letter describes, and the sentence quoted is one of two grounds given. Nor does the letter identify any agency that does hold the authority. Unlike the responses of the National Highway Traffic Safety Administration, the Federal Aviation Administration, the Department of Energy, the Occupational Safety and Health Administration and the United States Access Board, all collected at subsection 21, this one names no destination. The Foundation does not supply one on the agency's behalf.

What the sentence does do is three things, and each of them bears on a question this comment puts to the Department.

- It identifies the subject as the health impacts of a flashing warning device. Of the responses collected at subsection 21, this is the only one directed to the health effects of a specific emitting product rather than to the allocation of authority in the abstract. The agency that approves the device for use on the public way was asked what it emits and what that does to people, and answered that the question is not one it can reach.
- It identifies the subject as the product class rather than the application. The agency wrote that the issues concern the regulation of "all Light Emitting Diode (LED) lights, not just those used in RRFBs." That is the same distinction this comment asks the Department to draw at Part V.C.2.k, where the point is made that instruments organized by application leave a hazard that crosses applications addressed in one domain and not another. Here a federal agency drew the distinction itself, in writing, in 2022, and placed the subject on the side of the line this Department occupies.

It records, in the agency's own paraphrase, an allegation that these devices induce seizures. Part V.E.1 sets out the thresholds that exist for flashing content presented on displays, including a federal limit of three flashes per second applied to digital content procured by government through section 508 of the Rehabilitation Act, and establishes that no federal limit of any kind applies to a flashing beacon. The complaint that produced this letter was brought under section 504 of the same Act. The Foundation draws no legal conclusion from the coincidence of statutes and does not suggest that section 508 reaches these devices. It observes that an allegation of seizures from a flashing roadway device was received by a federal agency in 2022, was not investigated, and was referred to no one.

The Foundation makes no criticism of the agency. A decision not to investigate a particular complaint is committed to the agency that receives it, the letter preserved the right to bring a private action under section 203 of the Act, and the Foundation's own view, stated at subsection 21 as to each of the other agencies, is that the authority described is described correctly. The agency that installs and approves the device said that the regulation of what it emits lies outside its authority. That statement is almost certainly right. It is also the point of this Part.

The response of December 7, 2022, on the Foundation's petition for repeal

On November 23, 2022 the Foundation petitioned for repeal of the interim approval under which rectangular rapid-flashing beacons are deployed. On December 7, 2022 an Agency Counsel in the Office of the Chief Counsel replied:

> We received the Soft Lights Foundation's petition for rulemaking regarding the interim approval of the RRFB traffic control device. As you know, FHWA issued a Notice of Proposed Amendments (NPA) to the MUTCD. The rulemaking process for the NPA has not yet concluded and, therefore, a final rule has not been issued. The Soft Lights Foundation submitted comments about the RRFB to the NPA docket. Its petition will be considered as part of the organization's March 10, 2021, comments to the NPA docket. Your letter and this response will also be submitted to the docket.

That is not a statement that the subject belongs elsewhere. It is a deferral in time: the petition was folded into a pending rulemaking rather than answered. The Foundation records it without complaint, because consolidating a petition with comments already before the agency in an open docket is ordinary practice.

The rulemaking has since concluded. What the Foundation asks the Department to notice is what the agency was able to consider when it did. The comments and the petition addressed the effect of a flashing device on the people in front of it. There is no federal measurement convention for that effect, no exposure criterion, and no study of the kind § 360ii(a)(4) directs. An agency asked to weigh those effects in a traffic control rulemaking had nothing federal to weigh them against, because the agency that holds the authority to produce it has not produced it. Part VIII sets out what followed.

What the liaison duty would have carried, and to whom

This subsection has set out two answers from the agency that publishes the Manual on Uniform Traffic Control Devices. The first says that the health effects of a flashing warning device raise issues extending beyond that agency's authority. The second folded a petition into a pending rulemaking. Neither is a finding about the device, and the Foundation has said that it regards the first as correct.

What the Foundation asks the Department to add to those two facts is a third, which is the subject of this Part. Paragraph 360ii(a)(3) directs the Secretary to maintain liaison with and receive information from other Federal departments and agencies with related interests, and paragraph (a)(6) to consult and maintain liaison with them. The agency that sets the flash rate of every warning beacon in the United States has stated in writing that the health question is not within its

authority. The authority is here. The channel between the two is the one those paragraphs describe, and it is the Secretary's to open.

The Foundation makes the point concrete rather than abstract, because the duty is to carry information and the question is what information there is to carry. Part V of this comment collects it. A peer-reviewed neurophysiological review describes the interaction between flash rate and color and identifies red-blue alternation at fifteen hertz as the combination investigators are instructed to avoid. Appendix C and Appendix D set out what the measurement standards cover and, more to the point, the frequencies and effects they do not. Part VI.I reports the only photometric characterization of a flashing product in American service the Foundation has been able to obtain, which a private party had to pay for. None of this is secret, none of it is new, and none of it has been transmitted to the agency that sets the rates, because no one is charged with transmitting it except the Secretary.

The Foundation does not suggest that the Federal Highway Administration has failed in a duty. It has said the subject is beyond its authority and the Foundation agrees. The failure described by this Part is upstream of that answer and is the Department's own: the agency holding the electronic product radiation authority has not developed the information, and has not conveyed what exists to the agencies whose instruments decide how often a light on an American road will flash.

One qualification belongs with that argument, and the Foundation supplies it rather than waiting to be met with it. It is not the case that the federal government has never funded research into flashing warning lamps. It has. The study at Appendix D.4 was performed under contract to the United States Fire Administration, with further support from a fellowship program within the Department of Transportation, and it measured the effect of the intensity, color, modulation and flash rate of emergency vehicle lamps on drivers at night.

The Foundation asks the Department to read what that study was for. Its outcome measures were the visibility of the lamps, the discomfort glare they produced, the distance at which a driver could detect a responder, and the lateral position of the vehicle. Its stated purpose was the prevention of struck-by incidents among emergency responders. It is a study of occupational safety for the people standing beside the lamp, and a good one. It is not a study of what the emission does to the people it is pointed at, it contains no biological endpoint, and it was never meant to.

That is the shape of the gap this Part describes, and it is a more particular shape than an absence. The capacity to fund this research exists within the federal government and has been exercised. It has been pointed at the responder and not at the public, at discomfort and detection rather than at health, and by the agencies responsible for fire and transportation rather than by the agency holding the electronic product radiation authority. No part of 21 U.S.C. § 360ii was engaged in commissioning it, and the questions paragraphs (a)(2) and (a)(4) direct the Secretary to ask were not among the questions it asked.

7. Federal Aviation Administration — obstruction, airfield, and aircraft lighting

The Federal Aviation Administration specifies obstruction lighting on towers and structures, airfield lighting, and aircraft lighting, and the conversion of these to light-emitting diode sources has proceeded alongside the others described in this comment. Obstruction lighting is distinctive in that it is designed to be seen from a distance, at night, by people who are not its intended audience as well as by those who are, and it is installed in places where people live. Part VI has no subsection devoted to this product class, which is a gap rather than a decision.

The agency's specifications govern intensity, flash characteristics and color for aviation purposes. They are not written to address the exposure of persons on the ground, which is not that agency's subject, and the Foundation does not suggest it should be. It is this Department's.

a. Obstruction lighting, and the one federal lighting specification that mandates a reduction at night

The governing document is Advisory Circular 70/7460-1N, Obstruction Marking and Lighting, dated August 11, 2026, which cancels revision M of November 16, 2020. It does not itself carry the photometric values; it refers them to Advisory Circular 150/5345-43J, Specification for Obstruction Lighting Equipment, dated March 11, 2019. The Foundation sets the figures out because they are the only federal numerical specification of lamp intensity in candelas it has found outside the motor vehicle standard, and because of the one feature of them described below.

For red lights the specification gives the L-810 steady-burning lamp a minimum of 32.5 candelas at all radials through 360 degrees within a minimum vertical spread of 10 degrees; the flashing L-810(F) the same minimum average instantaneous intensity at 30 flashes per minute plus or minus 3; and the flashing red L-864 a peak of 2,000 candelas plus or minus 25 percent at 30 flashes per minute, with a minimum of 750 candelas across a minimum vertical spread of 3 degrees. For white lights the specification gives three intensities to each lamp, by time of day. The medium-intensity L-865 at 40 flashes per minute and L-866 at 60 are specified at 20,000 candelas by day, 20,000 at twilight and 2,000 at night. The high-intensity L-856 at 40 flashes per minute is specified at 270,000 candelas by day, 20,000 at twilight and 2,000 at night, and the L-857 at 60 flashes per minute at 140,000 by day with the same twilight and night values.

That last column is the reason this subsection exists. The specification does not permit the operator to reduce intensity at night; it requires the lamp to do so, as a condition of conformity, by a factor of ten for the medium-intensity lamp and of one hundred and thirty-five for the high-intensity one, with the transition controlled by a photocell at stated thresholds in foot-candles. Part IX.J asks the Department to recommend ambient sensing and a default-low condition for general illumination, and Part VI.D describes roadway and area lighting, in which no such requirement appears. The architecture that request describes is not novel and does not need to be invented. It is written into a federal specification, in candelas, with a measured trigger, and it has been in service for years.

The Foundation states what the comparison does not establish, because three overstatements are available and all three would fail. The step-down exists so that a lamp can be seen against a bright sky by day and a dark sky at night, not because anyone considered a person beneath it; neither circular addresses the exposure of persons on the ground at all. The tolerance of plus or minus 25 percent around each nominal value is a manufacturing conformance band and is not a protective ceiling; the only limits in the specification that operate as true maxima are on stray light, which must not be greater than 3 percent of the peak intensity at the same radial, and on output during the off period of a flash. And the Foundation does not suggest that aviation intensities are appropriate to general illumination, since a quarter of a million candelas directed at the sky is not a model for anything at eye level. What the comparison establishes is that a mandatory, automatic, measured reduction of lamp intensity at night is an ordinary provision of federal engineering practice, and that its absence from every instrument governing lighting that people actually live among is therefore not explained by difficulty.

b. Small unmanned aircraft: a lighting rule with a floor and no ceiling

Since 2021 the agency has permitted small unmanned aircraft to be operated at night and has required lighting to make them visible. 14 C.F.R. § 107.29, as amended by the final rule Operation of Small Unmanned Aircraft Systems Over People, 86 Fed. Reg. 4,314, 4,382 (Jan. 15, 2021), corrected at 86 Fed. Reg. 13,630, 13,631 (Mar. 10, 2021). The operative requirement, which appears in identical terms for night and for civil twilight, is this:

> The small unmanned aircraft has lighted anti-collision lighting visible for at least 3 statute miles that has a flash rate sufficient to avoid a collision. The remote pilot in command may reduce the intensity of, but may not extinguish, the anti-collision

> lighting if he or she determines that, because of operating conditions, it would be in the interest of safety to do so.

Three features of that sentence and one absence. It sets a minimum, and the minimum is a distance at which the lamp must still be seen rather than a quantity of light. It sets a flash requirement that is wholly qualitative, sufficient to avoid a collision, with no rate specified. It gives the pilot a discretionary permission to reduce intensity which is expressly not a permission to extinguish. And it sets no maximum.

The absence is not confined to the section. There is no maximum intensity, luminance or brightness anywhere in part 107. The words luminance, brightness, candela and glare do not appear in the part at all, and the word intensity appears only in the clause just quoted. No provision of part 107 limits lighting for the protection of persons on the ground; the protective provisions of the part are addressed to impact injury and to operational hazard. So the federal rule governing a new class of nighttime emitter specifies how far it must be seen and says nothing about how bright it may be, which is the same structure Part VI.C describes for emergency vehicle warning lamps and Part II.H.5 for the motor vehicle lighting standard.

The characteristics that make this class worth raising here are the ones the rule does not reach. A lamp designed to be conspicuous at three statute miles is a small source of high luminance. It is mounted on a platform that moves across the field of view rather than remaining in a fixed position. It switches rather than ramps, so the onset is effectively instantaneous. It operates at night, against a dark adapted eye. And it may be operated in numbers, which is the subject of the movement below. Part V.C.3 sets out why a small bright source at distance produces disability glare through intraocular scatter rather than through the light reaching the retinal image alone, Part V.C.5 why that effect is greater with age, astigmatism and cataract, Part V.D the response to temporal modulation, and Part V.E the photosensitive response. The Foundation asserts no quantitative finding about these aircraft, because none exists and the measurement that would supply one is the measurement Part V.J establishes nobody records. It asserts that the exposure is new, that it is unmeasured, and that the instrument governing it contains a floor and no ceiling.

There is one place where the agency has acknowledged the visual effect, and it is the most important thing in this subsection. Advisory Circular 107-2A, Small Unmanned Aircraft System, dated February 1, 2021, explains at paragraph 5.7.2.2 why the pilot is permitted to reduce intensity:

> However, the remote PIC may reduce the intensity of the light if the remote PIC determines it is in the interest of safety to do so. For example, a bright light or a bright strobe light on the small unmanned aircraft in very close proximity to the remote pilot could cause the remote pilot to lose the ability to observe the small unmanned aircraft's location, speed, attitude, or altitude with accuracy.

So the agency has recognized, in a published document, that a bright strobe on one of these aircraft can deprive a human observer of the ability to observe accurately. It is the mechanism this comment is about, stated by a federal agency about a light-emitting diode product. The Foundation notes precisely what the agency then did with the recognition. It addressed it to one observer, the remote pilot. It treated it as a matter of that pilot's performance rather than of anyone's health. And it met it with a discretionary permission rather than a limit. There is no counterpart anywhere in the rule or the circular for any other person who sees the same light. The Foundation does not say that was wrong. That agency's subject is aviation safety and the remote pilot is properly its concern. It says that the visual effect is acknowledged in a federal document, that the mechanism acknowledged is the impairment of accurate observation by a human eye, and that the question who else is standing in the light is not that agency's to answer. Part II.H.22 records that this agency told the Foundation on November 9, 2022 that it is not a regulatory agency on light-emitting diode requirements and would defer to this Department for comfort, health and safety regulations.

c. Performances flown with many aircraft at once

Operating more than one small unmanned aircraft from a single control station requires relief from 14 C.F.R. § 107.35, which permits a person to operate only one at a time. Relief is granted by certificate of waiver under § 107.200; § 107.205 is the list of regulations that may be waived and includes § 107.35. The certificates the Foundation has read waive the lighting requirements of § 107.29 in the same instrument.

The scale now authorized is the first point. A certificate issued in 2026 authorizes operations with up to 10,000 small unmanned aircraft per remote pilot in command, and one issued in 2025 authorizes up to 1,000 with one visual observer for every 250 aircraft. The Foundation states that these are ceilings written on a certificate rather than records of performances flown, and it has not established the largest number actually operated.

The second point is what the certificates condition and what they do not. They require that the lighting system be used in a manner sufficient to alert approaching aircraft, which is a performance term pointing outward to the operator's application rather than to any value. They require that the operating area be sterile, that spectators be kept out of the restricted area and that the area be monitored for intrusion. They require notice to the local flight standards district office including audience locations and the total number of aircraft. And they state that the certificate does not constitute a waiver of any state law or local ordinance. Not one of them sets a light intensity, a luminance, a candela value, a flash rate or any limit related to glare. Spectators appear in them only as an exclusion-zone problem, and persons who are not spectators are not mentioned at all. The authorization governs where a person may stand and not how bright the light may be.

The Foundation is careful about the request it makes here, and aligns it with Part VI.K. That subsection treats entertainment lighting and states that the Foundation does not ask the Department to regulate a light show, because a person who buys a ticket to a performance seeks the exposure. The Foundation does not withdraw that and does not ask for it here. What distinguishes this case from a concert is that these aircraft fly in open airspace above a city, and the federal authorization that permits them addresses the audience and is silent as to everybody else beneath them. The fifth matter at Part IX.I concerns the number of emitters a person meets at once. A performance that may place thousands of independently moving, individually addressable high-luminance emitters into a single field of view is the clearest instance of that question the Foundation has encountered, and the instrument authorizing it contains no photometric term of any kind.

d. What the Foundation asks under this subsection

Nothing that requires this agency to do anything, and nothing that depends on a finding about aviation. That the Department consult it under paragraphs (a)(3) and (a)(6) on two matters. The first is the obstruction lighting specification, which is the nearest thing in federal practice to the capability Part IX.J asks the Department to recommend, and which this Department has every reason to understand before recommending anything of the kind. The second is the lighting rule for small unmanned aircraft, where this agency has acknowledged in writing that a strobe on one of these products can impair accurate observation by a human eye, and has limited the remedy to the pilot because the rest is not its subject. And that any classification system developed under Part IX.G treat motion of the source across the field of view, and the number of sources present at once, as parameters rather than as qualifications added afterward.

8. Federal Communications Commission

a. Why this agency stands differently from the others in this Part

Every other agency treated in this Part regulates a product, a place, or a activity in which an emitting product is installed. This one shares a subject matter with this Department. Both administer frameworks addressed to non-ionizing electromagnetic radiation emitted by electronic products, and the statute that creates this Department's program defines electronic product

radiation to include radiofrequency and visible light alike. Part II.B. It is also the only federal agency with which a consultation of record about the health effects of an electronic product radiation exists at all. Subsection 18.

For that reason this subsection is organized around three things rather than one: what that Commission has said about the division of responsibility, what its rules do and do not reach in the radiofrequency emissions of light-emitting diode products, and the proceeding it has presently opened, which is the clearest occasion for the exercise of paragraph (a)(6) that has arisen in the period this comment describes.

b. The radiofrequency emissions of light-emitting diode products

The Foundation sets this out at some length and with citations, because an earlier draft of this subsection asserted both halves of it without them and one of the two assertions was imprecise.

i. What this Commission has said about who protects the public

The Office of Engineering and Technology of that Commission publishes a page of answers to questions about radiofrequency safety. It contains this:

> The Commission does not regulate exposure to emissions from these devices. Protecting the public from harmful radiation emissions from these consumer products is the responsibility of the U.S. Food and Drug Administration (FDA). Inquires [sic] should be directed to the FDA's Center for Devices and Radiological Health (CDRH), and, specifically, to the CDRH Office of Compliance …

The Foundation states the limits of that passage before stating its use, because the passage is easy to overread and an earlier draft of this comment did overread it. The page carries no date of publication or review. And the Foundation has not been able to recover the question under which the passage sits, so the class of articles to which the words these devices and these consumer products refer is not established from the page as the Foundation has read it; the surrounding discussion concerns microwave ovens. The Foundation therefore does not offer this passage as a statement that this Commission regards this Department as responsible for consumer products generally, and does not rely on it at all for the optical question this comment raises.

What the passage does establish is narrower and is still worth having. Where this Commission declines to regulate exposure to an emission from a consumer product, it identifies this Department as the agency responsible for protecting the public from that emission, and it refers the inquirer to the Center for Devices and Radiological Health by name and to one office within it. The division of responsibility is not a construction the Foundation has placed on the statute. It is the account the other agency gives of it, in its own published material.

Three further statements on the same page bear on this comment and the Foundation records them with the treatment they receive elsewhere. That the Center established a performance standard for microwave ovens in 1971, which Part II.C treats as the one exercise of the § 360kk power that reached a consumer product in general use. That the Center has not adopted performance standards for other products emitting radiofrequency energy, which is consistent with the record set out at Part II.C and Part I.C.7. And that the Food and Drug Administration is the lead federal health agency in monitoring the latest research developments, which is a statement of posture rather than of activity, and which Part II.D examines against what the Foundation has been able to establish the monitoring consists of.

ii. Which of this Commission's rules actually reach a light-emitting diode product

A light-emitting diode is a semiconductor driven by direct current and it does not use radiofrequency energy to produce light. What emits radiofrequency energy in such a product is the driver, which converts and switches at high frequency, and in a networked product the radio. The distinction matters to what a consultation would be about, so the Foundation states which part of this Commission's rules applies and which does not.

Part 18 does not reach these products. Its subject is industrial, scientific and medical equipment, which 47 C.F.R. § 18.107(c) defines as equipment "designed to generate and use locally RF energy for industrial, scientific, medical, domestic or similar purposes". The part does use the term RF lighting device, at §§ 18.213(d), 18.305(c) and 18.307(c), but it nowhere defines it; when the Commission adopted those provisions it described the class as devices which "produce light by using RF energy to stimulate gases contained inside a lamp". A light-emitting diode stimulates no gas. And § 18.107(a) defines radiofrequency energy as "Electromagnetic energy at any frequency in the radio spectrum from 9 kHz to 3 THz (3,000 GHz)", which places visible light, at roughly 430 to 750 terahertz, about two orders of magnitude above the definitional ceiling of the part. Visible light is outside part 18 by the part's own terms.

Part 15 is the part that reaches them, and it reaches them twice. A lamp or luminaire whose driver generates radiofrequency energy for use within the device but is not intended to emit it is an unintentional radiator within § 15.3(z), and the limits are the conducted limits of § 15.107 and the radiated limits of § 15.109, in subpart B. A luminaire containing a deliberate radio is in addition an intentional radiator within § 15.3(o), certified under subpart C, with the general radiated limits at § 15.209 and the band rules at §§ 15.247 and 15.407. The assembled article is a composite system, measured under § 15.31(k). So a networked luminaire carries two classifications at once, and Part VI.L treats the class.

The purpose those limits serve is the point of this movement. Part 18 states its own: its rules are promulgated under section 302 of the Communications Act of 1934 "in order to prevent harmful interference to authorized radio communication services." Part 15 conditions operation on causing no harmful interference and on accepting interference from authorized stations and other devices, §§ 15.5(b) and (c). Neither part contains a single emission limit adopted for the protection of human health. Health enters either part only by cross-reference, to the radiofrequency exposure requirements at 47 C.F.R. §§ 1.1307(b), 1.1310, 2.1091 and 2.1093, which § 18.313 imports for part 18 and which part 15 imports section by section in subpart C. Those requirements govern exposure to radiofrequency fields. No provision of part 15 or of part 18 addresses visible light, luminance, spectral composition, temporal modulation or glare in any respect.

One structural feature belongs here because it recurs throughout this comment. Every limit in both parts is a maximum. Neither part sets a floor of any kind: a device may emit less than the limit, or nothing at all, and what it may not do is exceed. That is what a limit adopted to protect something other than the emitter looks like, and Part I.C.7 records that no federal instrument imposes a limit of that shape on the optical emission of a light-emitting diode product in the general environment.

iii. What follows for consultation under this paragraph

The consultation this paragraph contemplates with this Commission has two subjects and they are not alike. On radiofrequency energy there is a framework, a proceeding presently open, and one letter of record; the movement below sets that out. On optical radiation there is nothing on this Commission's side, and the Foundation does not suggest there should be. That Commission has no authority over visible light and claims none, and nothing in this comment asks it to acquire any.

What the Foundation asks is one question that only this Department can put. These products emit in two regions of the spectrum at once, from the same housing, to the same person, under two unrelated federal regimes: an interference regime administered by that Commission which reaches the radiofrequency emission and says nothing about health, and this Department's own electronic product radiation control program which reaches the optical emission and has prescribed nothing. Part VI.L sets out the product class in which both occur. The Foundation asks the Department to ascertain and state whether the two emissions of these products have ever been considered together by anyone, and Part IX.E carries the request.

c. The proceeding now open at that Commission, and the occasion it presents

On September 17, 2026 the Office of Engineering and Technology of the Federal Communications Commission released Public Notice DA 26-997 in ET Docket No. 13-84, summarized in the Federal Register at 91 Fed. Reg. 60,128 (Sept. 22, 2026), seeking comment on the radiofrequency exposure issues remanded to that Commission in Environmental Health Trust v. Federal Communications Commission, 9 F.4th 893 (D.C. Cir. 2021). Comments are due October 22, 2026, which is the day after the comment period in this proceeding closes.

The notice records what the court directed, and the Foundation reproduces it because the three items define the scope of what is open. The Commission is to address its decision to retain its testing procedures for determining whether cell phones and other portable electronic devices comply with its guidelines; the impacts of radiofrequency radiation on children and the health implications of long-term exposure to it; and the impacts of radiofrequency radiation on the environment. The notice also records that the panel did not vacate the decision of 2019 and that it "merely directed the Commission to provide further explanation."

Two passages of that notice bear directly on this subsection. The first is an invitation:

> the Commission invites the broadest range of commenters to participate, including local, state, federal, and international health and safety agencies, science-based standard-setting organizations that are active in this area, and other interested parties.

The Foundation does not read that as an instruction to this Department and it is not one. It is an open invitation from a sister agency, placed on a public record, dated, naming federal health and safety agencies as a category of participant it wishes to hear from, in a docket whose subject is the adequacy of a federal exposure framework for a non-ionizing electronic product radiation. Paragraph (a)(6) directs the Secretary to consult and maintain liaison with other appropriate federal departments and agencies on techniques, equipment and programs for testing and evaluating electronic product radiation, and on the development of performance standards to control such emissions. Whatever view is taken of the breadth of that paragraph, an occasion for its exercise is presently open, it was created by the other agency rather than by this one, and it closes on October 22, 2026.

The second passage is the Commission's account of how it will weigh what it receives:

> Probative value will be accorded to parties who have demonstrated a capacity to interpret the biological research necessary to assess the health impact of RF emissions and determine what exposure levels are considered safe for humans, and who can do so with sufficient detail and persuasiveness to overcome the failings that the court identified when the Commission last attempted to rely on the expertise of expert agencies.

On the record set out at subsection 20, the last occasion on which that Commission relied on the expertise of an expert agency in this docket was the correspondence of April 24, 2019 from the Director of the Center for Devices and Radiological Health. The Foundation draws attention to the sentence for one reason and states the reason precisely. Subsection 19 concludes that the program's single consultation of record produced an assurance which the receiving agency relied on and which a court then held could not carry the decision that rested on it. That conclusion is the Foundation's, and a reader is entitled to discount it accordingly. This passage is the receiving agency's own account of the same events, written seven years later, and it is less favorable than the Foundation's: it describes the episode as an attempt, and it fixes the standard for present submissions as the capacity to overcome the failings the court identified in it.

The Foundation states the limits of the point, because the overstatement available here would be serious and would be wrong. The notice confines itself to record evidence that was properly before the court in that case. It is a proceeding about radiofrequency exposure and it is not a forum for the optical question this comment raises. The Foundation does not suggest that material

concerning visible light could properly be filed there, does not ask this Department to file any such material, and does not ask this Department to take any position on the radiofrequency science. Nor does the Foundation know whether this Department intends to participate; it may already have done so. What the Foundation says is narrower. Paragraph (a)(6) imposes a duty of consultation and liaison rather than a duty to reach any conclusion. The agency with which the one consultation of record exists has reopened the record on the very order that consultation supported, it has invited federal health agencies to take part, and this Department will be preparing its answer to this Request for Information in the same weeks.

One further feature of the notice is recorded as incomplete rather than relied upon. The notice asks expressly for comment on the probative value of a letter of 2014 from the Department of the Interior, which the court had faulted the Commission for not discussing. In the Federal Register summary of the notice this Department is not named. The Foundation draws no conclusion from that, because the Federal Register document is by its own terms a summary of a longer Public Notice which the Foundation has not been able to obtain, and the longer document may name it.

d. What the Foundation asks under this subsection

Four things, none of which requires this Department to adopt any position on radiofrequency energy. That it state whether it has communicated with that Commission, since the correspondence of April 24, 2019, about any of the matters remanded in Environmental Health Trust, and if so place the communications on this record. That if it has not, it treat the open docket as an occasion of the kind paragraph (a)(6) contemplates, and say what it decides. That it state whether the assessment conveyed in 2019 remains its position, which is a question Part II.D asks in another form and Part IX.B asks directly. And that it state the division of responsibility for the radiofrequency emissions of products it has itself classified as electronic products, which is the subject of the subsection above and of Part VI.L.

9. Consumer Product Safety Commission

The Consumer Product Safety Commission has jurisdiction over consumer products, which includes the flashlights, portable lamps, toys, tools and appliances that carry the emitters described at Part II.G.3 and Part VI.G. Its complaint database receives reports from the public about consumer products, and Part VII.J notes it among the channels that should be checked for reports concerning LED products.

The division of authority here is not a matter of practice or of agency preference. It is statutory, and the Commission has said so.

On November 7, 2022 Jonathan Midgett, Ph.D., the Consumer Ombudsman in that agency's Office of the Executive Director, wrote to the Foundation by electronic mail. He began by saying that the agency's staff evaluates products on an individual basis and that its jurisdiction over LED lights depends on the hazard. He then drew the division:

> CPSC may have jurisdiction over LED lights for hazards such as electrocution and fire, but CPSC does not have jurisdiction over LED lights under the CPSA if the risk is related to electronic product radiation that may be regulated by FDA.

The email then quotes the provision, which is the second sentence of section 31 of the Consumer Product Safety Act, 15 U.S.C. § 2080(a):

> The Commission shall have no authority under this chapter to regulate any risk of injury associated with electronic product radiation emitted from an electronic product (as such terms are defined by sections 355(1) and (2) of the Public Health Service Act) if such risk of injury may be subjected to regulation under subpart 3 of part F of title III of the Public Health Service Act.

The referenced provisions of the Public Health Service Act are those transferred into the Federal Food, Drug, and Cosmetic Act and now codified at 21 U.S.C. §§ 360hh and following, as Part II.A.1

describes. The Foundation does not have to supply that identification, because the Commission supplied it. Its quotation of the provision carries a bracketed note of the Commission's own, recording that the referenced sections of the Public Health Service Act were later transferred to 21 U.S.C. § 360hh. Part II.A.1 gives the renumbering provision and its public law citation and they are not repeated here. So the agency that is barred identified the statute that bars it, and the statute it identified is this one.

Two consequences follow, and the second is the one that matters.

The first is that the Commission is right. It is barred by statute, and no amount of evidence about injury would give it authority over a risk arising from electronic product radiation.

The second is in the words of the bar. It operates where the risk "may be subjected to regulation" under this chapter. It is not conditioned on the risk having been regulated, or on a performance standard existing, or on the Secretary having determined that one is necessary. The potential for regulation under this chapter is what displaces the Commission's authority. It follows that the Department's conclusion that a standard is not necessary does not return the subject to the Commission. It leaves the subject where the statute put it, with this Department, and unaddressed.

10. Department of Labor — OSHA and NIOSH

Of all the liaison relationships this Part describes, the one with the Department of Labor is the least contestable, for the textual reason given in subsection 1: the Secretary of Labor is named in the statute and is not within the category qualified by the word appropriate.

The Foundation notes the direction in which the duty runs, because it is sometimes stated the other way around. Neither the Occupational Safety and Health Administration nor the National Institute for Occupational Safety and Health bears any duty under this chapter. Chapter 9, subchapter V, part C of title 21 imposes its obligations on the Secretary of Health and Human Services. It is this Department that is directed to consult and maintain liaison with the Secretary of Labor, and the request the Foundation makes is addressed accordingly: that this Department discharge its own duty, not that another Department be directed to discharge one it does not have.

That is not a theoretical observation. The Foundation approached the Occupational Safety and Health Administration directly, over two years, and the correspondence establishes the point.

On September 7, 2022, the Assistant Secretary of Labor for Occupational Safety and Health responded to a Foundation petition for rulemaking on electromagnetic radiation from LED devices. He wrote that the topic was not on the agency's regulatory agenda and would not be added at that time, given other priorities he identified, among them heat injury, workplace violence, and occupational exposure to COVID-19. He stated that the agency's Directorate of Standards and Guidance would examine the relevant scientific literature and monitor developments. Concerns raised under the Americans with Disabilities Act were referred to the agencies that administer that statute.

The Foundation reads that letter as a decision about the allocation of rulemaking resources rather than a determination that occupational exposure to LED optical radiation is not a workplace hazard. The letter makes no finding on the latter question, and the Foundation does not suggest that it does.

On July 22, 2023, the Foundation petitioned the same Assistant Secretary, in a document titled Petition To Publish Performance Standards for the Visible Radiation Emitted by Products Using Light Emitting Diodes. It asked that the agency:

> consult and liaison with the FDA to minimize the risk of harm to all workers, especially those who are most sensitive, from LED visible radiation devices and to publish performance standards for all categories of LED products, in accordance with 29 U.S.C. 651 and 21 U.S.C. Section 360ii—

and relied on 29 U.S.C. § 651(b), the congressional declaration of purpose to assure so far as possible safe and healthful working conditions, together with § 360ii(a).

On August 15, 2024, the Director of the Directorate of Standards and Guidance replied to that petition and to a further letter of July 1, 2024. The reply states that the agency cannot violate the provision relied upon because that provision does not apply to it, and declines the requested consultation with the Food and Drug Administration on that basis.

The Occupational Safety and Health Administration is correct. Section 360ii(a)(6) imposes no duty on the Secretary of Labor and none on that agency. It imposes a duty on the Secretary of Health and Human Services. The Foundation asked the wrong department, and the department it asked said so accurately.

What the exchange establishes is therefore not a failure by the Department of Labor. It is the shape of the problem. A person seeking to have occupational exposure to this radiation evaluated is told by the Department of Labor that the liaison provision does not apply to it, which is right, and by the Food and Drug Administration that a performance standard is not necessary, which is the subject of Part I.C. The provision that connects the two — the direction to this Department to consult and maintain liaison with the Secretary of Labor — has been invoked by neither agency, and only one of the two can invoke it.

Two things in the correspondence are worth the Department's attention as it considers the request below. The first is that the agency with occupational health expertise stated in 2022 that it would examine the relevant scientific literature. Whether it did, and what it found, is precisely the kind of information § 360ii(a)(6)(A) contemplates passing between the two departments, and this Department can ask for it. The second is that the Department of Labor has now been on notice of this subject since 2022, so a consultation initiated by this Department would not be arriving unannounced.

Labor appears three times in this chapter, which is not an accident of drafting.

- Section 360ii(a)(6) names the Secretary of Labor among the four officers with whom consultation and liaison are directed.
- Section 360ii(a)(3) directs the Secretary to maintain liaison with and receive information from, among others, "industry and labor associations" on present and future potential electronic product radiation. Part II.E.
- Section 360kk(a)(1) directs that, in developing a performance standard, the Secretary consult with interested persons "including representatives of industries and labor organizations which would be affected by such standards." Part II.C.1.

Congress wrote occupational exposure into this statute in three separate provisions, at the program level, at the information-gathering level, and within the standard-setting procedure itself.

One feature of the arrangement makes the request unusually straightforward. The National Institute for Occupational Safety and Health is not an agency of the Department of Labor. It is a component of the Centers for Disease Control and Prevention, within this Department. The Department therefore does not need to reach outside itself to obtain an occupational health evaluation of this exposure. The Institute conducts health hazard evaluations at workplaces on request, and the expertise the question requires is already inside the building.

The occupational exposures at issue are not confined to one setting. They include, at least: employees in large-format retail and grocery interiors, treated at Part VI.F, who work a full shift beneath high-density arrays designed for merchandise presentation rather than for visual comfort; warehouse and distribution center workers under high-bay lighting; roadway and utility workers in work zones among flashing warning lamps, treated at Part VI.C.3; emergency responders exposed at close range to the lamps mounted on their own apparatus, Part VI.C.1; and

commercial and transit drivers who face oncoming headlamps for the length of a shift, Part VI.B.1. What these have in common is duration. Part V.C.2 explains why duration is the variable the existing exposure limits stop accounting for.

As to what presently governs these exposures on the occupational side, the Foundation can identify no federal limit addressed to the optical characteristics at issue. The illumination provisions the Foundation is aware of prescribe minimum intensities for particular work, not maximum luminance, and no federal standard prescribes a spectral requirement, a glare limit, or a limit on temporal modulation in a workplace. The practical consequence is that an employer who wished to evaluate this exposure would find no criterion to evaluate it against, and an employee who raised it would find no standard to invoke.

The Foundation accordingly asks the Department:

- to state on the record whether consultation or liaison under § 360ii(a)(6) has occurred at any time with the Secretary of Labor with respect to visible light emitted by LED products, and if so, when and with what result;
- to initiate that consultation if it has not occurred, on the subjects the paragraph specifies — techniques, equipment and programs for testing and evaluating electronic product radiation, and the development of performance standards under § 360kk;
- to request from the Department of Labor the examination of the scientific literature that its Directorate of Standards and Guidance stated in September 2022 it would undertake, and to publish what it receives;
- to direct the National Institute for Occupational Safety and Health to evaluate full-shift occupational exposure to visible light from LED products, beginning with the settings listed above, and to publish the result;
- to receive information from labor associations under § 360ii(a)(3), which so far as the Foundation is aware has not been sought on this subject;
- and, when a performance standard is developed under § 360kk, to consult representatives of labor organizations as § 360kk(a)(1) requires.

11. United States Access Board

The Access Board writes the accessibility guidelines that public entities and places of public accommodation build to. Part VIII sets out the position in full: the guidelines contain no criterion addressed to optical radiation, and the Foundation has established that the Federal Highway Administration has treated disability access in relation to flashing devices as a matter for other authorities.

The Board has addressed this subject directly, and its answer is the most useful single document in this Part.

On June 5, 2023 the Foundation petitioned the Board for rulemaking to publish accessibility requirements for LED products pursuant to 21 U.S.C. § 360ii, asking that the Board consult and liaise with the Food and Drug Administration to develop techniques to evaluate the visible radiation emitted by LEDs and to publish performance standards minimizing exposure. On August 21, 2023 the General Counsel of the Board denied the petition. The denial reads in part:

> The Access Board must deny this petition as the Board has no authority under 21 U.S.C. §360ii either to initiate rulemaking or to require the FDA, were they to do so, to coordinate with the Access Board. This statute directs the FDA to establish and carry out an electronic product radiation control program, to include issuing performance standards for electronic products pursuant to 21 U.S.C. §360kk and to [consult and maintain liaison with the Secretary of Commerce, the Secretary of Defense, the Secretary of Labor, the Atomic Energy Commission, and other appropriate Federal departments and agencies]— The Access Board was not directed

> by Congress to participate in the development of these Standards and, as such, it is not within the Board's authority to require such a consultation.

Three things in that passage repay attention.

The first is that a federal agency other than this Department has construed § 360ii, and has construed it as directing the Food and Drug Administration to establish and carry out an electronic product radiation control program. The Board quoted paragraph (a)(6) in full in support of that reading.

The second is that the Board is right about its own position. Congress did not name it in paragraph (a)(6), and nothing in the paragraph allows the Board to compel a consultation that this Department does not initiate. The direction runs one way, as Part II.H.10 says of the Secretary of Labor and as subsection 1 explains generally.

The third is the sentence that follows, and the Foundation asks the Department to read it twice. The Board continued:

> However, the Access Board does provide technical assistance regarding accessibility issues to other federal agencies upon request. Were we to receive such a request from the FDA or another federal agency, we would provide assistance to the extent our resources and expertise allowed us to do so.

That is a standing offer, made in writing by the General Counsel of the agency that writes the accessibility guidelines public entities build to, and it has been open since August 2023. The Foundation is aware of no request having been made to the Board by the Food and Drug Administration or by any other federal agency concerning visible light emitted by LED products.

What that converts the request at Part IX.E into is worth stating plainly. The Foundation is not asking this Department to persuade a reluctant agency, to negotiate an interagency agreement, or to expend anything beyond the effort of composing a letter. The expertise exists, it is federal, it has been offered, and it has not been sought. Part VIII describes what the absence of any accessibility criterion addressed to optical radiation has meant for the people this comment concerns; the Board has said it would help to develop one if asked.

A consultation under this paragraph would be directed at the gap that produces. Accessibility guidelines can address a barrier only once the barrier has been characterized. Characterizing this one requires the measurement that § 360ii(a)(4) directs and that has not been performed, which is why Part VIII and Part II.F are the same argument in two registers.

12. Department of Education — school facilities

The Department of Education administers the programs under which school facilities are built, renovated and equipped, and school interiors are among the settings treated at Part VI.E. Children are exposed in them for the length of a school day, on a compulsory basis, in rooms whose lighting they did not choose and cannot alter.

Three features distinguish this setting from the others in this Part. The exposure is compulsory in a way that almost no other is. The exposed population includes children, whose optical media transmit short-wavelength light more freely than those of adults, as Part V.C.5 describes. And the lighting is installed through procurement decisions responsive to published federal guidance, which means that a finding of the kind Part II.G.4 describes would change installations without any regulation being issued.

13. Federal Trade Commission — labeling and advertising of LED products

The Federal Trade Commission prescribes the Lighting Facts label that appears on general service lamp packaging, which reports brightness in lumens, estimated annual energy cost, life, light appearance on a warm-to-cool scale expressed in kelvin, and wattage.

The label is the only disclosure of emission characteristics most purchasers ever see, and the quantities it reports are the quantities this comment identifies as insufficient. Lumens describe total output weighted by the photopic response. Correlated color temperature describes appearance and not spectral content, as Part V.B.3 sets out, and two lamps of identical correlated color temperature may differ substantially in short-wavelength emission. Nothing on the label reports spectral power distribution, source luminance, or temporal modulation. A purchaser seeking to avoid the characteristics described in this comment cannot do so from the information the federal government requires to be disclosed.

The disclosure requested at Part IX.F would be given effect at the point of purchase through this label or its successor, which is why this agency belongs in the consultation this paragraph directs.

14. General Services Administration, Department of Defense, and other federal building operators

This subsection differs in kind from the thirteen before it, and the Foundation says how at the outset. Those agencies regulate an emitting product, or a place in which one is installed, and each of the nine that answered said the subject was not its own. The agencies treated here regulate nothing relevant to this comment. They buy, specify, install, operate and own lighting, and they employ the people who work beneath it. The federal government appears in this subsection as an employer and a landlord rather than as a regulator.

The Foundation also records at the outset that it set out to write this subsection on an assumption which the documents refuted, and that the correction improved the argument rather than weakening it. The assumption was that federal facilities criteria specify how much light and how much power and say nothing about spectrum, flicker or glare. They say a great deal about all three.

a. Scale, and which officer the statute names

The Office of Personnel Management reported 2,289,472 federal civilian employees as of March 31, 2025, which it describes as a preliminary figure and which excludes the Postal Service and the intelligence agencies. The Department of Defense reported for 2024 an active-duty strength of 1,267,738 and a Selected Reserve and Guard strength of 754,403, a total military community of 2,022,141. The Public Buildings Service of the General Services Administration states that it maintains, builds, leases and operates more than 360 million rentable square feet of space, of which 1,699 federally owned buildings account for approximately 187 million.

The Secretary of Defense is one of the four officers paragraph (a)(6) names, and the direction to consult that officer carries no qualifier. Subsection 1. The General Services Administration falls in the residual category and the Foundation does not contend otherwise.

One precision about the scope of paragraph (a)(6) belongs here, because the Foundation would otherwise be claiming more than the text gives it. That paragraph specifies its two subjects: techniques, equipment and programs for testing and evaluating electronic product radiation, and the development of performance standards under § 360kk. It is not a general direction to advise the Secretary of Defense about the health effects of the lighting in Department of Defense buildings. The Foundation accordingly rests this subsection principally on paragraph (a)(3), which directs liaison with and receipt of information from other federal departments and agencies with related interests, and Part II.E develops that paragraph. Paragraph (a)(6)(A) is engaged too, and squarely, but for a narrower reason: what the criteria described below actually contain is testing and evaluation criteria for the emission of a lamp, which is the subject the paragraph names.

b. What the federal facilities criteria require, which is more than the Foundation expected

The Department of Defense criteria are the Unified Facilities Criteria for interior and exterior lighting systems, UFC 3-530-01, dated February 9, 2023 with Change 1 of December 15, 2023, and

the Department of Defense Building Code, UFC 1-200-01, lists it as a core criterion with which projects must comply and reproduces no lighting criteria of its own. Five provisions of the lighting criteria bear on this comment.

The first is a mandate. Paragraph 2-1.1 requires solid state lighting and light-emitting diode systems for all interior lighting, paragraph 2-2.1 requires them unless no equivalent product exists for the application, paragraph 2-2.1.3 directs that incandescent and tungsten halogen sources not be used except where specifically required for certain medical uses, and paragraphs 2-8.1 and 2-8.2 require that emergency lighting units and internally illuminated exit signs be light-emitting diode. That is the clearest instrument the Foundation has found anywhere in federal practice requiring this technology rather than permitting it.

The second is a limit on color temperature. Paragraph 2-1.4.6.1 directs: provide light sources with a correlated color temperature of no greater than 4100 K for all interior spaces, and records that the recommended value for most interior applications is 3500 K, with 2700 K recommended for residential and hospitality uses. That is a numerical ceiling on a spectral characteristic of a lamp, in a federal document, applicable across a building portfolio of the size just described.

The third is a limit on glare, and it is quantitative. Paragraph 2-1.4.1 directs that in regularly occupied spaces luminaires be used whose luminance is less than 650 candelas per square foot, or 7,000 candelas per square meter, in the zone between 45 and 90 degrees from nadir. An alternate path permits higher luminance where continuous dimming is provided and accessible to occupants. A second alternate path permits compliance by demonstrating, through software modeling, a Unified Glare Rating of less than 19. Paragraph 2-1.4.2 separately directs that disability glare caused by bright luminaire components be avoided. The Foundation asks the Department to notice what that is: a federal criterion limiting the luminance of a luminaire within a stated angular zone, which is the form of limit Part IX.I discusses and which Part I.C.7 records does not exist for any product in general use.

The fourth is flicker, and here the criteria are narrower than they first appear. The term is used at paragraph 2-2.1.2, which requires that screw-base replacements dim without flicker or dropouts across the dimming range, at paragraph 2-9.2.4 as to existing control systems, and at paragraph 2-9.2.5 as to linear retrofits. Every one of those provisions treats flicker as a performance defect at the dimming interface rather than as an exposure to be limited. There is an appendix headed Flicker which the Foundation has not read. Part V.D sets out why the distinction matters: a product that does not visibly flicker when dimmed may still modulate at a depth and frequency with physiological consequence.

The fifth is an appendix headed Lighting for Circadian Rhythms, whose sections address spectrum, timing, duration, quantity and distribution, and the spectral power distribution of circadian lighting luminaires. The Foundation has not read it and does not know whether it is mandatory criteria or advisory guidance, which is the question that matters most about it. What the Foundation can report from the main body is paragraph 2-1.4.6.2, which states that tunable white lighting is not a substitute for spectral tuning and does not provide circadian rhythm-specific lighting conditions.

The General Services Administration criteria are the Facilities Standards for the Public Buildings Service, the document known as the P100, in its edition of May 2024, with the lighting requirements at sections 6.1 through 6.3 of its electrical engineering chapter. The Foundation has not been able to read that chapter and states the requirements as they are quoted, by section, in two documents the agency itself commissioned. On that authority the P100 requires interior lighting below 4100 K and exterior lighting below 3500 K, a color rendering index greater than 80 for interior lighting, a fidelity index greater than 85 for lighting in its upper project tiers, and circadian-effective lighting in tiered projects. It restricts lighting power density further than the strictest model energy codes, by thirty percent below the space-by-space method of the governing building energy standard.

c. The mandate that drove the conversion, and the only criterion it uses

The conversion of federal building lighting to light-emitting diode sources was not a matter of taste. Two statutory provisions drive it and the Foundation identifies the operative one precisely, because the mechanism is the point.

Title 42 U.S.C. § 8253(a) requires each agency to apply energy conservation measures to its federal buildings and sets a schedule of reductions in energy consumption per gross square foot rising to thirty percent by fiscal year 2015 against a 2003 baseline. That table was put in its present form by section 431 of the Energy Independence and Security Act of 2007, which replaced the schedule originally set by section 102(a)(1) of the Energy Policy Act of 2005. Title 42 U.S.C. § 6834 separately requires new and renovated federal buildings, where life-cycle cost-effective, to be designed to consume at least thirty percent less energy than the governing standard as it stood in 2005.

The provision that actually produces retrofits is § 8253(f), added by section 432 of the Act of 2007. Each agency designates an energy manager; covered facilities must account for at least seventy-five percent of the agency's facility energy or water use; each energy manager must complete a comprehensive energy and water evaluation of roughly a quarter of covered facilities each year, so that each facility is evaluated at least every four years; and within two years of each evaluation the measures identified must be implemented where they are life-cycle cost-effective, with performance contracting used for at least half of them. That quadrennial cycle, with a two-year implementation clock, is the machinery that converts an audit finding into a lighting retrofit across a portfolio of hundreds of millions of square feet.

The criterion the machinery applies is life-cycle cost-effectiveness and there is no other. Nothing in § 8253(f) permits or requires the health of the occupant to be considered in choosing a light source. And the asymmetry in the companion section is worth stating exactly, because Congress did address the indoor environment there and confined what it addressed. Section 6834(a)(2)(C) directs that standards be developed with regard to radon and other indoor air pollutants, and § 6834(a)(3)(D)(iii)(IV)(cc) credits improved indoor environmental quality through enhanced indoor air quality. Congress legislated about the quality of the air in federal buildings and legislated nothing about the light. Part IV.G describes the same asymmetry in the general illumination standards that govern the lamps the public buys.

The Foundation adds one point of currency rather than leave a reader to a superseded instrument. The executive order on federal sustainability of December 8, 2021 was revoked on January 20, 2025, and the Foundation has identified no replacement. That does not weaken anything above. The provisions just described are statutory and remain in force, so the driver of this conversion is permanent rather than a matter of executive policy that changes hands.

d. The conflict the government has already documented, in its own commissioned words

Two documents the General Services Administration commissioned say, in substance, what Part IV.G and Part V.B of this comment say, and the Foundation quotes them because a federal agency's own contractor is a better witness than the Foundation.

The first is guidance on light-emitting diode lighting and controls prepared for that agency by a national laboratory and dated December 6, 2023. On flicker it states:

> Very low flicker can induce seizures; higher flicker can cause headaches and migraines.

It directs that the driver be high frequency and not have rectangular or complex waveforms, and then records the difficulty:

> There is currently no quick and easy way to assess the driver's waveform.

The Foundation asks the Department to read those two sentences together. A federal building operator has been told, in guidance it paid for, that the modulation of these products can induce seizures and cause headaches and migraines, and in the same guidance that there is no ready means of determining whether a given product does so. Part V.D sets out the literature on the first proposition and Part V.J the absence of any measurement regime answering the second. A measurement method is a technique for testing and evaluating electronic product radiation, which is the subject paragraph (a)(6)(A) names, and Part II.G sets out that this Department has developed none. The same guidance states that all tubular retrofit lamps can create glare problems and that they should be tested in place.

The second document is a technical report prepared for that agency by a research center of a medical school, dated March 14, 2025, on codes and standards that can conflict with circadian-effective lighting in the agency's buildings. Its finding is that the agency's own lighting power limits are in tension with the health-based lighting the agency's own standard requires: that the limit could make it extremely challenging to provide circadian-effective lighting, and that a particular setpoint would very likely result in inadequate circadian-effective light levels. The report inventories the instruments that bear on the question — the agency's own facilities standard, the building energy standard, the model energy code, a state energy code, an illuminating engineering recommended practice, a green building rating system and a design standard for circadian lighting — and it names no instrument of this Department, because there is none to name.

e. The meeting this Department was not at

On November 9, 2022 the Solid-State Lighting Program of the Department of Energy and the National Institutes of Health convened a research and development meeting on human physiological responses to light. The participants included that Program and the Building Technologies Office of the Department of Energy; the National Institutes of Health as co-host, with two conveners named; the National Aeronautics and Space Administration, represented by the head of its Fatigue Countermeasures Laboratory; and the Department of Defense, represented by a Commander of the United States Navy serving as Director of the Military Operational Medicine Research Program. The Centers for Disease Control and Prevention appear in the report only as a source of statistics.

Neither the Food and Drug Administration nor the Center for Devices and Radiological Health appears in that document. The Foundation states the finding at the level the record supports: it has read the published account of the meeting and this Department is not in it, and it does not assert that no official of this Department was aware of the meeting or has ever spoken to anyone who attended.

What the meeting establishes is the proposition this Part is about, in the cleanest form the Foundation has found. The federal government convened a meeting on the physiological effects of light on human beings. The health agency charged with research on human health was there. The space agency was there. The military medical research program was there. The energy agency that drove the technology convened it. The agency holding the statutory duty to study emissions of, and conditions of exposure to, electronic product radiation, and to develop criteria to minimize exposure to unnecessary radiation, was not among them. Paragraph (a)(3) directs this Department to maintain liaison with and to receive information from other federal departments and agencies with related interests. A convened interagency meeting on the physiological effects of light is the paradigm case of a related interest, and the Foundation has not identified any record of this Department receiving anything from it.

f. The same question was asked in 1974, by a component of this Department

The Foundation closes this subsection with a comparison that is to this Department's credit in its earlier form, and it offers the comparison for that reason rather than against the Department.

In 1974 the National Institute for Occupational Safety and Health, a component of this Department, convened a symposium on the occupational safety and health effects of reduced illumination, and the General Services Administration participated in it. The published proceedings of March 1, 1975 carry a paper by an official of that agency on its approach to energy conservation in lighting. The proceedings record a need for more information on the impact of low levels of lighting at the workplace, and address the role of color and contrast in health and safety.

So the sequence is this, and the Foundation states it as a sequence of facts. Fifty-one years ago, when the federal government changed the lighting in its own buildings for reasons of energy, a component of this Department convened a public inquiry into what that would do to the people working under it, and the building operator came and presented. The federal government has since changed the lighting in its own buildings again, on a far larger scale, under a statutory mandate whose only criterion is cost-effectiveness, to a technology whose spectral and temporal characteristics differ from what it replaced in the respects Part V.B describes. The Foundation has identified no comparable inquiry, and no participation by the component of this Department that holds the electronic product radiation authority.

g. What the Foundation asks under this subsection

Four things, and three of them require the agreement of no one.

First, that the Department state whether it has at any time advised, consulted or corresponded with the General Services Administration, the Department of Defense or any other federal building operator concerning the health effects of artificial light, and produce what it holds. Part IX.E.

Second, that it obtain from those agencies the criteria described at subsection b and say, on the record, whether it agrees with them. The Foundation asks that without suggesting the answer. These are procurement specifications for the government's own buildings rather than regulations; they bind nobody outside the government, they were written by facilities engineers rather than by a health agency, and the Foundation does not present them as health standards or contend that their numbers are the right numbers. What they show is narrower and is enough. Numerical criteria for the color temperature and the luminance of a lamp have already been written down by federal agencies, for buildings housing millions of people, without waiting for the settled criterion of necessity whose absence is advanced as a reason that no standard can be developed.

Third, and this is the request the Foundation makes nowhere else in this comment, that the study paragraph (a)(4) directs be performed in the federal portfolio. Part II.F sets out that no study of the emissions of, or the conditions of exposure to, visible light from these products exists. Part V.J sets out what such a study would have to measure and why nobody has measured it: the quantity is the spectral irradiance at the position of a person's eye under the conditions in which the person actually is, and obtaining it requires access to installed lighting in occupied space with the agreement of the owner and the occupants. The federal government owns or leases that space and employs the occupants. No access negotiation is required, no private consent, no manufacturer's cooperation, no new authority and no rulemaking. The lighting was installed to the government's own specifications, under the government's own mandate, in the government's own buildings, for the government's own employees. The Foundation does not assert that federal buildings are harming federal employees and has measured nothing. The argument is about availability and not about harm: whatever is thought of the difficulty of studying conditions of exposure generally, it is not difficult here, and Part IX.C carries the request.

Fourth, that the position of the federal workplace be addressed expressly. Subsection 10 records that staff of the Occupational Safety and Health Administration told the Foundation that the subject was not on that agency's regulatory agenda and that they awaited notification from this Department concerning light-emitting diode hazards in the workplace. Federal workplaces are not outside that program. Section 19 of the Occupational Safety and Health Act, 29 U.S.C. § 668, assigns responsibility for occupational safety and health programs to the head of each agency, and

the implementing regulations adopted under Executive Order 12196 of February 26, 1980 provide at 29 C.F.R. § 1960.8(b) that the head of each agency shall comply with the standards of that Administration applicable to the agency. So the standard that would govern the exposure of two and a quarter million federal civilian employees to the lighting in buildings their employer owns does not exist, and the agency that would write it has said it is waiting to hear from this Department. Part VI.E treats the product class and the exposed populations, and Part VIII the position of employees with the conditions described at Part V.C.5.

15. United States Customs and Border Protection

This agency is established in the Department of Homeland Security by 6 U.S.C. § 211(a), which provides that "There is established in the Department an agency to be known as U.S. Customs and Border Protection." The customs revenue functions that preceded the transfer were retained by the Secretary of the Treasury rather than moved, 6 U.S.C. § 212, and the definition of a customs revenue function at § 215 includes the compiling of import statistics. It is not a health agency and it regulates nothing that emits.

It is in this Part for a reason none of the preceding subsections supplies. Every agency at subsections 4 through 14 is an agency whose own program places an emitting product in front of people and which has told the Foundation in writing that the subject belongs to this Department. This agency has told the Foundation nothing. What it has done is relay this Department's own position to the regulated trade, in an operative instruction, in these words:

> LED products emit visible optical radiation, which qualifies them to be radiation-emitting electronic products

That is CSMS 17-000330 of June 6, 2017, a message of this agency relaying an update from this Department, and the Foundation is careful to describe it as what it is rather than as a statement of this Department. Subsection 18 sets out the whole of the arrangement: a final rule of November 29, 2016, a shared operational system, an instruction to importers and nine years of practice. Part VI.V sets out the tariff mechanism, and the two questions of fact the Foundation asks about its present condition.

The liaison of record with this agency is the most extensive this Department has with any federal agency concerning light-emitting diode products, and its subject is admissibility rather than emission. The Foundation does not criticize that. Nothing in paragraph (a)(6) required the liaison to be about anything other than what it was about, and this agency is not equipped to be asked about spectral composition or retinal exposure. The comparison the Foundation asks the Department to draw is set out at subsection 21.

16. United States International Trade Commission

An independent agency, created by the act of September 8, 1916, 39 Stat. 795, as the United States Tariff Commission, renamed by section 171 of the Trade Act of 1974, 19 U.S.C. § 2231, and organized under 19 U.S.C. § 1330. It maintains and publishes the Harmonized Tariff Schedule of the United States, is directed by 19 U.S.C. § 3005 to keep the schedule under continuous review and to recommend modifications and by § 3007 to publish it, and chairs the interagency committee that annotates the statistical digits of a tariff number under section 484(f) of the Tariff Act of 1930. Subsection 1.d; Part VI.V.

This agency regulates no product, operates no program that places a lamp in front of anyone, and holds no health responsibility of any kind. The Foundation includes it in this list for one reason and states the reason narrowly. The identifier on which this Department's only routine identification of a light-emitting diode product as a radiation-emitting electronic product depends is this agency's publication, and the question Part VI.V asks about the present state of that identifier is a question this agency and Customs and Border Protection can answer between them and nobody else can.

No consultation of record between this Department and this agency has been identified. The Foundation does not suggest that consulting it would answer any health question, because it would not. It would answer a question of fact.

17. United States Fire Administration

This subsection is longer than the two before it, because this agency has done, for one class of light-emitting diode product, a version of what paragraphs (a)(2), (a)(4) and (a)(5) direct this Department to do, and it did so without any health mandate and without any authority over electronic product radiation.

a. What it is, and the Department it was placed in

It was established by the Federal Fire Prevention and Control Act of 1974, Pub. L. 93-498, approved October 29, 1974, 88 Stat. 1535, as the National Fire Prevention and Control Administration. Section 5(a) of that Act provided that "There is hereby established in the Department of Commerce an agency which shall be known as the National Fire Prevention and Control Administration", and the Act defined the Secretary to whom the Administrator reported as the Secretary of Commerce. The codified provision, 15 U.S.C. § 2204(a), still reads that the agency is established "in the Department of Commerce"; those words were never struck. The present placement is carried by the definitions at 15 U.S.C. § 2203 and by the reorganization instruments: the functions were transferred to the Director of the Federal Emergency Management Agency by Reorganization Plan No. 3 of 1978, §§ 201 and 301, 43 F.R. 41,944, 92 Stat. 3788, effective April 1, 1979 under Executive Order 12127, and the functions of that Agency passed to the Secretary of Homeland Security under the Homeland Security Act of 2002.

b. The research function that was deliberately left behind in the Department of Commerce

Section 201 of the Reorganization Plan did not transfer everything, and what it kept back belongs in this Part. It transferred the functions under the 1974 Act "exclusive of the functions set forth at Sections 18 and 23 of the Federal Fire Prevention and Control Act (15 U.S.C. 278(f) and 1511)." Section 18 of that Act is codified at 15 U.S.C. § 278f, and it provides:

> There is hereby established within the Department of Commerce a Fire Research Center

So when the fire administration function went to the Federal Emergency Management Agency, the fire research function was expressly withheld and left with the Secretary of Commerce, and it remains in the chapter of title 15 that governs the National Institute of Standards and Technology, because section 18 was enacted as an amendment to that bureau's own organic act. Subsection 1.b. The content and priorities of the program are to be determined in consultation with the Administrator, and one of the three subjects the section specifies is this:

> research into the biological, physiological, and psychological factors affecting human victims of fire

The Foundation records that for a single and limited purpose. It is not an argument about fire. It is an instance, in the Department this paragraph names first, of a statutory research program directed at the physiological effects of a physical hazard on human beings, with a duty of dissemination running to the Secretary, administered in the same bureau that maintains the national measurement scales for visible light. The bureau presently conducts that work through a Fire Research Division within its Engineering Laboratory. The objection that research of this kind lies outside the competence of the Department of Commerce is answered by a statute of 1974 that put it there and a reorganization of 1978 that declined to move it.

c. What the Administrator is directed to do about warning devices

Title 15 U.S.C. § 2207(a) directs the Administrator to:

> conduct a continuing program of development, testing, and evaluation of equipment for use by the Nation's fire, rescue, and civil defense services, with the aim of making available improved suppression, protective, auxiliary, and warning devices incorporating the latest technology

The Foundation draws attention to the words warning devices, and to the verbs. Development, testing and evaluation of a warning device, with the latest technology in view, is the same activity paragraph 360ii(a)(5) directs this Department to perform with respect to procedures and techniques for minimizing exposure, and Part II.G sets out that it has not been performed. One agency has that duty as to the equipment and has acted on it. The other has it as to the radiation and has not.

d. What it has actually done about emergency vehicle warning lights

Three things, of which the first is relied on throughout this comment. This agency contracted for the controlled experiment described at Appendix D.4.5, which measured the effect of the intensity, color, modulation and flash rate of emergency vehicle warning lamps on drivers at night. That study found that higher intensity lamps were judged consistently more glaring while being only marginally more visible, that discomfort glare is related to short-wavelength content, that blue lamps at high intensity elicit high levels of discomfort glare, and that using lower intensities at night would reduce discomfort glare without reducing visibility. It is relied on at Part II.H.6, Part VI.C.1, Part VI.I and Part V.L, and it is the only federally funded assessment of discomfort glare from flashing lamps the Foundation has found. The Foundation records, because it matters to how the report should be cited, that the study was produced under contract to this agency but is published by the Emergency Responder Safety Institute and not by this agency, and that the Foundation has found no copy of it on any federal site.

Second, this agency has published the conclusions in its own voice. Its report FA-336 of February 2014 describes the research program as concerning "the disorientation of motorists caused by the daytime and nighttime use of emergency warning lights" and as having "documented the resulting desirable (conspicuity) and undesirable (glare) effects", and states, in discussing the minimization of emergency vehicle lighting, that "excessive lighting has been proven to increase the risk of secondary crashes". And a notice published by this agency on March 7, 2024 states two findings in a single line each:

> Blue and red lights are rated most visible; blue and white lights are most glaring.
>
> Reducing light intensity at night will maintain alerting but allow responders to be seen more accurately.

Third, and this is the comparison the Foundation asks the Department to hold onto. A federal agency with no health mandate, no authority over electronic product radiation and no power to prescribe a performance standard for a lamp has paid for research into the discomfort glare and the spectral content of a class of light-emitting diode product, has published the findings, and has told its own constituency to use less light at night. It did so because the product was impairing the vision of the people it is responsible for. Parts II.D through II.G set out that this Department, which holds the duty to study emissions and conditions of exposure and to develop and evaluate techniques for minimizing them, has done none of it for this radiation.

e. The incident reporting comparison, and the limit the Foundation places on it

Section 9 of the 1974 Act, 15 U.S.C. § 2208(a), directs the Administrator to operate "an integrated, comprehensive National Fire Data Center for the selection, analysis, publication, and dissemination of information related to the prevention, occurrence, control, and results of fires of all types", and specifies among the subjects "information on the number of injuries and deaths resulting from fires". The Administrator implemented that direction as the National Fire Incident Reporting System, which this agency describes as a voluntary reporting standard and as the world's largest national annual database of fire incident information. For 2024 this agency reports

that 22,582 fire departments submitted data, and it states that the system captures about seventy percent of fire incidents annually and is not a complete census. The system was retired on January 31, 2026 and is being replaced by the National Emergency Response Information System.

The Foundation states exactly what that comparison establishes, because the loose version of it would be wrong in three ways. It does not suggest that fires and optical radiation are alike as hazards. It does not suggest that § 2208 is a model for a provision this Department lacks, because the statute neither names the reporting system nor obliges any state or locality to report; its lever is to encourage and assist. And it does not treat a system that captures about seventy percent of incidents on a voluntary basis as complete. What the comparison establishes is that a national voluntary incident reporting system for a category of injury is an ordinary thing for the federal government to operate, that Congress directed one in another domain in 1974 and an agency built it and ran it for decades at the scale just described, and that the objection that such a system would be impracticable for optical radiation is answered by the existence of one for fire. Part VII.J sets out that for optical radiation there is no such system at all, and Part IX.D asks for one.

f. What the Foundation does not claim about this agency

No consultation of record between this Department and this agency has been identified, in either direction. This agency has not written to the Foundation and is not among the agencies collected at subsection 21. It maintains three published position statements, on home smoke alarms, on residential fire sprinklers and on fire service ethics, and none of them concerns lighting. The Foundation has not established that it holds any view about light-emitting diode products in general, as distinct from emergency vehicle warning lamps, and does not attribute one to it. And the Foundation does not suggest that this agency should regulate anything; it could not, and has not asked to.

18. Department of Justice

This Department's own rules are not the only federal rules that determine whether an emission denies a person access to a public service. The Department of Justice issues the regulations under Title II and Title III of the Americans with Disabilities Act and adopts the standards made under them, and Part VIII sets out the framework in full. If a criterion is ever written stating when an optical emission denies access, it is written under that authority or the Access Board's.

The Foundation addresses the question of fit before the record, because paragraph (a)(6) is confined to two subjects and this agency does not test electronic products. The Foundation's position is that the Department of Justice falls within the residual category as to the second subject the paragraph names, the development of performance standards under § 360kk, because a criterion stating when an emission denies access would have to be expressed in the quantities such a standard bounds, and because the Access Board at subsection 11 is in this Part on the same footing and its own denial quoted the paragraph at length in explaining why. Where the connection is to information rather than to standards, paragraph (a)(3) is the broader provision and Part II.E treats it.

What the record shows is set out at subsection 6 and the Foundation restates the sequence here because the agency is the subject of this subsection rather than a step in another's story. A complaint under section 504 of the Rehabilitation Act, concerning rectangular rapid-flashing beacons installed by three municipalities, was submitted to the Department of Justice. That Department transferred it to the Department of Transportation. That Department referred it to the Office of Civil Rights of the Federal Highway Administration. That office declined to investigate, and the ground it gave was the Department of Justice's own statement in the 2010 Title II final rule that there is no statutory requirement that every Title II complaint receive investigation, together with the provision at 28 C.F.R. § 35.172(d).

Two observations follow and the Foundation separates them, because only the first is about this Department. The first is that this Department's name appears nowhere in that sequence. A complaint about the optical characteristics of a federally approved device travelled through three

federal bodies, and the agency holding the radiation-health authority over the emission was not one of them and so far as the Foundation can establish was never notified. The second is that the Foundation does not contend that any of the three acted improperly. The transfer and the referral were each within the receiving body's ordinary practice, and the declination rested on a published regulation rather than on an ad hoc view.

The Foundation has identified no communication between this Department and the Department of Justice concerning the visible light emitted by light-emitting diode products, and asks the Department to state whether any has occurred. It asks that this agency be among those to which the written invitation at Part IX.E.5 is sent, and it notes the particular reason for doing so here: of all the agencies in this Part, this is the one whose rules would have to carry any accessibility criterion that a performance standard made it possible to write.

19. Equal Employment Opportunity Commission

The Commission administers Title I of the Americans with Disabilities Act, which reaches employment. The workplace is the one place of exposure a person cannot leave for the duration of a shift, which Part VIII.B.6 develops and which Part VI.E treats as a setting in its own right.

The Foundation explains why this is a separate agency from the one at subsection 10 rather than a duplication of it. Subsection 10 concerns the Department of Labor, whose occupational safety provisions operate through standards of general application, and records that agency's position that the liaison provision of this subchapter imposes nothing on it, which the Foundation accepts as correct. Title I operates differently. It proceeds through individual charges of discrimination and through the duty to provide reasonable accommodation, so an employee affected by the lighting of their workplace has a route that does not depend on any occupational safety standard existing. That route runs through this Commission, and it is open now.

What the record shows is slight and the Foundation states it as such. On February 26, 2023 the Foundation wrote to the Chair of the Commission; the letter is at Appendix E.20 and Part VIII.B.6 sets it out. That subsection also records the feature of the letter that limits what can be drawn from the silence that followed: the Foundation's own letter stated no request for action. The Foundation treats that as a limitation of its own document rather than of the Commission's conduct, and no reply is recorded.

The Foundation states what it does not claim, which is most of what might be claimed. It has not established that the Commission has received any charge concerning lighting. It has not surveyed the Commission's determinations, its guidance or its litigation releases. It does not assert that the Commission has failed in any duty, and it repeats the point made at subsection 10 about the direction in which these duties run: this subchapter imposes obligations on the Secretary of Health and Human Services, and the Commission bears none under it.

What the Foundation asks is accordingly narrow. That this agency be among those to which the written invitation at Part IX.E.5 is sent, and that the Department state whether any communication with it has occurred. And that the consultation, if it occurs, seek the one thing the Commission holds and this Department does not: whatever charges, determinations or guidance it has concerning lighting as a subject of reasonable accommodation. That is precisely the kind of information paragraph (a)(3) contemplates passing between agencies, and this Department can ask for it.

20. The documented instances of consultation and liaison with another federal agency

The one consultation of record, and what a court made of it

The Foundation sets this out as body text rather than leaving it to a note, because it is the whole of the program's documented practice on this subject and because what happened to it afterward is a matter of published judicial record.

On April 24, 2019 Jeffrey Shuren, then Director of the Center for Devices and Radiological Health, wrote to Julius Knapp, then Chief of the Office of Engineering and Technology of the Federal Communications Commission. The Foundation has obtained the letter and describes it from the document.

It is a reply, and it is a reply to two requests rather than one. The Commission had written on March 22, 2019 requesting the Center's guidance on standards as new technologies such as 5G were introduced. It had written earlier, on February 4, 2014, requesting guidance on the exposure principles under which the Commission should consider wireless power transfer devices operating at frequencies for which its rules specified no exposure limits, and asking the Center to identify any risk of interference with medical devices. The April 2019 letter answers both. Whether the Center replied to the 2014 request when it was made is not shown by the document, which refers to it only as a request previously made.

The Foundation therefore states its position more precisely than it was able to before. This is the only letter from this Department to another federal agency about the health effects of an electronic product radiation that the Foundation has been able to identify. It is not a single event. It is one side of a correspondence in which the other agency asked twice, five years apart, and it establishes that the channel for consultation existed, was known to both agencies, and was used.

The Commission relied on it. In its 2019 order declining to revise its radiofrequency exposure limits, the Commission cited this Department's assessment as support for its conclusion.

That order was reviewed. In Environmental Health Trust v. Federal Communications Commission, 9 F.4th 893 (D.C. Cir. Aug. 13, 2021), the Court of Appeals for the District of Columbia Circuit granted the petitions in part and remanded. It held the order arbitrary and capricious in its failure to respond to record evidence, and in its complete failure to respond to comments, as to effects other than cancer. It observed that the Commission said nothing at all in its order about any specific health effects unrelated to cancer. And as to the material the Commission had relied on, including this Department's statements, the court held that conclusory assertions cannot substitute for a reasoned explanation. It upheld the Commission's reasoning on cancer, and it took no position in the scientific debate.

What the Foundation takes from that, and what it does not

It does not say that the 2019 letter was wrong, and it takes no position on the radiofrequency science or on the merits of that litigation. The holding was about the Commission's obligation to explain its own decision, not about this Department's conduct, and the Foundation does not characterize this Department's conduct here or anywhere in this comment in the vocabulary of judicial review. Part I.C.10 explains why.

Two narrower propositions survive those limits, and the Foundation relies only on them.

The first is about the program. The single documented instance of this Department consulting another federal agency about the health effects of an electronic product radiation produced an assurance which the agency that received it relied on, and which a court of appeals then held could not carry the decision that rested on it. The Foundation offers that without comment on who was at fault. It offers it because the instance is the program's only one, and because a program whose sole consultation of record ended that way is a program whose consultation practice has not been tested and found adequate. It has been tested once, in the only forum that tests such things, and the result is reported above.

The second is about what an agency owes a record, and it is the proposition this comment is ultimately addressed to. A federal court of appeals has held that an agency administering an exposure framework for one form of non-ionizing radiation, presented with a record of evidence on health effects, must respond to that evidence and must give a reasoned explanation for the conclusion it reaches, and that saying nothing at all about a category of effect will not do. The court required no particular outcome. It required that the agency explain.

That is what this comment asks for, and the Foundation states the request in those terms because it is the request the Department can grant without conceding anything. Parts V and VII place a record before the Department: the peer-reviewed literature appraised at Appendix C, and 593 reports of harm at Appendix A, every one of which was transmitted to the Food and Drug Administration before this Request for Information issued. Part IV.B. The Foundation does not ask the Department to agree with any conclusion it draws from that record. It asks the Department to respond to it, and to say why it reaches whatever conclusion it reaches, including as to the consultation this subsection describes and the nine federal bodies whose answers are collected at subsection 22.

What the Center recommended in that letter, which is the most important thing in it for this comment

The passage above concerns the part of the letter about cell phones, because that is the part the Commission relied on and the part the litigation concerned. Most of the letter is about something else, and the Foundation sets that part out at length, because it is the closest thing in the record to this Center doing what this comment asks of it.

The Commission had asked about wireless power transfer devices operating at frequencies for which its rules set no human exposure limit. On that subject the Center did not confine itself to assessing whether harm had been established. It recommended that limits be set:

> "We agree that with the increase in technology that uses frequencies below 300 kHz and even below 100 kHz, setting human exposure limits below 300 kHz and 100 kHz would better ensure the protection of the general public."

It then explained the physical basis for the recommendation, that at the lower end of that range nerve stimulation and induced currents predominate while at the upper end heating does, and drew the regulatory consequence that the long averaging times associated with thermal limits are not appropriate to a rapid biological response. It named two existing consensus standards as adequate models for the Commission to adopt.

On interference with implanted and body-worn medical devices, it recommended reduction of the emission itself as the remedy:

> "Therefore, the most effective mitigation against EMI to active medical devices from the emissions of WPT devices is to reduce the WPT emissions and thus medical device exposure."

And it specified four means:

> "The methods to reduce exposure should include limits on the WPT output power, designing the WPT with safety interlocks (i.e., designing the WPT source so that it can detect the presence of humans or animals and shut off or greatly reduce power output), creating exclusion zones, and recommending separation distances between the WPT emitter and any active medical devices."

The two halves of the letter are not alike, and the difference can be tabulated

The Foundation asks the Department to read the halves of this document against each other. The Center answered two inquiries in one letter. In the half where it recommended action it was specific, and in the half where it declined to recommend action it was not. The difference is visible on the face of the document and does not depend on any characterization by the Foundation.

As to cell phones, the Center reviewed the then recently published rodent study of the National Toxicology Program in the context of all available scientific information, including epidemiological studies, and concluded that no changes to the current standards were warranted at that time, that the experimental findings should not be applied to human cell phone usage, and that the available scientific evidence to date did not support adverse health effects in humans at or

under the current limits. It described this as part of its ongoing monitoring activities and stated that it continues its review of the many sources of scientific literature on the topic.

	Wireless power transfer: no limit existed	Cell phones: limits already existed
What the Center did	Recommended that human exposure limits be set below 300 kHz and 100 kHz	Concluded that no changes to the current standards were warranted at this time
Operative verbs	Reduce emissions; limits on output power; shut off or greatly reduce power output	Collect and analyze; review; monitor
Existing standards named	Two, each identified by designation and year, either adequate as a model	None
Mitigation methods specified	Four: a cap on output power, a sensing interlock, exclusion zones, separation distances	None
Where the letter's footnotes go	All three, at footnotes 1 to 3	None
Forward commitment	A recommendation the receiving agency could act on	Continued review, of unstated scope and on no stated schedule

Every source the letter cites supports the half in which the Center recommended action. The half in which it declined to recommend anything refers to the rodent study and to epidemiological studies in its text and cites none of them. The Foundation draws attention to that distribution because the letter demonstrates, within its own four corners, that this Center knows how to support a conclusion about an electronic product radiation with named standards, specified methods and cited literature. Where it did not do so, the omission cannot be attributed to the state of the art or to the conventions of the genre.

The Foundation also observes what the word monitoring does not disclose. It does not name a study, a program, a measurement, a criterion, a trigger, or a date. The Department is the body charged with the program, and a reader cannot tell from the letter what the program did. Part II.D and Part VI.M.3 return to this, because the Final Response of May 24, 2024 answered the Foundation's petition in the same register, and because a statement that an agency continues to review a subject is a statement about posture rather than about anything the agency has done or will do. Environmental Health Trust holds that conclusory assertions of that kind cannot substitute for a reasoned explanation. Part II.H.20.

The letter recites this Department's function without its purpose

One sentence of the letter requires separate attention, because it states the Department's own responsibility and states it incompletely:

> "As you are aware, FDA is responsible for the collection and analysis of scientific information that may relate to the safety of cellphones and other electronic products."

Section 360ii(a)(1) does direct the Secretary to collect and analyze data. But the collection and the analysis are instrumental, and the provision that states what they are for is paragraph (a)(2), which directs the development of criteria to minimize exposures to and emissions of unnecessary electronic product radiation. The letter recites the instrument and omits the purpose, and in place of the purpose it supplies the word safety. The word minimize does not appear anywhere in the letter. Part I.B.3 and Part II.B set out the difference between the two frames and why it decides this proceeding.

The Foundation does not suggest that the omission was deliberate, and nothing in its argument turns on whether it was. What matters is that the same letter which left the minimizing purpose out of its account of the Department's function then applied that purpose, in substance and

without naming it, to the other radiation it was asked about. The letter recommended reducing an emission in order to reduce exposure. That is paragraph (a)(2) being performed, in the half of the letter where no limit existed, by an author who had just described this Department's responsibility as one of collection, analysis and safety.

The word unnecessary appears in the letter once, and in the same half:

> "Adoption of higher emissions levels may expose patients to unnecessary risk."

The Foundation states precisely what that sentence does and does not supply. It is unnecessary risk and not unnecessary radiation, so it is not a construction of the statutory term and the Foundation does not offer it as one. What it shows is narrower and still useful. The Center was willing to identify an exposure as unnecessary, and to recommend limits on that footing, without a quantified reference for necessity, without a dose-response relationship for the harm it was concerned about, and on a record of potential rather than demonstrated injury. The concern the letter describes is a potential for interference inferred from the known susceptibility of implanted devices and from the absence of immunity testing below 150 kHz. It recommended limits anyway.

That matters here because the absence of a settled criterion of necessity is advanced as a reason that no optical standard can be developed. Part VI.M. This letter shows the Center proceeding without one.

What follows for this proceeding, and what does not

Visible light emitted by light-emitting diode products is, on the single question of whether a limit already exists, in the position of wireless power transfer and not in the position of cell phones. No federal limit exists on the radiance, the irradiance, the luminance or the spectral distribution of a visible-light emitter in the general environment. Part I.C.7. The Final Response of May 24, 2024 answered that absence in the safety frame, concluding that a standard was not necessary given a long history of safety with respect to the visible wavelengths emitted. The April 2019 letter shows that this Center has, for another radiation, answered the absence of a limit in the other frame, and did so on a thinner record of harm than the one Parts V and VII place before the Department now.

Three of the four methods the letter recommends are methods this comment asks for, and the Foundation had reached them before obtaining the letter. A cap on output is the performance standard at Part IX.I. A source that detects a person and shuts off or greatly reduces its output is, in the optical case, the ambient-sensing and default-low capability at Part IX.J. Exclusion zones and separation distances are statements about geometry, which is the subject of the fifth matter at Part IX.I concerning the number of emitters a person meets at once, and the Foundation notes that the Center reached for geometry as a remedy in a case where a single emitter was at issue.

The Foundation confines the argument to this. It does not contend that recommendations made for a radiofrequency emission translate to an optical one without work, and the mechanisms, the exposed population and the cost of the remedies all differ. It does not contend that the Center was wrong about cell phones. It contends that the choice between the minimizing frame and the safety frame is a choice this Center has made both ways within one document, that the variable which separated them was the presence or absence of an existing limit rather than the strength of the evidence of harm, and that optical radiation sits on the side of that line where the Center recommended action.

A second instance, of an entirely different character, and the Foundation is careful about what it shows

The correspondence described above is the only exchange between this Department and another federal agency about the health effects of an electronic product radiation that the Foundation has been able to identify. It is not, however, the only liaison of record between this Department and another federal agency about light-emitting diode products. There is a second, and it is sustained, codified and operational.

On November 29, 2016 the Department published a final rule, Submission of Food and Drug Administration Import Data in the Automated Commercial Environment, 81 Fed. Reg. 85,854, effective December 29, 2016, Docket FDA-2016-N-1487, RIN 0910-AH41. The rule added subpart D to 21 C.F.R. part 1 and requires that certain data elements, among them the complete FDA Product Code, be transmitted at the time of entry in the Automated Commercial Environment, which is the system operated by United States Customs and Border Protection. The rule identifies section 536 of the Federal Food, Drug, and Cosmetic Act, 21 U.S.C. § 360mm, as its authority in respect of radiation-emitting electronic products. In the rulemaking the Department described the relationship in its own words: "The discharge of this joint responsibility has involved close coordination and cooperation."

Five months after that rule took effect, on June 6, 2017, Customs and Border Protection published a message to the trade, numbered CSMS 17-000330 and headed Light-Emitting Diode (LED) Reporting to FDA, relaying an update from this Department. It stated that "LED products emit visible optical radiation, which qualifies them to be radiation-emitting electronic products" and instructed that entry data was expected for light-emitting diodes used for general or local area illumination, such as lamps and lightbulbs, under a stated tariff heading. Part VI.V sets out the tariff mechanism and Part II.B.6 the classification that sits behind it.

A third federal body is engaged in the same arrangement without being a party to it. The tariff headings to which this Department attaches its import flags are not written by this Department or by Customs and Border Protection. They are the Harmonized Tariff Schedule of the United States, which is the tariff law of the United States at 19 U.S.C. § 1202 and is maintained and published by the United States International Trade Commission, an independent agency, under 19 U.S.C. § 3005. The classification of these products at the border therefore runs through three federal bodies, of which this Department is one.

One of those three reaches a named officer, and the Foundation records it here because the consequence belongs to this subsection rather than to Part VI.V. The tariff number in the instruction of June 6, 2017 was a ten-digit number, and the ninth and tenth digits of such a number are set by the Committee for Statistical Annotation of Tariff Schedules under section 484(f) of the Tariff Act of 1930, 19 U.S.C. § 1484(f). That subsection directs the Secretary of the Treasury, the Secretary of Commerce and the United States International Trade Commission to establish the statistical enumeration, naming the Secretary of Commerce expressly, and the committee through which they do it comprises the Commission, Customs and Border Protection and the Bureau of the Census. The Secretary of Commerce is one of the four officers paragraph (a)(6) names without the qualifier appropriate. Subsection 1.d. So the arrangement this subsection describes as the program's one sustained liaison already touches, at its mechanical core, an officer the statute directs this Department to consult unconditionally — on a matter of admissibility, and on nothing else.

The Foundation is careful about what that establishes and what it does not, because the distinction is the whole of its value. It establishes that this Department is capable of sustained liaison with another federal agency about light-emitting diode products, that it has conducted such liaison through notice-and-comment rulemaking, that it maintains a shared operational system with that agency, that it has issued instructions to the regulated trade through it, and that it characterized the relationship as a joint responsibility discharged by close coordination and cooperation. Paragraph 360ii(a)(6) directs the Secretary to consult and maintain liaison with other federal departments and agencies, and this is what the Department does when it decides to.

What it does not establish is any consultation about what these products emit or what exposure they produce. The subject of that liaison is admissibility: whether an article may lawfully enter the United States, and what data must accompany it. Nothing in the rule, in the system or in the instruction to the trade concerns the spectral composition of the emission, its luminance, its temporal modulation, or any effect on any person. The Foundation does not criticize that.

Customs and Border Protection is not a health agency, and nothing in paragraph 360ii(a)(6) required the liaison to be about anything other than what it was about.

The comparison the Foundation asks the Department to draw is therefore not between a good instance and a bad one. It is between two kinds of silence. With the agency that inspects these products at the border, this Department has a rule, a shared system, an operative instruction and nine years of practice. With the agencies that put these products on the roadway, in the police vehicle, at the pedestrian crossing, in the classroom and on the appliance — the agencies set out at subsections 4 through 14, each of which has told the Foundation in writing that the subject belongs to this Department — there is one letter, on radiofrequency energy, to one of them, in 2019. The capacity is demonstrated. It has not been directed at the question this comment is about.

21. What those instances show about the program as a whole

There is a second pattern in the record, and the Foundation regards it as the most significant single finding in this Part. It is not that the other agencies have ignored the subject. Several of them have addressed it directly, and have said that it belongs to the Food and Drug Administration.

The clearest instance is in writing. On November 9, 2022 the Manager of the Airport Engineering Division in the Office of Airport Safety and Standards of the Federal Aviation Administration wrote to the Foundation:

> To be more clear, the FAA provides standards and guidance for certain types of airport and obstruction lighting and is not a regulatory agency on LED requirements. The agency defers to other agencies, depending on the issue at hand. We would defer to the FDA for comfort, health, and safety regulations and to OSHA for specific topics like cockpit lighting, in regard to LED products.

It is not an isolated answer. Between March 2022 and August 2023 nine federal bodies told the Foundation, in writing, that this subject was not theirs, and the first of them did so before any of the Foundation's petitions to this Department had been decided. The complaint in the action described at Part IV.D.1 collects eight of them, and the Foundation has read the underlying letters for five.

The Federal Highway Administration, through the ADA Team Leader of its Office of Civil Rights, on October 19, 2022, that allegations about the health impacts of rectangular rapid-flashing beacons raise complex issues related to the regulation of "all Light Emitting Diode (LED) lights, not just those used in RRFBs," that extend beyond that agency's authority. Alone among the responses in this list, it names no agency that does hold the authority. Subsection 6.

The National Highway Traffic Safety Administration, twice: in the published denial of three petitions for non-compliance orders, 87 Fed. Reg. 75,327 (Dec. 8, 2022), that it recognizes the expertise of its sister agencies that are health-focused, such as the Food and Drug Administration; and again by letter of February 13, 2024 from its Office of the Chief Counsel, that separate expertise resides in sister agencies that are health-focused, such as the Food and Drug Administration. Subsection 5; Part IV.C.3; Part IV.C.9.

The Department of Energy, in its published denial of the Foundation's petition for repeal at 88 Fed. Reg. 16,869 (Mar. 21, 2023), that the Food and Drug Administration has authority to regulate certain aspects of LED products. Subsection 4 and Part IV.G.

And the Occupational Safety and Health Administration, through staff of its Directorate of Standards and Guidance, that it awaited notification from the Food and Drug Administration concerning LED hazards in the workplace. Subsection 10.

The National Transportation Safety Board, on March 23, 2022, through the Chief of its Executive Secretariat, who wrote: "We encourage you to pursue your concerns with the

National Highway Traffic Safety Administration or with one of the non-government safety organizations, such as the Insurance Institute for Highway Safety, which may be able to conduct the study you desire. This will be our final reply to you on this issue." That Board investigates and recommends; it does not regulate, and the Foundation does not suggest that it should have acted. The Foundation records the reply because of what it proposes. The study it suggested might be conducted by a private organization is the study that 21 U.S.C. § 360ii(a)(4) directs the Secretary of Health and Human Services to conduct.

The Environmental Protection Agency, on October 7, 2022, that Congress has granted it no statutory authority to regulate visible light or non-ionizing radiation emitted from electrical devices including LEDs, and that it maintains no experts in the field. Subsection 3.

The Consumer Product Safety Commission, on November 7, 2022, that it is barred by 15 U.S.C. § 2080 from regulating a risk of injury from electronic product radiation where that risk may be subjected to regulation under this chapter. Subsection 9.

The Federal Aviation Administration, on November 9, 2022, in the terms quoted above.

The United States Access Board, on August 21, 2023, that it has no authority under 21 U.S.C. § 360ii either to initiate rulemaking or to require this Department to coordinate with it, and that the statute directs the Food and Drug Administration to establish and carry out the program. Subsection 11.

The Access Board answer differs from the rest in a way that matters. The other agencies said the subject was not theirs. The Board said the subject was not within its authority and added that it would provide technical assistance to the Food and Drug Administration on request. It is the only one of the nine that offered to be consulted.

The Foundation sets out the whole of that record for a reason that goes beyond its volume, and states the accounting exactly, because a count of this kind is the first thing a skeptical reader will test. Nine federal bodies, over seventeen months, addressed the question of who is responsible for the health effects of visible light emitted by light-emitting diode products. Not one of them claimed the subject. Six of the nine identified this Department: five named the agency, and the sixth named the chapter of the United States Code this comment concerns and said it was barred from acting where that chapter may reach. Two disclaimed their own authority without identifying any other agency. The ninth pointed to the National Highway Traffic Safety Administration, which has itself twice pointed here. Of the six that identified this Department, one said it was awaiting notification from it and one offered it technical assistance on request.

The Foundation does not say that any of those agencies was wrong. It has examined each of their positions in the subsections above and finds them, so far as it can tell, correct. That is what makes the record worth the Department's attention. This is not a case of a subject falling between agencies because each supposed another was handling it. It is a case of a subject that Congress assigned to one agency, that every other agency asked about has correctly said belongs to that agency, and that the agency has answered by stating that a performance standard is not necessary.

The significance is not that any of those agencies was wrong. On the contrary, the Federal Aviation Administration's answer appears to the Foundation to be correct. That agency sets standards for obstruction and airfield lighting for aviation purposes. It holds no authority to evaluate the health effects of optical radiation, and it said so. Each of the other agencies is in a similar position, for the reasons given in the subsections above.

The significance is where the deferral points. Each agency that has addressed the question has identified the same destination. The destination is this Department, and this Department has answered that a performance standard is not necessary. The result is that a subject several federal agencies have expressly assigned to one agency has not been taken up by that agency, and the agencies that pointed to it have no occasion to revisit the matter, because they were right to point.

The Foundation asks the Department to weigh that pattern when it considers the breadth objection discussed at subsection 2. The objection is that the category of appropriate agencies is unmanageably large. The record suggests a different difficulty. The other agencies have not been reluctant to engage; several have engaged and have identified the agency with the authority. What is missing is the response from the agency they identified.

What the record does to the judgment the statute confers

The Foundation returns to the one textual point the government has pressed, because the record in this subsection bears on it directly and the Foundation does not think the point survives contact with that record in the form the government gives it.

Paragraph (a)(6) directs consultation and liaison with four named officers and with other appropriate Federal departments and agencies. Part I.C.5 concedes, and the Foundation concedes again here, that the word appropriate confers judgment over which additional agencies are consulted. The concession is real and the Foundation does not withdraw it.

But judgment over which agencies are appropriate is not judgment over whether any are. And the nine answers set out above bear on the first question in a particular way, because appropriateness is not a quality this Department assesses in the abstract. It is a relation between two agencies. Each of the nine was asked whether this subject was within its authority, and each answered in writing. Six of them identified this Department. One of those six said it was awaiting notification from this Department. Another offered this Department technical assistance on request. Not one said that consultation with it would be unwelcome, unnecessary, or outside its competence to receive.

The Foundation puts the consequence narrowly. An agency that has told the Foundation in writing that this subject belongs to this Department, and in one case that it is waiting to hear from this Department, has answered the appropriateness question as to itself. Whatever judgment paragraph (a)(6) commits to the Secretary about which additional agencies are appropriate, it is difficult to see how that judgment could be exercised against an agency in that position, and the Foundation is aware of no reason it has been.

That last clause is the point of this movement, and the Foundation states it as an absence rather than as a characterization. The Foundation has not found, in the Final Response of May 24, 2024, in any other agency document it has obtained, or in the litigation record, any statement of the Department's reasons for not consulting these agencies. The Final Response addressed the request for a performance standard under § 360kk. Part II.M.3 sets out that it is the only one of the six duties in § 360ii(a) whose mechanism carries a condition of necessity, and the only one that letter addressed; the letter does not discuss paragraphs (a)(2) through (a)(6).

The government's own position in the pending litigation is to the same effect, and the Foundation relies on it rather than on any inference of its own. Opposing an arbitrary-and-capricious claim for want of final agency action, the United States stated that there has been no decisionmaking process, much less a consummation of the agency's decisionmaking process, as to consultation with the National Highway Traffic Safety Administration on testing and evaluating visible light from light-emitting diode vehicle headlamps. Part I.C.4 quotes it.

The Foundation takes that representation at face value and draws the consequence that follows for this proceeding rather than for the case. If no decisionmaking process has occurred, then there is no exercise of the judgment paragraph (a)(6) confers. A discretion that has not been exercised has not been exercised wrongly, and the Foundation makes no such claim; Part I.C.10 sets out why it declines to characterize the Department's position in the vocabulary of judicial review, and that reasoning holds here. What it asks for is the thing an unexercised discretion lacks and a court could not supply. It asks the Department to exercise it, and to say what it decides and why.

That request costs the Department nothing it is defending. A statement of reasons for consulting these agencies, or for not consulting them, takes no position in the pending case, reopens no

determination, and concedes no proposition in this Part. It is also, so far as the Foundation can tell, the only thing that would allow anyone outside the Department to understand why a subject that nine federal bodies have placed here has not moved. Part IX.E.4 states the request.

22. Summary table: agency, emitting products regulated, FDA consultation of record

The subsections above set out each agency in turn. The table collects them, so that the pattern can be seen rather than followed. The last column is the one the Foundation asks the Department to read first.

Agency	Emitting products or activities it regulates	What it said about this subject, and when	Consultation of record
United States Customs and Border Protection	Admissibility of imported articles; operates the entry system through which this Department's product codes are filed. Regulates no emission.	June 6, 2017: relayed this Department's position to the regulated trade, that "LED products emit visible optical radiation, which qualifies them to be radiation-emitting electronic products".	Yes, and sustained. Final rule of November 29, 2016, a shared entry system, an operative instruction to importers, and nine years of practice — on admissibility, not on emissions or exposure. Subsections 15 and 18.
Federal Communications Commission	Radiofrequency emissions of devices under 47 C.F.R. parts 15 and 18, and human exposure to radiofrequency fields. No authority over visible light.	Undated page: where it does not regulate exposure to emissions from a consumer product, protecting the public from them is the responsibility of the FDA, and inquiries are directed to CDRH; the class of products meant is not established. September 17, 2026: reopened ET Docket No. 13-84 on the Environmental Health Trust remand, inviting federal health and safety agencies to comment by October 22, 2026.	Yes. The letter of April 24, 2019 from the Director of CDRH, on radiofrequency energy. The only consultation of record on the health effects of any electronic product radiation. Subsection 18. None identified as to optical radiation.
National Transportation Safety Board	Investigates and recommends; does not regulate	March 23, 2022: encouraged the Foundation to pursue the matter with NHTSA or a non-government safety organization; final reply.	None identified
Environmental Protection Agency	Ionizing radiation; no authority over visible light	October 7, 2022: Congress has granted it no statutory authority to regulate visible light or non-ionizing radiation from electrical devices; maintains no experts in the field.	None identified
Federal Highway Administration	Manual on Uniform Traffic Control Devices; interim approvals for roadway devices	October 19, 2022: the health impacts of these beacons raise complex issues related to the regulation of all LED lights, not just those used in beacons, extending beyond its authority. Names no agency that holds it.	None identified
Consumer Product Safety Commission	Consumer products, including lamps, flashlights, toys, tools and appliances	November 7, 2022: barred by 15 U.S.C. § 2080(a) from regulating a risk of injury from electronic product radiation where that risk may be subjected to regulation under this chapter.	Referral of electronic product radiation complaints from that Commission to this Department, described by the Center in 2019 as routine. Not consultation about emissions or exposure. Subsection 9.

Agency	Emitting products or activities it regulates	What it said about this subject, and when	Consultation of record
Federal Aviation Administration	Airport and obstruction lighting for aviation purposes	November 9, 2022: not a regulatory agency on LED requirements; would defer to the FDA for comfort, health, and safety regulations.	None identified
National Highway Traffic Safety Administration	Motor vehicle lighting under FMVSS No. 108	December 8, 2022 and February 13, 2024: recognizes that separate expertise resides in sister agencies that are health-focused, such as the FDA.	None identified
Department of Energy	Lamp efficiency standards for general service lamps	March 21, 2023: the FDA has authority to regulate certain aspects of LED products.	None identified
Occupational Safety and Health Administration	Workplace health and safety; named in § 360ii(a)(6)(A)	September 7, 2022 and subsequently: the topic is not on its regulatory agenda; staff awaited notification from the FDA concerning LED hazards in the workplace.	None identified
United States Access Board	Accessibility guidelines for the built environment and public rights-of-way	August 21, 2023: no authority under 21 U.S.C. § 360ii to initiate rulemaking or to require this Department to coordinate; the statute directs the FDA to establish and carry out the program; would provide technical assistance to the FDA on request.	None identified

The last column does not read the same way in every row, and the Foundation asks the Department to read the three exceptions before the eight. Each of the three is a real instance of liaison. None of the three is about what these products emit.

With the agency that inspects these products at the border the liaison is sustained, codified and operational, and its subject is whether an article may lawfully enter. With the Commission there is one letter, written in 2019, about a different radiation; the agency that received it has since reopened the record on the order that relied on it, and has invited federal health agencies to take part. With the Consumer Product Safety Commission there is a standing arrangement for routing complaints, which the Center described in 2019 as routine. Subsections 9, 15 and 18 set out each one.

So the table shows two kinds of silence rather than one, and subsection 21 develops the distinction. Where liaison exists, its subject is admissibility, or another radiation, or the routing of complaints. As to what light-emitting diode products emit and what exposure they produce, the Foundation has identified no record of consultation between this Department and any agency in this table.

That is a statement about what the Foundation has found and not about what exists. It does not mean that no such consultation occurred. The Foundation cannot prove a negative of that kind, and states every assertion of absence in this comment as a statement of what it has found rather than of what exists. What it can say is that it asked. The request under the Freedom of Information Act described at Appendix E.48 sought, as its fifteenth item, all documents relating to 21 U.S.C. § 360ii(a)(6)(A) for ten named federal agencies, among them every one of the nine agencies that answered the Foundation. Whether that request reached the Commission or the border agency the Foundation has not established and does not assert. No record has been produced, and the United States has admitted in the action at Appendix E.50 that as of the filing

of that complaint no determination had been made, no responsive record produced, and no exemption asserted. Part IV.D.3.

Four agencies treated in this Part are absent from the table, and the Foundation says why rather than leave the omission to be noticed. The Equal Employment Opportunity Commission has made no statement about this subject that the Foundation has found, and no consultation with it has been identified, so a row for it would be empty in both of the last two columns; subsection 19 sets out why it is in this Part. The Department of Justice has acted on this subject matter, in that it received and transferred a complaint concerning flashing devices and its own rule supplied the ground on which another agency declined to investigate, but it has said nothing about this Department and nothing about what these products emit; subsection 18 sets that out. The United States International Trade Commission has made no statement about this subject and no consultation with it has been identified, so a row for it would be empty in both of the last two columns; subsection 16 explains why it is in this Part at all. The United States Fire Administration has made statements bearing directly on this subject, and they are set out at subsection 17, but it has said nothing about this Department and no communication between the two has been identified. What that agency contributes to this comment is research it funded and findings it published, which a table of this shape cannot hold and which subsection 17 holds instead.

I. § 360jj — Studies by the Secretary and Reports to Congress

1. The text

Section 360jj(a) provides:

> *"The Secretary shall conduct the following studies, and shall make a report or reports of the results of such studies to the Congress on or before January 1, 1970, and from time to time thereafter as he may find necessary, together with such recommendations for legislation as he may deem appropriate"*

The second of the enumerated studies is:

> *"A study to determine the necessity for the development of standards for the use of nonmedical electronic products for commercial and industrial purposes."*

LED vehicle headlamps, LED streetlights, LED flashing warning beacons, and LED general service lamps are nonmedical electronic products used for commercial and industrial purposes. Nothing in the paragraph excludes them.

2. What is qualified in this provision, and what is not

The distinction matters and the comment should draw it precisely. The direction to conduct the studies carries no qualifier: the Secretary shall conduct them. The first report carried a date certain, January 1, 1970. Only two things in the provision are committed to judgment: whether further reports are made from time to time thereafter, which turns on what the Secretary finds necessary, and what legislative recommendations accompany them, which turns on what he deems appropriate.

3. How the United States has characterized § 360jj

In the liaison litigation described at Part IV.D.2, both the government and the magistrate judge cited § 360jj as the contrasting example of a provision that does direct the agency to specific subject matter. The findings reason that because § 360jj(a)(1)(C) requires the FDA to study used electronic products and particularly antiquated X-ray equipment, Congress "directed regulation of specific products when it so intended," and therefore did not create product-specific requirements in § 360ii(a)(6).

4. Whether the § 360jj(a)(2) study has ever been conducted as to LED products

The Foundation does not contend that the Secretary never conducted the study the provision directs. It contends something narrower and, on the face of the chronology, unanswerable: whatever study was conducted in or about 1969 cannot have examined LED products, because the products did not exist. High-brightness white light-emitting diodes suitable for general illumination were not commercially available until the late 1990s. The product class that now accounts for most human exposure to artificial optical radiation postdates the only performance of the duty the record may show.

a. The study was performed once, in 1969, and its scope was stated on its face

The predecessor of § 360jj was section 357 of the Radiation Control for Health and Safety Act of 1968, Public Law 90-602, whose text is materially identical. The Secretary performed the duty. The Bureau of Radiological Health of the Department of Health, Education, and Welfare transmitted the 1969 Annual Report to Congress on the Administration of the Radiation Control for Health and Safety Act of 1968 on April 1, 1970, incorporating the Report to the Congress on Studies Conducted Pursuant to Section 357. That report was prepared from a series of eight Bureau staff documents.

The staff document performing the second study is BRH/DEP 70-30, A Study to Determine the Necessity for the Development of Standards for the Use of Selected Nonmedical Electronic Products for Commercial and Industrial Purposes, issued by the Division of Electronic Products of the Bureau of Radiological Health. Its preface states:

> *"The Radiation Control for Health and Safety Act of 1968 requires the Secretary of Health, Education, and Welfare to conduct "a study to determine the necessity for the development of standards for the use of nonmedical electronic products for commercial and industrial purposes." The required study was performed during 1969 and was limited to three classes of products: industrial radiographic and fluoroscopic x-ray units, particle accelerators, and analytical x-ray equipment. The findings are presented in this report."*

The introduction states the same limitation: the study "was confined to the following three classes of products: industrial radiographic and fluoroscopic X-ray units; particle accelerators, and analytical X-ray equipment."

b. All three classes are sources of ionizing radiation

Industrial radiographic and fluoroscopic X-ray units, particle accelerators, and analytical X-ray equipment emit ionizing radiation. Not one of the three is a source of visible light or of any other non-ionizing optical emission. The statutory definition at § 360hh(1)(A) reaches "any ionizing or non-ionizing electromagnetic or particulate radiation." The study as performed addressed the first branch of that definition and not the second.

c. What the study concluded for the products it did examine

The study did not conclude that standards were unnecessary. As to particle accelerators it states: "It is the conclusion of this study, therefore, that standards including instrumentation for the safe use of accelerators are needed." The second study, where performed, found a need for standards.

d. The consequence

The duty in § 360jj(a)(2) has been performed once, for three classes of ionizing radiation sources, in 1969. It has never been performed for any product emitting visible light. That is not a conclusion the Foundation asks the Department to draw from silence. It is what the agency's own report says about its own scope, in its preface and in its first paragraph.

e. The separate annual reporting requirement, and its repeal

Part C originally carried two reporting obligations. One was the studies and reports provision now codified at § 360jj. The other was a standing requirement that the Secretary report annually to Congress on the administration of the program, codified at 21 U.S.C. § 360qq. Annual reports were transmitted under that provision for approximately three decades. Section 360qq was repealed by Public Law 105-362, title VI, § 601(a)(2)(A), on November 10, 1998. Section 360jj was not repealed and remains in force.

f. Participation of other agencies in the studies

Section 357 of the 1968 Act also directed the Secretary to invite the participation of other agencies and organizations in conducting the studies. That direction survives, at § 360jj(b) and (c), and it is a second interagency requirement, independent of § 360ii and attached to the studies rather than to the program generally. Subsection (b) provides that, in carrying out these studies, the Secretary shall invite the participation of other Federal departments and agencies having related responsibilities and interests, State governments, and interested professional, labor, and industrial organizations; and that on request the Secretary shall keep interested congressional committees currently informed of the progress of the studies and permit them to send observers to meetings of the study groups. Subsection (c) provides that the Secretary or his designee shall organize the studies and the participation of the invited participants, and that a participant's dissent from the Secretary's findings and recommendations shall be included in the report if the dissenter so requests.

Two consequences follow for this comment. The first is that the participation duty is not satisfied by the liaison duty of § 360ii(a)(3), and the absence of either is not excused by the presence of the other; they are separate provisions with separate triggers. Part II.H. The second is that subsection (c) supplies the verb this comment has otherwise had to supply for itself. The Secretary is to organize the studies and the participation of the invited participants. Part IV.G.12 describes federally funded research on this subject which no one has organized, received or evaluated. That is the condition § 360jj(b) and (c) were enacted to prevent.

5. The petition of December 30, 2025

On December 30, 2025 the Soft Lights Foundation and Mark Baker petitioned the Commissioner under 21 C.F.R. §§ 10.25 and 10.30 to comply with § 360jj(a)(2) and submit a report to Congress on the health hazards of LED products, the measures necessary to address them, and the cooperation required with other federal agencies. Part IV.C.2 sets out the petition and the agency's response.

a. What the petition asks

The petition is titled Petition to Report to Congress on the Impacts of Light Emitting Diode Products on Human Health. It was submitted jointly by the Soft Lights Foundation and by Mr. Baker, which Part IV.A.2 notes, and it is addressed to the Commissioner of Food and Drugs under 21 C.F.R. §§ 10.25 and 10.30, invoking 21 U.S.C. § 360jj(a)(2) and § 360ii.

It asks the Secretary to conduct the study that § 360jj(a)(2) directs and to submit a report to Congress addressing three matters:

> the photobiological, neurological, psychological, hormonal and other health hazards of light-emitting diode products;
>
> the measures necessary to ensure the comfort, health, safety and civil rights of the public with respect to exposure to visible light radiation emitted by those products;
>
> and the cooperation required between the Food and Drug Administration and other federal agencies in order to operate a functional radiation control program as to those products.

The Foundation draws attention to what the petition does not ask. It does not ask for a performance standard. It does not ask the agency to find that these products injure anyone. It asks

the Secretary to perform a study the statute directs and to tell Congress what the study found. That is the same posture this comment takes throughout, and for the same reason: the question whether anything further is warranted cannot be answered until the work the statute directs has been done.

b. The procedural history, stated without characterization

The petition was received on December 30, 2025. Under 21 C.F.R. § 10.30(e)(2) the Commissioner is to furnish a response within 180 days of receipt, and the regulation provides four permitted dispositions, of which one is a tentative response indicating why the agency has been unable to reach a decision.

On June 18, 2026, the one hundred and seventieth day, the agency issued a response of that fourth kind, stating that the petition raises issues requiring further review and analysis by agency officials. The 180 days expired on June 28, 2026. As of the closing date of this request for information the petition has been pending for 295 days.

The Foundation does not contend that the regulation was contravened. A tentative response is expressly permitted, and the agency gave one within the period. The chronology is set out because the subject of the petition is the subject of this request for information, and because the Department is now being asked by its own notice for information on a question that one of its components has had before it, under a statutory duty, since December 2025.

c. Why the petition bears on this comment

The petition and Part II.F of this comment ask for the same work. Paragraph 360ii(a)(4) directs the study and evaluation of emissions and conditions of exposure. Section 360jj(a)(2) directs a study to determine the necessity for the development of standards for the use of nonmedical electronic products, and a report to Congress of the result. What differs is where the output goes, not what the work is.

That difference is worth something, and the Foundation says why. Congress has acted on the adjacent subject already, as Part IV.F sets out. A report under § 360jj(a)(2) would therefore arrive to a body that has demonstrated an interest in it, and would place before that body a federal account of what these products emit and how people are exposed to them — which does not presently exist in any form, as Part II.F.4 describes.

The second thing worth noting is the one established at subsection 2 above. The direction to conduct the studies carries no qualifier. Whatever is said about the judgment conferred elsewhere in this part of the Act, the petition asks for something the statute directs without condition.

6. A duty performed once is not a duty discharged

The structure of § 360jj is continuing. The Secretary conducts the studies and reports on or before a date certain and from time to time thereafter. A provision drafted that way contemplates that the subject matter will change and that the obligation will be revisited when it does. It is the same architecture as the self-evaluation duty that 28 C.F.R. § 35.105 places on public entities, discussed at Part VIII: an evaluation completed once, as to the facilities and programs then existing, is not an evaluation of what the entity operates now.

The text settles the question. The Secretary is to make a report or reports of the results of such studies to the Congress "on or before January 1, 1970, and from time to time thereafter." A date certain for the first report is not a terminus for the duty. The words that follow it contemplate further studies and further reports, and a provision drafted in those terms is not discharged by one performance in 1969.

The subject matter of the second study makes the point independently. Paragraph (a)(2) directs a study to determine the necessity for the development of standards. Necessity is not a fixed fact. It depends on what products exist, what they emit, how many of them there are, and what is known

about their effects, and every one of those variables has changed beyond recognition since 1969. A study that answered the question of necessity for three classes of ionizing-radiation sources in that year does not answer it for a class of products that did not then exist in any comparable form and that now reaches substantially the whole population. Part II.D.6.

The 1970 document's own method confirms the reading. Its title describes a study of selected nonmedical electronic products. Selection presupposes a larger field from which the three classes were drawn, and presupposes that what was not selected remained unexamined. Subsection 4 sets out the scope the document states on its face. The Bureau chose three classes, examined them, and said so. It did not purport to have exhausted the statutory question.

The Foundation states the limit of this argument. It does not contend that § 360jj requires a study of every product class, or any study at any particular interval, and the phrase from time to time confers latitude as to timing which the Foundation does not dispute. What it contends is narrower: that a study confined by its own terms to three classes of ionizing-radiation sources, performed in 1969 and reported in 1970, has not answered the statutory question for light-emitting diode products in 2026; that the question is therefore open; and that the latitude conferred by from time to time is latitude as to when the duty is performed and not as to whether it is.

7. Comparison: judicial treatment of an abandoned statutory program

One judicial treatment of a comparable statutory program is worth setting beside this record, and the Foundation states it as a comparison rather than as authority.

In July 2026 the United States District Court for the District of Columbia held that the Environmental Protection Agency had unreasonably delayed in carrying out duties under the Noise Control Act of 1972, a statute of the same era and of comparable structure, the agency having almost entirely stopped implementing it more than four decades earlier. The duties at issue included informing the public of the health consequences of the exposure, identifying major sources of it, and setting emission standards.

The Foundation draws attention to the branch of review on which that case proceeded, because it differs from the branch on which this record has so far been litigated. Section 706(1) of title 5 reaches agency action unlawfully withheld or unreasonably delayed. The liaison claim described at Part IV.D.2 was litigated on the first of those. A duty to conduct a study and to report, unperformed as to a product class for more than twenty-five years, sits more naturally on the second. The Foundation makes no prediction about any proceeding and asks nothing of this Department on this ground; it notes the comparison because an agency that has stopped implementing a program of this kind has been held to account for the delay rather than for a decision.

8. The repealed annual report to Congress, and the premise on which it was repealed

Section 360jj is not the only reporting provision this Part has to account for. Until 1998 the Secretary was also required to report to Congress every year on the administration of the whole program. That requirement no longer exists, and the circumstances of its removal bear directly on the subject of this comment.

What was repealed

Section 540 of the Federal Food, Drug, and Cosmetic Act, codified at 21 U.S.C. § 360qq, required an annual report to Congress on the administration of the Radiation Control for Health and Safety Act of 1968. It began life as section 360D of the Public Health Service Act and came into the Food, Drug, and Cosmetic Act by the same transfer described at Part II.A.1. It was repealed by section 601(a)(2)(A) of Public Law 105-362, enacted November 10, 1998, 112 Stat. 3285.

The Foundation describes the repealing statute before drawing anything from it, because the statute will not bear a reading that the repeal was aimed at this program and the Foundation does

not advance one. Public Law 105-362 is the Federal Reports Elimination Act of 1998, whose long title is to eliminate unnecessary and wasteful Federal reports. It contains no findings and no statement of purpose. It runs to fifteen titles covering Agriculture, the National Oceanic and Atmospheric Administration, Education, Energy, the Environmental Protection Agency, Health and Human Services, Housing and Urban Development, Indian Affairs, Interior, Justice, the National Aeronautics and Space Administration, the Nuclear Regulatory Commission, the Office of Management and Budget and the Office of Personnel Management, trade, and Transportation, and it makes on the order of one hundred and thirty amendments.

Within this Department alone it eliminated some twenty-five reports. In the same subsection as the radiation report it repealed reporting requirements concerning a tribal direct-billing demonstration program, a Public Health Service report under a statute of 1970, and the effect of an Indian Health Service eligibility rule. Elsewhere in the same section it eliminated reports on organ transplantation, the biennial report of the Director of the National Institutes of Health, sudden infant death syndrome research, the National Vaccine Program, chronic fatigue syndrome research, end-stage renal disease, and the annual reports of the interagency committees on diabetes and on arthritis. The radiation report was swept up in a general exercise and the Foundation says no more about the repeal than that.

The Department recommended the repeal, and gave its reason

What the Foundation does rely on is why the requirement was given up, because the reason was the Department's own and it was stated in writing.

The annual report for calendar year 1994, transmitted to Congress on March 27, 1996, recommended the repeal of section 540. The annual report for calendar year 1995, transmitted on April 8, 1997, recommended it again. The ground given was that the same information already reached Congress, and reached it more quickly, through other channels: the technical reports of the Center for Devices and Radiological Health, the Radiological Health Bulletin, the Center's web page, and other public sources. The second of those transmittals adds the practical reason:

> Agency resources devoted to the preparation of this report should be put to other, better uses.

The Foundation states the provenance of that account precisely. It describes these recommendations from the Presidential messages transmitting the two reports to Congress, and not from the reports themselves, which it has not obtained. The recommendation is therefore attributed on the authority of the transmittals.

The justification was a substitution premise, and nothing provided for it to be revisited

The Foundation asks the Department to notice the form of that reasoning, because it is a form that recurs throughout this subject. The obligation was not given up on the ground that the information did not matter. It was given up on the ground that the information would continue to reach Congress by other means. That is a substitution premise, and the Foundation does not suggest it was unreasonable when it was made.

But a substitution premise is a statement of fact about the world, and a statement of fact can stop being true. A repeal founded on one is sound only for as long as the substitute performs, and nothing in the Act of 1998 provided for anybody to check. Twenty-eight years have passed. The Foundation accordingly asks the Department to test the premise now, on the subject of this comment, by answering four questions. Each concerns the Department's own records and publications, none requires any scientific determination, and the Foundation is not in a position to answer any of them.

> First, and most important: where has this Department informed Congress about visible light emitted by light-emitting diode products? The Foundation asks for the document and its date. The products at issue include motor vehicle headlamps, flashing and warning lamps,

roadway and area lighting, and interior lighting, and the matters at issue include the reports described at Part VII and the petitions described at Part IV. If the information has reached Congress by some channel other than a report of this kind, the Foundation asks the Department to identify it.

Second, as to the Radiological Health Bulletin, the Foundation has looked and records what it found. The Center maintains a page listing the newsletters it presently publishes. Five are listed: a newsletter of the Digital Health Center of Excellence, an educational newsletter of the Division of Industry and Consumer Education, the MedSun newsletter, a newsletter of the Office of Science and Engineering Laboratories, and a standards newsletter. The Radiological Health Bulletin is not among them, and none of the five is dedicated to radiation-emitting products, although the description of the educational newsletter names them among the subjects it covers.

The Foundation therefore does not ask whether the Bulletin still exists. It asks the Department to state when it ceased publication, and to say which of the three channels named in 1996 and 1997 as the substitute for the annual report is still operating. The Foundation has not been able to establish the date on which the Bulletin ceased and does not assert one. What it records is that the publication named to Congress as part of the reason the annual report was unnecessary is not among the publications the Center lists today.

Third: do the technical reports of the Center continue as a series, and has any of them addressed non-coherent light sources since 1979? The year is not chosen by the Foundation. It is the year the Center itself identified, in the paper it put before its own statutory committee in October 2016, as the last in which the agency developed a performance standard for any lamp. Part II.K.5.

Fourth, as to the Center's web page, the Foundation has looked and records what it found. The page describing the Radiological Health Program states the mission as protecting the public from hazardous or unnecessary radiation exposure from radiation-emitting electronic products, and offers links to the electronic product radiation control program, radiation safety, recent scientific publications, and other program pages. It does not mention light-emitting diodes, lamps, non-coherent light sources, or visible light anywhere. It does not mention an annual report, a bulletin, or any report to Congress.

The Foundation has since found the one page on that site which does mention these products, and records it here because it bears on the same question. The page is about laser products, and it mentions light-emitting diodes once, to say that they are different from laser diodes and not subject to the laser performance standard. It says nothing else about them and directs the reader nowhere. Part IX.A.5 sets it out. So the position as to this channel is that the program page does not mention these products and the one page that does mentions them only to state what does not apply. Whatever the substitution premise of 1996 and 1997 assumed the web page would carry, it does not carry this.

What survived the repeal

Congress repealed the report and nothing else. Section 360ii remains, with every paragraph this Part has examined. Section 360jj remains, including the study and report provisions discussed in the subsections above. Section 360kk remains, and so does the committee provision at subsection (f). The duties were left exactly where they were. What was removed was the single recurring, unconditional occasion on which the Department had to say what it had done about them.

The Foundation sets out four dates and draws no causal connection between them, because it cannot and does not need to. In 1979 the agency developed the last performance standard it has ever made for a lamp, on its own account. Part II.K.5. In 1998 the annual report was repealed, on the Department's recommendation. In October 2016 the statutory committee met for the last time the Foundation has been able to identify, with light-emitting diodes on its agenda. Part II.K.5. In May 2024 the Department answered the Foundation's petition by concluding that a performance standard was not necessary given a long history of safety with respect to the visible wavelengths emitted. Part I.C.7.

Why this bears on the petition of December 30, 2025, and on this comment

The petition described at Part II.I.5 asked the Secretary to conduct a study of light-emitting diode products and to report to Congress under § 360jj(a)(2). The Department responded that it was unable to reach a decision on it. What that petition sought is substantially what section 540 once compelled every year without anybody having to ask. The Foundation did not frame the petition as a request to restore a repealed obligation and does not frame it so now. It observes only that the mechanism which would have produced the information automatically was given up in 1998, and that the mechanism which remains requires a petition and has so far produced no decision.

The Foundation has also attempted to obtain the underlying records directly, by request under the Freedom of Information Act, and the course of that attempt is described at Part IV.D. It states here only what is necessary to the present point: the records sought concerned this Center's treatment of visible light from light-emitting diode products, no records were produced in response, and proceedings followed which remain pending. The Foundation offers no characterization of a matter that is before a court.

The general point is the one the Foundation asks the Department to carry away from this subsection, and it is not confined to this program. Where a reporting duty is given up because the information is said to be available elsewhere, and the elsewhere does not in fact carry it, the saving is not of paperwork. What disappears is the subject. There is no document the Department is obliged to produce in which the absence of any standard, any study, any committee proceeding, or any consultation about this radiation would become visible on a fixed schedule, and the Foundation has been unable to find one produced voluntarily.

That is the reason this comment takes the form it does. The Foundation is submitting 593 first-hand reports, a petition record, a chronology, and an account of the program's own documents, to a request for information, because it has not found a federal document that states these things and can point the Department to none. If the Department can point to one, the Foundation asks that it do so in response to this comment, and it will stand corrected.

J. Related Duties Within the Same Part

1. § 360ll — Notification of defects and repair, replacement, or refund

a. The duty, and the thing about it that matters most

Section 360ll(a)(1) provides, so far as relevant:

> Every manufacturer of electronic products who discovers that an electronic product produced, assembled, or imported by him has a defect which relates to the safety of use of such product by reason of the emission of electronic product radiation, or that an electronic product produced, assembled, or imported by him on or after the effective date of an applicable standard prescribed pursuant to section 360kk of this title fails to comply with such standard, shall immediately notify the Secretary of such defect or failure to comply—

The sentence contains two triggers joined by the word or, and the Foundation asks the Department to attend to the first of them. One trigger is failure to comply with a standard prescribed under § 360kk. That trigger depends on a standard existing. The other is the discovery of "a defect which relates to the safety of use of such product by reason of the emission of electronic product radiation." That trigger does not.

The consequence is the most important structural point in this Part. The entire ground of the Final Response of May 24, 2024 is that performance standards are not necessary. Whatever is made of that ground as to § 360kk, it has no bearing on the first trigger of § 360ll(a)(1). A manufacturer who discovers that its product has a defect relating to safety of use by reason of radiation emission must notify the Secretary immediately, and must notify purchasers, dealers

and distributors, whether or not any standard has ever been prescribed for that product. The absence of a standard is not a defense to the defect duty. It is irrelevant to it.

b. What follows notification

Subsection (b) directs how notice reaches first purchasers, subsequent transferees, dealers and distributors. Subsection (c) requires the notice to describe the defect, evaluate the hazard, and state the measures to be taken. Subsection (d) requires the manufacturer to furnish the Secretary copies of its communications on the subject. Subsection (f) requires the manufacturer, without charge, to repair the product, to replace it with a like product that has no defect, or to refund the purchase price, and to reimburse transportation costs. That is a recall remedy, and it exists in this chapter already.

Subsection (e) is the provision the Foundation asks the Department to notice particularly. It authorizes the Secretary, upon determining that a product has such a defect, to direct the manufacturer to furnish the notification. The determination is the Secretary's to make. It requires no rulemaking, no performance standard, and no action by any other agency.

Because the provision is the one on which this subsection turns, the Foundation sets it out rather than describing it. Section 360ll(e) provides:

> If through testing, inspection, investigation, or research carried out pursuant to this part, or examination of reports submitted pursuant to section 360nn of this title, or otherwise, the Secretary determines that any electronic product—(1) does not comply with an applicable standard prescribed pursuant to section 360kk of this title; or (2) contains a defect which relates to the safety of use of such product by reason of the emission of electronic product radiation; he shall immediately notify the manufacturer of such product of such defect or failure to comply. The notice shall contain the findings of the Secretary and shall include all information upon which the findings are based. The Secretary shall afford such manufacturer an opportunity to present his views and evidence in support thereof, to establish that there is no failure of compliance or that the alleged defect does not exist or does not relate to safety of use of the product by reason of the emission of such radiation hazard.

Three features of that text bear on what follows. The determination may be reached "through testing, inspection, investigation, or research carried out pursuant to this part, or examination of reports submitted pursuant to section 360nn of this title, or otherwise." The words or otherwise are not decorative: the statute contemplates that the Secretary may come to the determination on information from any source, including information supplied from outside the agency. Once the determination is made, notification to the manufacturer is mandatory and immediate. And the manufacturer is then given an opportunity to answer, which is to say that the provision contains its own procedural protection and does not require the Secretary to be certain before beginning.

c. The notice of December 1, 2025

The Foundation has invoked this provision. On December 1, 2025 it wrote jointly to the Commissioner of Food and Drugs and to the Administrator of the National Highway Traffic Safety Administration, under the heading Notice of Defective Technology — LED Vehicle Headlamps. The letter transmitted three compilations for entry into the record keeping systems of both agencies and for public release: the LED Incident Reports covering April 21, 2024 to November 27, 2025; the comments on the Ban Blinding Headlights petition covering November 17, 2016 to November 30, 2025; and the signatures on that petition. It recited that the petition had reached 75,000 signatures on November 28, 2025 and that the comments exceeded 4,700.

The letter quoted 49 U.S.C. § 30118(a) and 21 U.S.C. § 360ll(e) and asked both agencies to comply with their duties under those provisions by notifying the manufacturers that LED vehicle headlamp technology is defective, and by requiring each manufacturer to open an investigation and submit detailed reports.

The Foundation states what that letter accomplished and what it did not. It did not establish a defect; no private party can. What it did was supply the Secretary with information, which is the circumstance the words or otherwise in § 360ll(e) describe. The Foundation is aware of no response to it, and no determination under § 360ll(e) has been communicated to the Foundation or published.

c. What the Foundation contends, and what it does not

The Foundation contends that light-emitting diode headlamps have a defect which relates to the safety of their use by reason of the emission of electronic product radiation, and that the same is true of light-emitting diode roadway lighting. The grounds are set out at Part V and Part VII: the source radiance and short-wavelength content described at Part V.B, the disability and discomfort glare described at Part V.C.3 and V.C.4, and the reports of seizure, migraine, visual impairment and other neurological effect described at Part VII.

The Foundation does not contend that the Department should accept that conclusion on this comment. A defect determination under § 360ll(e) is a finding of fact about particular products, and it would be improper to ask for it on a record the Department has not built. What the Foundation asks is the step before: that the Department conduct the testing and evaluation § 360ii(a)(4) directs, which is what would permit a determination under § 360ll(e) to be made either way. Part II.F. The defect provision is another route by which the absence of that work prevents the statute from operating.

d. The parallel provision at the Department of Transportation, and the gap beside it

A corresponding mechanism exists for motor vehicles. Under 49 U.S.C. § 30118 a manufacturer who learns that a vehicle or item of motor vehicle equipment contains a defect related to motor vehicle safety must notify the Secretary of Transportation and the owners, and the Secretary may make that decision independently after notice and an opportunity for a hearing. The Foundation has invoked that provision. On June 30, 2025 it submitted a petition to the National Highway Traffic Safety Administration under § 30118(e) requesting a hearing on LED headlights, following its petition of March 1, 2024 to limit headlamp intensity and its petition of May 15, 2024 to limit correlated color temperature. Part IV.C.

The procedures by which that agency opens and conducts a defect investigation are prescribed at 49 C.F.R. part 554. The Foundation notes the existence of those procedures for a reason that bears on this Part: there is no counterpart to them under this chapter. Section 360ll confers the authority described above, and the Foundation has identified no regulation in subchapter J establishing how the Secretary determines that a defect exists, how a determination is initiated, or what a person outside the agency may do to seek one. The power at § 360ll(e) exists without any stated procedure for invoking it.

The request to the Department of Transportation has not been the Foundation's alone. In December 2025 the Foundation published a form of letter and invited members of the public to send it to the Administrator, asking that a hearing be held under § 30118(e) to determine whether manufacturers have met the notification requirements of § 30118 for LED vehicle headlamps. Letters were sent. The public petition those letters refer to carries more than 75,000 signatures and more than 4,700 comments describing the hazard, and Part VII.G addresses what that material does and does not establish.

The Foundation sets that beside § 360ll in order to make a point about scope rather than about either agency. Section 30118 reaches motor vehicles and motor vehicle equipment, and nothing else. Section 360ll reaches every electronic product that emits electronic product radiation.

Roadway and area lighting is the case that shows what that difference means. A streetlight is not motor vehicle equipment. No provision of title 49 reaches it. The Consumer Product Safety Commission's authority runs to consumer products, and a luminaire installed on a municipal pole

is not one. The Department of Energy regulates its efficacy and not its emission, as Part IV.G sets out. For a light-emitting diode streetlight alleged to have a defect relating to safety of use by reason of its emission, § 360ll is not merely the best route. So far as the Foundation can determine, it is the only one in federal law.

That is the answer to a question the Department may fairly ask of this comment: why bring this subject here rather than to the agencies that regulate the products. For headlamps there is another agency, and the Foundation has gone to it. For street and area lighting, for indicator lamps, for the retail interiors described at Part VI.F, and for most of the product classes in Part VI, there is no other agency. There is this chapter, and the duties it imposes on this Department.

2. § 360nn — Inspection, records, and reports

Section 360nn is the inspection, records and reports provision of the same part. It authorizes officers designated by the Secretary to enter and inspect premises where electronic products are manufactured or held, and it directs that manufacturers and dealers establish and maintain such records and make such reports as the Secretary may reasonably require.

The Foundation brings it into this Part for one reason, which is its relation to the provision at subsection 1. Part II.J.1 sets out § 360ll(e), and the text quoted there provides that the Secretary may reach a determination of defect through testing, inspection, investigation or research carried out pursuant to this part, or examination of reports submitted pursuant to section 360nn, or otherwise. So § 360nn is named in the defect provision as one of the routes by which the Secretary may come to know what a product does.

What follows is a matter of sequence rather than of argument. The records and reports this provision authorizes the Secretary to require are the records that would answer several of the questions this comment asks: what the products in commerce emit, which Part IX.C asks be characterized, and what manufacturers themselves know about it, which Part IX.F asks be disclosed. The authority to require them does not depend on a performance standard existing, and the Foundation has identified no instance in which it has been exercised as to the visible light emitted by a light-emitting diode product.

The Foundation asks nothing under this head beyond what Part IX.C and Part IX.F ask. It records the provision because a comment that asks the Department to find out what these products emit should identify the provisions that already let it ask.

K. § 360kk(f) — The Technical Electronic Product Radiation Safety Standards Committee

1. What the statute requires

Establishment and composition. The Committee consists of fifteen members: five selected from government, five from the affected industries and five from the general public, of whom at least one is to represent organized labor.

Qualification. Each member is to be technically qualified by training and experience in a field applicable to electronic product radiation safety.

Consultation before a standard. The Secretary shall consult the Committee before prescribing any standard under § 360kk. This is the operative requirement, and it is the reason a functioning Committee is a precondition to the relief requested at Part IX rather than an afterthought to it.

The Committee's own power to propose. The Committee may itself propose radiation safety standards for the Secretary's consideration. It is therefore not merely reactive, and a functioning Committee is a route to a standard that does not depend on the agency acting first.

The record of proceedings. All proceedings of the Committee shall be recorded and the record shall be available for public inspection.

2. The implementing regulations — 21 C.F.R. part 14, subpart G

a. § 14.120 — establishment

The regulation establishes the Committee in the agency's own rules and fixes its size, providing for the Technical Electronic Product Radiation Safety Standards Committee, consisting of fifteen members, to advise the Commissioner before any performance standard for an electronic product is prescribed. The Committee is therefore not a body the agency may constitute or not as it chooses. It exists by statute, and the agency has given it a regulation of its own.

b. § 14.122 — functions

This is the provision on which the Foundation places most weight, and it is set out in full because its structure is the answer to the position described at subsection 6. Section 14.122 provides:

> (a) In performing its function of advising the Commissioner, TEPRSSC—
>
> (1) May propose electronic product radiation safety standards to the Commissioner for consideration;
>
> (2) Provides consultation to the Commissioner on all performance standards proposed for consideration under 21 U.S.C. 360kk; and
>
> (3) May make recommendations to the Commissioner on any other matters it deems necessary or appropriate in fulfilling the purposes of the act.
>
> (b) Responsibility for action on performance standards under 21 U.S.C. 360kk rests with the Commissioner, after receiving the advice of TEPRSSC.

Three functions are conferred, and only one of them is triggered by anything the Commissioner does. Paragraph (a)(2) is the consultation that attaches to standards proposed for consideration. Paragraphs (a)(1) and (a)(3) are the Committee's own, and paragraph (a)(3) is not confined to standards at all. Its subject is any other matter, and the judgment as to which matters qualify is placed with the Committee by the words it deems necessary or appropriate.

The Foundation draws the consequence at subsection 6. It states here only what the text provides. A Committee that does not convene cannot exercise paragraph (a)(1) or paragraph (a)(3) at any time, whether or not a standard is under consideration, because both are functions it performs on its own motion and neither waits on the Commissioner.

c. § 14.125 — procedures, including submission of a proposed standard to the Committee before publication in the Federal Register

Paragraph (a) is the provision the Department has invoked in explaining the Committee's inactivity, and the Foundation quotes it in full so that the reader may measure the explanation against the text:

> When the Commissioner is considering promulgation of a performance standard for an electronic product, or an amendment of an existing standard, before issuing a proposed regulation in the Federal Register the Commissioner will submit to TEPRSSC the proposed standard or amendment under consideration, together with other relevant information to aid TEPRSSC in its deliberations.

Three further paragraphs of the same section matter and are less often noticed.

- Paragraph (c) fixes the quorum at ten members, of which at least three shall be from each of the government, industry and general public categories. The Foundation draws attention to the source. The quorum is not merely a term of the Committee's charter, which an agency may revise; it is in the Code of Federal Regulations.
- Paragraph (d) provides that the Chairperson of TEPRSSC will ordinarily submit a report to the Commissioner within sixty days, extendable by thirty. The consultation contemplated by paragraph (a) is therefore completed by a report, and the report is the Chairperson's to make.

> Paragraph (b) provides for materials to reach members at least two weeks before a meeting where possible.

Paragraph (d) has a practical consequence that bears directly on the relief sought in Part IX.H. If the office of Chairperson is vacant, the consultation required by paragraph (a) cannot be completed as the regulation contemplates, because the officer who is to report does not exist. A position that the Committee will be reconstituted if and when a standard comes under consideration accordingly assumes that reconstitution can be accomplished within the period the regulation allows for the report. The Foundation does not assert that it cannot. It asks the Department to say how long the reconstitution would take, because the regulation measures the consultation in days.

d. § 14.127 — membership and terms

The Commissioner appoints five members from government, five from the affected industries and five from the general public. Terms are three years, members may not serve two consecutive full terms, and the conflict of interest provisions of part 14 apply. The limitation on consecutive terms is worth noting for a reason that is not adverse to the Department: a committee of this kind requires continuous replenishment by design, so vacancies are the expected condition and filling them is a recurring administrative task rather than an extraordinary one.

e. § 14.130 — conduct of meetings and availability of records

All proceedings of the Committee are to be recorded and the record is to be available for public inspection, and proceedings are open except where the Commissioner closes a portion of a meeting under § 14.27. Taken with the notice requirements of the Federal Advisory Committee Act, this provision has an evidentiary consequence that subsection 5 relies on and that the Foundation states here. A meeting of this Committee cannot occur without public notice and cannot occur without a record. The absence of notice and of a record is therefore not merely a failure of the Foundation's search. It is the form in which the absence of a meeting would be expected to appear.

3. Chartering history

The Foundation has obtained the operative charter. It was approved on December 18, 2024 by the Director of the Advisory Committee Oversight and Management Staff, and its stated filing date is December 24, 2024. The charters are renewed on a two-year cycle and are filed on December 24; the Foundation has also seen the charters filed on that date in 2014 and in 2016, and a renewal notice published on January 24, 2023, 88 FR 4190, extending the then charter to December 24, 2024.

The charter describes the Committee as a permanent statutory committee established pursuant to the Radiation Control for Health and Safety Act of 1968, 21 U.S.C. § 360kk(f), governed also by the Federal Advisory Committee Act as amended, 5 U.S.C. 1001 et seq. Management and support services are assigned to the Center for Devices and Radiological Health. The duration is stated as Continuing.

The charter states its own objectives in terms the Foundation relies on at Part II.K.7 and at Part IX.H, because they are the agency's description of what this body is for:

> This Act creates the Technical Electronic Product Radiation Safety Standards Committee (TEPRSSC) and requires the Commissioner to consult with the Committee before prescribing standards for radiation emissions from electronic products. The TEPRSSC advises FDA regarding proposed performance standards for electronic products which emit radiation.

Its statement of duties is to the same effect, and adds the Committee's own power of initiative:

> This Committee provides advice and consultation to the Commissioner of Food and Drugs on the technical feasibility, reasonableness, and practicability of performance standards for

electronic products to control the emission of radiation from such products and may recommend electronic product radiation safety standards to the Commissioner for consideration.

The termination date, which falls within weeks of this comment

The charter provides that unless renewed by appropriate action before it expires, it will expire two years from the date it is filed. Filed December 24, 2024, it expires December 24, 2026.

Three provisions of that charter bear on the subsections that follow, and the Foundation quotes them because they are the agency's own undertakings rather than the Foundation's characterizations.

On frequency: "Meetings shall be held approximately once every other year." Meetings are to be open to the public except as the Commissioner determines otherwise, and notice of all meetings is to be given to the public.

On membership: fifteen voting members including the Chair, selected by the Commissioner or designee from among authorities knowledgeable in the fields of science or engineering applicable to electronic product radiation safety, and invited to serve for overlapping terms of up to four years. The fifteen comprise five from governmental agencies including State and Federal Governments, five from the affected industries after consultation with industry representatives, and five from the general public of whom at least one shall be a representative of organized labor.

The charter's four-year term resolves a discrepancy this comment flagged at Part II.K.2, where 21 C.F.R. § 14.127 gives terms of three years. The three members shown on the roster held terms running from April 11, 2022 to December 31, 2025, which is three years and rather more than eight months. The Foundation therefore takes the charter to govern and does not rely on the three-year figure. It notes the point because a reader comparing the regulation with the roster would otherwise find an inconsistency the Foundation had not addressed.

On quorum: "A quorum shall consist of 10 members, of which at least 3 shall be from the general public, 3 from the government agencies, and 3 from the affected industries." The same quorum is prescribed by regulation at 21 C.F.R. § 14.125(c), and the Foundation cites the regulation in preference to the charter wherever the two agree.

A fourth provision should be added to those three, because it forecloses an answer that might otherwise be given. The charter assigns to the Designated Federal Officer the duty to attend each Committee meeting, to approve and prepare all meeting agendas, and to call all the Committee and subcommittee meetings. The officer who convenes this Committee is therefore not the Chair, and the roster at Part II.K.4 shows that office to be filled. The Committee's inability to meet is accordingly not for want of anyone empowered to call a meeting. It is for want of members to attend one.

The same provision assigns the Designated Federal Officer the duty to maintain information on committee activities and to provide it to the public as applicable, including as required by 5 U.S.C. § 1009(b). The charter's recordkeeping provision adds that Committee records will be available for public inspection and copying subject to the Freedom of Information Act. Part II.K.5 and Part VII.I return to the consequence of those undertakings for the meeting record.

The charter also states the cost of operating the Committee, and the Foundation gives both components because the smaller one alone would understate it. The estimated annual cost of operating the Committee, including compensation and travel expenses for members but excluding staff support, is $29,333. The estimated staff support is 0.50 person years, at an estimated annual cost of $100,937. The two together are approximately $130,000 a year.

The Foundation notes those figures for one reason only, and it is not a complaint about expense. Whatever has prevented this Committee from functioning, the cost of convening it is not a substantial obstacle for a Department whose annual appropriation is measured in billions. The

Foundation makes no suggestion that cost has been the reason, and the Department has never given it as one.

4. Membership status

The Department publishes a roster of this Committee, and it answers the question this subsection previously had to leave open. The Foundation sets out what the roster states, as reviewed in October 2026, and then the arithmetic that follows from it.

The roster describes the Committee's purpose by reference to the statute, in terms worth quoting because they are the agency's own account of what the body is for:

> Advises on technical feasibility, reasonableness, and practicability of performance standards for electronic products to control the emission of radiation under 21 U.S.C. 360kk(f)(1).

It then states a figure for vacancies, against the fifteen seats the statute and the charter provide:

> Current Number of Vacancies: 12

Twelve vacancies against fifteen seats leaves three. The roster lists three members, each with the same term, and distributes them among the statutory categories as follows.

> Government representatives: two. One is the Chief of the Electronic Products Branch, Division of Nuclear Safety, at a State emergency management agency, whose expertise the roster gives as nuclear safety health physics. The other is a Surveillance Section Director in the Consumer Protection Division of a State health department, whose expertise the roster gives as regulatory radiation control.
>
> General public representatives: one. A professor of radiology at a university school of medicine, whose expertise the roster gives as medical physics.
>
> Industry representatives: none. The roster defines the category in its own legend, as Industry Representative, and lists no person in it.

The roster shows the office of Chairperson as vacant, in terms. It names a Designated Federal Officer in the Office of Management of the Center for Devices and Radiological Health, who is not a member of the Committee.

All three members were appointed on the same day, April 11, 2022, and all three terms ended on the same day, December 31, 2025. No person shown on the roster holds a term that has not run out.

The Foundation states three qualifications before drawing any conclusion, because each is capable of being raised against it. The roster carries its own caveat, which the Foundation quotes rather than paraphrases: one or more vacancies may be in the nomination process or a final appointment may have been made. The page bears no date of last revision, so the Foundation cannot establish how current it is. And the Foundation does not assert that the Committee has no members at all. An expired term is not the same thing as a vacant seat. The roster lists these three as members while showing their terms as ended, and it counts twelve vacancies rather than fifteen, so the Department evidently does not treat the three as having left. Whether a member may continue to serve pending replacement is a question of the charter, the Federal Advisory Committee Act and the instruments of appointment, which the Foundation does not resolve and does not need to resolve.

The arithmetic against the quorum the regulation requires

Section 14.125(c) of title 21 of the Code of Federal Regulations fixes the quorum of this Committee at ten members, of whom at least three must be drawn from each of the government, industry and general public categories. The charter provides the same. Measured against the roster, every element of that requirement fails, and three of the four fail by a margin.

> Ten members are required. Three are listed.

Three government representatives are required. Two are listed.

Three general public representatives are required. One is listed.

Three industry representatives are required. None is listed.

The Foundation asks the Department to notice how little that conclusion depends on anything capable of dispute. It does not turn on whether the roster is current, because the shortfall is twelve appointments. It does not turn on whether a member whose term has expired may continue to serve, because if all three continue to serve the number is still three. It does not turn on the identity or the diligence of any member, none of whom is responsible for a vacancy. And it does not turn on the headcount at all, because the industry category is empty and no quorum of this Committee can be constituted without three members drawn from it. That element fails on its own and would fail if every other seat were filled.

The position as to the Chair is separate and equally concrete. Section 14.125(d) provides that the Chairperson of the Committee ordinarily submits the report of its consultation to the Commissioner within sixty days, and that report is the act by which the consultation required by § 360kk(f) is completed. The roster shows the office as vacant.

The nomination record, which is now background rather than inference

The Foundation previously had to reason about membership from the agency's requests for nominations. Those remain relevant as history rather than as evidence of the present position. On January 10, 2025 the agency published a request for nominations for five general public representatives and five government representatives, for current and upcoming vacancies effective January 1, 2025, with first consideration for nominations received by March 11, 2025. That was a request to fill ten of the fifteen seats, and it is now nineteen months old.

It was not the first. The Foundation has identified four requests for nominations to this Committee, published on November 30, 2021, February 16, 2022, December 1, 2022 and January 10, 2025, together with a renewal of the charter published on January 24, 2023. In the same period it has identified no notice of any meeting. The roster page itself carries a standing invitation, stating that the agency is requesting nominations for members to serve on its advisory committees as part of its ongoing efforts to recruit qualified experts with minimal conflicts of interest.

The Foundation offers that sequence without characterizing it. An agency that publishes four requests for nominations and maintains a standing invitation is an agency attempting to seat the Committee, and the Foundation does not suggest neglect. What the sequence and the roster together establish is that the difficulty is of long standing, that the agency has been aware of it for at least five years, that four nomination requests have not remedied it, and that as matters stand the Committee has three members, no Chair, no industry representative, and not one member whose term is current.

5. Meeting record

The Foundation has obtained the materials from that proceeding and sets out what they show, because they are the agency's own words to its own statutory committee.

The meeting was noticed in the Federal Register on September 22, 2016 and was held on October 25 and 26, 2016 at Gaithersburg, Maryland. The notice states the purpose of the first day in terms the Foundation quotes exactly, because the whole of the argument that follows is built on them:

> "On October 25, 2016, the committee will discuss and make recommendations regarding possible FDA performance standards" for, among other subjects:
>
> "Radiofrequency (RF) radiation products, such as microwave ovens and wireless power transfer"; and
>
> "non-coherent light sources (e.g., LEDs and UVC lamps) including new initiatives."

> "Radiofrequency (RF) radiation products, such as microwave ovens and wireless power transfer"; and
>
> "non-coherent light sources (e.g., LEDs and UVC lamps) including new initiatives."

The Foundation asks the Department to notice three things about that notice, each of which is a fact about the agency's own practice rather than an argument.

First, light-emitting diodes and radiofrequency radiation were before this Committee together, in one sitting, as candidate subjects for performance standards. The present request for information concerns electromagnetic radiation, and the Department has already had both halves of that subject before the committee the statute gave it for exactly this purpose.

Second, wireless power transfer was among the radiofrequency subjects on that agenda. Part II.H.20 sets out the letter of April 24, 2019 in which the Center recommended to the Federal Communications Commission that human exposure limits be set for wireless power transfer below 300 kHz and 100 kHz, and recommended four methods of reducing the emission. The sequence is therefore that a subject came before the statutory committee in October 2016, and that two and a half years later the Center recommended limits on it to another agency. The Foundation does not know what the Committee said about it in 2016.

Third, and this is the observation the Foundation asks the Department to weigh most carefully in the whole of this Part, the notice is itself evidence of what the agency was doing. A notice stating that the Committee will discuss and make recommendations regarding possible FDA performance standards for non-coherent light sources, LEDs among them, is a published statement that performance standards for those products were a subject the agency was taking to its statutory committee for recommendations. The phrase including new initiatives points the same way.

That bears directly on § 14.125(a), the provision quoted at subsection 2, whose trigger is the Commissioner considering promulgation of a performance standard for an electronic product. The Foundation does not need to resolve what degree of settled intention the word considering requires, and declines to try. It is enough to put the Department to an election, because the two available answers lead to the same place.

> If performance standards for light-emitting diode products were under consideration in October 2016, then § 14.125(a) was engaged, the Committee was consulted as the regulation contemplates, and the question for the Department is what became of that consideration. No proposed regulation followed. The Foundation has identified no published document in which the agency recorded a decision not to proceed, no notice withdrawing the subject, and no statement that the consideration had concluded. A consideration begun and neither completed nor abandoned on the record is the condition this comment describes throughout: not a decision against a standard, but no decision at all. Part II.D and Part II.I.
>
> If performance standards for those products were not under consideration in October 2016, then the Committee was convened, and spent a day discussing possible performance standards across seven subject areas, at a time when nothing was under consideration. On that view the agency's own practice in 2016 is inconsistent with the position that this Committee need meet only when a standard is under consideration, and the explanation for nine years of inactivity cannot rest on § 14.125(a).

The Foundation does not know which answer is correct and says so. It asks the Department to supply it: to state whether performance standards for non-coherent light sources were under consideration in or after October 2016, and if they were, to state when and by what document that consideration ended. That is a question about the Department's own records, it requires no scientific determination of any kind, and the Foundation is not in a position to answer it.

One further matter should be stated so that it is not mistaken for an answer. The Final Response of May 24, 2024 concluded that a performance standard was not necessary, and a reader might take that as the disposition of whatever began in 2016. The Foundation asks the Department not to treat it so without saying so expressly. That document responded to the Foundation's petition of

2022, it was issued eight years after the proceeding described here, and so far as the Foundation can determine it does not mention the proceeding of October 25, 2016, the paper presented there, or the Committee's recommendations. If it is the disposition of the 2016 consideration, the Department should say so and should explain how a petition response discharges a consideration that preceded the petition by six years. Part I.C.7 and Part VI.M.

At the Committee meeting of October 25, 2016, the Center for Devices and Radiological Health presented a paper titled Non-Coherent Light Sources, prepared by Sharon Miller, Ph.D., of the Office of In Vitro Diagnostics and Radiological Health and delivered by William Calhoun, Ph.D. The paper treats light-emitting diodes as non-coherent light sources, which it describes as electronic products that emit light, commonly known as lamps. Its stated agenda was what a non-coherent light source is, how the agency regulates light-emitting diodes and ultraviolet-C lamps, the agency's concerns as to each, and questions for the Committee.

On the regulatory history the paper states that in 1979 the agency developed performance standards for two types of non-coherent light source emitting ultraviolet radiation, sunlamp products and high-intensity mercury vapor lamps, and that "since that time, FDA has not developed any new Performance Standards for lamps."

Under the heading Safety Concerns the paper identifies, as to light-emitting diodes:

- the blue light hazard, stating that blue light is hazardous to the retina "especially due to reduced pupillary constriction compared to white light," that the peak of the hazard is at 440 nanometers, and that there is "high luminance or hot spots due to small source size";
- glare from increased scatter due to shorter wavelengths, and afterimages;
- circadian rhythm disruption, with fatigue, sub-optimal performance and "effects on long-term health";
- and "uncertainty regarding chronic effects of low doses on eye damage," giving age-related macular degeneration as the example, with the further statements that there are "no studies with appropriate animal models," that a 2012 study found subthreshold retinal damage at doses below published thresholds, and that military personnel after months in desert conditions have retinal lesions resembling solar retinitis.

The paper also sets out the risk group classification of the photobiological safety standard, describing the four groups as based on "potential acute hazard" and giving the exempt group as presenting no risk for up to 10,000 seconds. Part V.C.2 explains why that figure, and the word acute, matter to the whole of this comment.

The Foundation states carefully what this document is and is not. It is a staff presentation. It is not a finding by the agency, it is not a determination of harm, and the Foundation does not offer it as one. What it establishes is narrower and is not open to dispute.

- The subject of this comment was before the agency, and before the Committee the statute created, in October 2016.
- The particular characteristics this comment identifies at Part V — short-wavelength peak, high luminance arising from small source size, scatter and glare, circadian effect — are the characteristics the agency itself identified.
- The agency itself described the state of the evidence on chronic low-dose effects as uncertain and noted the absence of appropriate animal studies.
- And the agency itself stated that it had developed no new performance standard for any lamp since 1979.

6. Consequence: the standard-setting mechanism is not presently operable

Three things follow, and the Foundation states them in the order of how firmly the record supports them.

The first is a matter of the agency's own charter. That document provides that meetings shall be held approximately once every other year. That provision is not conditioned on a standard being under consideration. If the last proceeding was in October 2016, the interval since is not approximately two years.

That observation gains force from the way the charter is maintained. This charter is not a document settled once and left. It expires two years after filing unless renewed, and the Department renews it. The renewal published on January 24, 2023 extended it for two further years, and the Department has described the Committee in that notice as a non-discretionary Federal advisory committee established to provide advice and consultation to the Commissioner. The meeting provision is a term of the instrument that is renewed.

The Foundation therefore puts the point in the form the record supports. In successive charters the Department has undertaken that meetings of this Committee shall be held approximately once every other year. The undertaking has been renewed in the period during which no meeting was held. And the undertaking is not conditioned on anything: it does not refer to a standard, to a proposal, to a petition, or to the Commissioner considering anything. Whatever may be said about § 14.125(a), it cannot explain an interval of nine years in the performance of a provision to which § 14.125(a) is irrelevant.

The Foundation states two qualifications, because it would rather state them itself than have them supplied. The provision says approximately once every other year, and the word approximately plainly admits of some latitude; the Foundation's point does not depend on precision, because nine years is not an approximation of two. And a charter provision of this kind is an administrative undertaking rather than a legislative rule, so the Foundation does not characterize the interval as a violation of law and does not ask the Department to treat it as one. It asks something narrower and harder to answer. The Department has said, repeatedly and in a document it renews, that this Committee shall meet approximately every other year. The Foundation asks the Department to state why it has not, and to state that reason in terms that do not depend on § 14.125(a), since the undertaking does not.

The renewal that falls due in December 2026

One further matter is placed before the Department because of its timing, and the Foundation raises it as a question rather than as a charge. The operative charter expires on December 24, 2026. Part II.K.3. That is approximately two months after the closing date for comments in this proceeding, which means the Department will decide whether to renew this charter within weeks of reading this comment.

If the charter is renewed in the ordinary way, the Department will re-adopt, for a further two years, an instrument providing that meetings of this Committee shall be held approximately once every other year, that its quorum is ten members including three from the affected industries, and that it exists to advise the Commissioner on the technical feasibility, reasonableness and practicability of performance standards. It will do so in respect of a Committee that, on the Department's own roster, has three members, no Chair, nobody at all in the industry category, and no meeting since October 2016.

The Foundation does not suggest that the charter should not be renewed. It should. The Committee is a creature of statute and its existence is not discretionary. What the Foundation asks is that the renewal not be the only thing that happens: that the Department treat the occasion as the natural moment to fill the seats, appoint a Chair and set a meeting, and that it say in response to this comment whether it will. A renewal unaccompanied by appointments would commit the

Department on paper, for the sixth consecutive two-year period, to a meeting frequency it has not observed since 2016.

The second concerns capacity to act, and on this the Foundation is able to be definite where earlier drafts of this comment were not. Section 360kk(f) makes consultation with the Committee a precondition to prescribing any standard under that section. The quorum is fixed by regulation at ten members with at least three from each of the three categories, 21 C.F.R. § 14.125(c), and by the charter in the same terms. The Department's published roster lists three members, no Chair, and no industry representative. Subsection 4 sets out the arithmetic and the qualifications that do not disturb it. A quorum cannot be constituted from that membership.

The Foundation is careful about what that does and does not mean. It does not mean the Committee has been dissolved; it has not, and Part II.K.3 records the renewals. It does not mean the Committee has no members; the roster lists three and counts twelve vacancies rather than fifteen. It does not mean the condition is permanent; it is an appointments problem and the Department can remedy it without resolving anything else. And it rests on no inference about the statute, which contains no express quorum requirement, but on the regulation the agency wrote for itself and the roster the agency publishes.

Formal existence and functional capacity are different questions

The Foundation separates two propositions that are easily run together, because the distinction is the whole of its position and because the Department is entitled to know which one it is being asked to answer.

The first is whether the Committee exists. It does. It is a permanent statutory committee, its charter has been renewed, and the Department publishes both its roster and its purpose. The Foundation asserts nothing to the contrary and would be wrong to.

The second is whether the Committee can presently do the thing the statute requires of it before a standard is prescribed. It cannot, because a quorum cannot be constituted from three members where the regulation requires ten including three drawn from a category that is empty, and because the officer who completes the consultation is not in office.

A body may exist and be unable to act, and it is the second proposition that bears on this proceeding. The Foundation does not ask the Department to accept any characterization of the Committee's condition, and advances none. It asks the Department to apply its own regulation to its own roster. The relief sought follows from the second proposition alone and requires no view about the first: fill the seats, appoint a Chair, and convene the Committee. Part IX.H.

The third is the one the Foundation asks the Department to weigh most carefully, because it is about the structure of the reasoning rather than about any fact in dispute. The explanation given for the Committee's inactivity is that the agency is not considering new performance standards. But consultation with the Committee is what the statute requires before a standard may be prescribed. So the position is that no standard is contemplated, therefore the Committee need not function; and the Committee not functioning is among the reasons no standard can be prescribed. Each proposition rests on the other, and neither is examined.

There is a textual answer to that reasoning and it does not depend on anything the Foundation contends about LED products. Section 360kk(f)(1)(B) provides that the Committee may propose electronic product radiation safety standards to the Secretary for his consideration. The Committee is not solely a body that reviews what the agency brings to it. Congress gave it an independent power to put standards before the Secretary that the Secretary has not proposed. A committee holding that power cannot be stood down on the ground that the agency is not contemplating a standard, because identifying standards the agency has not contemplated is part of what Congress created it to do.

The same answer in the agency's own regulation, which is where it is clearest

The reasoning described above has been supported by reference to § 14.125(a), quoted at subsection 2. The Foundation accepts that provision entirely and relies on it. Its submission is that the provision does not bear the weight placed on it, for a reason that is structural rather than interpretive.

Section 14.125(a) imposes a duty on the Commissioner. It is a duty of submission: when he is considering a standard or an amendment, he must give the Committee the proposal and the relevant information before he publishes. The provision governs what the Commissioner must hand over, and when. It does not confer the Committee's functions, it does not state when the Committee shall meet, and it does not purport to condition the Committee's existence or activity on anything.

The Committee's functions are conferred by § 14.122(a), and there are three of them. Section 14.125(a) feeds only the second. Paragraph (a)(2) is the consultation on standards proposed for consideration, and it is that function, and that function alone, which waits on the Commissioner. Paragraph (a)(1) permits the Committee to propose standards to the Commissioner on its own motion. Paragraph (a)(3) permits it to make recommendations on any other matters it deems necessary or appropriate in fulfilling the purposes of the act.

Paragraph (a)(3) is the provision the Foundation asks the Department to weigh. Its subject is not standards. Its subject is any other matter within the purposes of the Act, and the purposes of the Act include the minimizing purpose set out at Part I.B.3 and Part II.B. And the clause that identifies which matters qualify is it deems necessary or appropriate, which places that judgment with the Committee and not with the Commissioner.

The consequence is that an explanation framed in terms of § 14.125(a) answers a different question from the one asked. Whether the Commissioner is presently considering a standard determines whether the duty of submission under § 14.125(a) has arisen. It does not determine whether the Committee may propose a standard under § 14.122(a)(1) or recommend on any other matter under § 14.122(a)(3), because neither of those functions is triggered by the Commissioner at all. A Committee that cannot convene cannot exercise either of them, and that disability does not wait on a standard coming under consideration. It is present now.

The Foundation makes one observation about the terms of § 14.125(a) and then leaves the point, because it does not need it. The provision does not define what it is to be considering promulgation of a standard, and it does not say how long before publication the submission must be made. Those are genuine indeterminacies and a reader may make of them what the reader will. The Foundation does not rest anything on them. Its argument is that § 14.125(a) is the wrong provision for the purpose, not that it is an unclear one.

Nor does the Foundation contend that reconstituting the Committee would be a sufficient response to this comment. It would not be, and the Foundation says so plainly because others have made the opposite case. In a petition to this Department of December 20, 2021, petitioners urging action on radiofrequency radiation objected that reconstituting a dormant advisory committee was a minor step and was not a rulemaking compliant with the Administrative Procedure Act. On that narrow proposition the Foundation agrees with them. Reconstituting the Committee is not a standard, it is not a rulemaking, and it would not by itself minimize anyone's exposure to anything. The Foundation asks for it on different grounds: not as the remedy, but because it is the precondition the statute imposes on the remedy, and because two of the Committee's three functions are presently incapable of being exercised at all.

7. Relationship to this request for information

The Foundation puts this narrowly, and declines the broader form of the argument that is available to it.

It does not contend that the Committee is required to review the comments submitted in response to this request for information. This is not a proceeding under § 360kk, no standard is before the Department, and the Committee's statutory function is addressed to standards. A comment that claimed otherwise would be wrong and would deserve to be corrected.

What the Foundation observes is this. The Department has issued a request for information seeking scientific and technical material on the health effects of electromagnetic radiation. Congress has provided the Department with a standing committee of fifteen people, each required to be technically qualified by training and experience in a field of science or engineering applicable to electronic product radiation safety, drawn in equal parts from government, industry and the public, meeting in public, with its proceedings recorded and available for inspection, and empowered to propose standards on its own initiative. That committee last met, so far as the Foundation can determine, in October 2016, at a meeting where the Center presented its concerns about light-emitting diodes.

The Foundation asks the Department to reconstitute the Committee and to convene it. Part IX.H. The request is independent of everything else in this comment. It requires no view about whether light emitted by LED products injures anyone, no determination that a standard is necessary, and no finding of any kind. It requires the Department to fill the seats and hold the meeting its own charter says shall be held approximately once every other year, at a stated cost of approximately one hundred and thirty thousand dollars a year including staff support. Until that is done, the mechanism Congress built for deciding questions of this kind is not available to the Department, whatever the Department may conclude about the questions.

L. Reporting of Accidental Radiation Occurrences — 21 CFR 1000.3(a), 1002.20

1. The definition and the reporting duty

The regulation defines the term broadly. 21 C.F.R. § 1000.3(a) provides:

> Accidental radiation occurrence means a single accidental event or series of accidental events that has/have resulted in injurious or potentially injurious exposure of any person to electronic product radiation as a result of the manufacturing, testing, or use of an electronic product.

Two features of that definition are favorable to the Foundation and one is not, and the Foundation sets out all three.

The exposure need only be "potentially injurious." Demonstrated injury is not required by the text.

The occurrence may arise from the "use" of an electronic product. It is not confined to malfunction, misuse or breakage.

But the events must be accidental, and that word is doing work. A headlamp or luminaire emitting exactly as it was designed to emit is not obviously the subject of an accident. The Foundation does not pretend the point is free from difficulty.

The reporting duty is at 21 C.F.R. § 1002.20, and the first thing to notice about it is who bears it. The section provides that "manufacturers of electronic products shall, where reasonable grounds for suspecting that such an incident has occurred, report to the Director." Incidents associated with a death or serious injury are to be reported immediately; others may be compiled and submitted quarterly.

2. What the Foundation has submitted, and what it is

The Foundation has transmitted to the Center for Devices and Radiological Health the LED Incident Reports and the compilation of reports concerning vehicle headlamps described at Part VII, most recently by the letter of December 1, 2025 described at Part II.J.1.c, which transmitted

them expressly for entry into the agency's record keeping systems. It has also submitted at least one individual radiation report, concerning light-emitting diode lamps on an emergency vehicle, which the agency numbered COR22000194 on October 14, 2022. Part VII.I.2. Receipt of the transmittals is documented at Part IV.B.

The Foundation states plainly what those submissions are not. Section 1002.20 imposes its duty on manufacturers. A report from a member of the public, or from an organization, is not a report under § 1002.20 and does not discharge any manufacturer's obligation. The Foundation has supplied the agency with information. It has not performed, and could not perform, the statutory reporting function.

3. The question that follows, which is for the Department

That allocation of the duty is what makes this subsection worth the Department's attention, and it produces a question the Foundation cannot answer and the Department can.

If exposures of the kind described in Part VII are accidental radiation occurrences, then the manufacturers of the products concerned were required by § 1002.20 to report them, upon reasonable grounds for suspecting that such an incident had occurred. The Foundation accordingly asks the Department to state how many reports under § 1002.20 it has received from any manufacturer concerning visible light emitted by light-emitting diode products, and in what years. The Foundation does not know the answer. If the answer is none, that is a fact about compliance with an existing regulation, and it is a fact the Department is in a position to establish without conducting any study at all.

If the answer is none, a second question follows. The Foundation has placed before the agency several hundred first-hand accounts of exposure to these products, and has done so in writing and with acknowledgment. Whether those accounts give a manufacturer reasonable grounds for suspecting that such an incident has occurred is a matter the Department can address, and § 360ll(e) supplies the mechanism for addressing it. Part II.J.1.

4. The structural point, which does not depend on the definition

Whatever view is taken of the word accidental, this is the only incident reporting provision in subchapter J, and it runs in one direction only. It obliges manufacturers to report what they have reasonable grounds to suspect. It establishes no channel through which an exposed person may report anything, and the Department has not created one; Part VII.J.1 describes the request made to a component of this Department on March 3, 2023 that such a channel be established, and the fact that it was not.

The consequence is the one Part I.C.7 identifies. A regulatory scheme in which the only reports come from manufacturers, about their own products, upon their own suspicion, and in which no route exists for the people exposed, will produce few reports whatever is happening to the people exposed. An absence of reports in such a scheme is not evidence about the products. It is a description of the scheme.

M. Summary: Which Duties Have Been Discharged and Which Have Not

This Part has examined each duty in turn. The accounting is set out here in one place, stated as findings about the record rather than as argument, so that the Department can see what the Foundation says is unperformed and test each item against its own files.

1. The duties of 21 U.S.C. § 360ii(a)

Paragraph (a)(1), performance standards. Discharged as to twelve product categories, by the standards collected at 21 C.F.R. parts 1020 through 1040. Not discharged as to visible light emitted by LED products, as to which the agency declined on the ground that a standard is not necessary. Part II.C.

Paragraph (a)(2), research and operational activity to minimize emissions and exposure. The Foundation has identified no research, development, training or operational activity directed to this radiation, and no baseline against which any minimization could be measured. Part II.D.

Paragraph (a)(3), liaison with and receipt of information from other agencies, States, standards bodies, industry and labor. Information has been received and acknowledged; no evaluation of it has been published. The Foundation has identified no liaison with any State agency, any professional or standards body as to incoherent optical radiation, or any labor association on this subject. Part II.E.

Paragraph (a)(4), study and evaluation of emissions and of conditions of exposure. A literature search and systematic review was commissioned and has not been published. No measurement of emissions and no characterization of exposure conditions has been identified. Part II.F.

Paragraph (a)(5), development, testing and evaluation of the effectiveness of techniques for minimizing exposure. The effectiveness of existing mitigations has been asserted; no evaluation establishing it has been identified, and the mitigations themselves have not been identified. Part II.G.

Paragraph (a)(6), consultation and liaison with the named officers and other appropriate departments. One documented instance exists in the whole program, concerning radiofrequency energy, in 2019. None has been identified for optical radiation with any agency, including the Secretary of Labor, who is named in the paragraph. Part II.H.

2. The related provisions

Section 360jj, studies and reports to Congress. Performed once, in 1969, for three classes of ionizing radiation source, and reported in 1970. Never performed for any product emitting visible light. A petition seeking performance has been pending since December 30, 2025. Part II.I.

Section 360kk(f), the Technical Electronic Product Radiation Safety Standards Committee. Chartered and continuing. Last met, so far as the Foundation can determine, in October 2016, at a meeting where the Center presented its concerns about light-emitting diodes. In January 2025 nominations were sought for ten of the fifteen seats. Part II.K.

Section 360ll, notification of defects. Available, and not conditioned on the existence of a performance standard. Invoked by the Foundation by notice of December 1, 2025. No determination under § 360ll(e) has been communicated or published. Part II.J.1.

Section 1002.20, reporting of accidental radiation occurrences. The only incident reporting provision in subchapter J. It runs from manufacturers only. The Foundation does not know whether any manufacturer has ever reported under it as to these products. Part II.L.

3. What the pattern shows

The Foundation draws one inference from that accounting and no more.

Of the six duties in § 360ii(a), exactly one operates through a mechanism that conditions action on a determination by the Secretary: paragraph (a)(1), which runs through § 360kk and its finding of necessity. That is the one duty the Final Response of May 24, 2024 addressed. The other five carry no such condition, and the letter does not discuss them.

The Foundation does not suggest that this was a stratagem. The more likely explanation is the ordinary one: the petitions asked for a performance standard, and the agency answered the question it was asked. But the consequence is the same either way. A disposition of the only conditional duty has been treated, in effect, as a disposition of the program, and the five unconditional duties have gone unaddressed by anyone.

That is what this comment asks the Department to correct, and the requests at Part IX are framed accordingly. They are not requests for a performance standard. They are requests that the duties which carry no condition be carried out: that the emissions and the conditions of exposure be measured and published, that the techniques for minimizing exposure be tested, that the agencies the statute names be consulted, that the Committee be reconstituted, and that the study Congress directed be conducted and reported. Whether a standard is necessary is a question that comes after those things, and on a record they would produce.

III. MINIMIZING EMISSIONS AND EXPOSURE

A. What This Part Does, and the Two Questions It Asks of Each Characteristic [RFI Q5, Q7, Q8]

Part II establishes that the Secretary is directed to "plan, conduct, coordinate, and support research, development, training, and operational activities to minimize the emissions of and the exposure of people to, unnecessary electronic product radiation," 21 U.S.C. § 360ii(a)(2), and to "develop, test, and evaluate the effectiveness of procedures and techniques for minimizing exposure to electronic product radiation," § 360ii(a)(5). It establishes that neither paragraph has been performed as to the visible light emitted by light-emitting diode products. Part II.D and Part II.G set out each. What Part II does not do is say what performing them would consist of. This Part does.

A direction to minimize is empty until the dimensions in which minimization is to occur have been identified. Radiation is not a single quantity that can be turned down. An emission has a spectrum, a geometry and a time course, and a person receives it at a place, for a duration, from some number of sources at once, at an hour of the day, with eyes of a particular age. A program directed to minimize emissions and exposure has to say which of those it proposes to bound, and in what dimension each boundary runs. Sixteen characteristics are identified below. The Foundation does not represent the list as exhaustive, and identifies at subsection H the two it regards as most likely to require addition.

Of each characteristic this Part asks two questions and keeps them separate, because they have different answers and different evidentiary requirements.

The first is the boundary question. In what dimension, and of what shape, must a limit be drawn if emission or exposure in this characteristic is to be minimized? That question is about the form of a criterion and can often be answered now, from the physics and from the structure of the existing instruments, even where no number can be supplied.

The second is the necessity question. What makes emission in this dimension unnecessary? That question has an answer already settled in this comment, and it is not the answer the word carries in energy policy. Part II.D.2.a distinguishes the two senses. In energy policy the question is whether a component of the emission serves the purpose of the lamp, which is measured in lumens delivered for each watt consumed. In paragraph 360ii(a)(2) the question is whether it serves any purpose for the person exposed to it, in a subchapter whose stated purpose is to protect the public health and safety from electronic product radiation. Those two senses can point in opposite directions, and Part II.D.2.a describes a spectral region in which they appear to have done so. The second sense is the test applied throughout this Part.

One further feature of paragraph (a)(2) governs the whole of this Part and is easy to lose. Minimization is a direction of travel and not a ceiling. Part II.D.2 sets out the contrast with § 360kk, which authorizes standards to control emission and conditions their prescription on a determination of necessity; a ceiling is satisfied by remaining beneath it, and once a product is beneath it nothing further is required. Paragraph (a)(2) attaches no such condition and states no such threshold. The consequence for this Part is that a boundary responsive to paragraph (a)(2) need not be a maximum permitted value, and in several of the dimensions below it cannot be.

What this Part is not. It is not a proposed performance standard. The single standard the Foundation asks the Secretary to consider prescribing is at Part IX.I, it addresses one characteristic of the sixteen, and the reasons for asking for one rather than sixteen are stated there. This Part is not the scientific literature, which is Part V, and it does not restate it; each subsection below cites the subsection of Part V that carries the evidence. It is not the product landscape, which is Part VI. It is not the terminology and unit conventions, which are at the front matter, subsection G, where every quantity named below is defined with its unit and its counterpart in the vocabulary of this request for information. This Part is the statement of which characteristics a program discharging paragraphs (a)(2), (a)(4) and (a)(5) would have to reach, and of what the Foundation can and cannot presently say of each.

A statement about the state of the record, made once here rather than sixteen times below. For most of these characteristics the Foundation cannot state the number at which a boundary should be set. That is not a concession extracted from it; it is the premise of the request. The research paragraph (a)(2) directs and the evaluation paragraph (a)(4) directs are what produce such numbers, and neither has been conducted as to this radiation. Where a value can be stated, it is stated below with its source. Where it cannot, the subsection says so and identifies what would have to be done to obtain it. A table of sixteen characteristics with a number against each would make a stronger-looking submission and a less honest one, and the Department would be entitled to discount the whole of it on discovering the first invented figure.

B. The Three Families, the Shapes a Boundary Can Take, and Two Items That Are Not Characteristics of the Emission

a. The three families, and why the sixteen are grouped rather than listed

The front matter, subsection G, groups the quantities in which optical emission is specified into three families, and states that this comment uses that grouping throughout. Spectral characteristics describe what wavelengths are emitted and in what proportion. Spatial characteristics describe the geometry of the emission: the radiance of the emitting surface, its apparent size and the angle it subtends at the eye, the directionality of the beam, the uniformity of output across the surface, and the number, separation and arrangement of emitters within the field of view. Temporal characteristics describe how the output varies in time: modulation depth and waveform, drive and flash frequency, duty cycle, rise and fall times, the duration of a single exposure, and exposure accumulated across repetitions.

That grouping is load-bearing elsewhere. Part V organizes the literature by it. Part VI describes each product class by it. Part IX.G proposes it as the structure of the classification system Question 5 of this request for information asks about. The sixteen characteristics are therefore presented below within the three families rather than as a flat list, so that this Part and those three can be read against one another without translation.

The grouping also carries a substantive point that a flat list would obscure, and the front matter states it: a criterion that limits one family while leaving the others unconstrained does not protect against the effects described in Part VII. A limit on luminous output that permits any spectrum and any flash rate, or a limit on spectrum that permits any radiance, leaves the mechanism of injury untouched. Several of the characteristics below are individually unbounded in federal law while a neighboring characteristic of the same product is bounded precisely, and Part VI.U records which.

b. The shapes a boundary can take, of which a maximum is only one

An objection available against this Part is that the Foundation asks for numbers it cannot supply. In several of these dimensions the objection misdescribes what is being asked for, and the Foundation sets out the available shapes so that the request in each subsection can be read against the right one. Four recur.

A ceiling: a maximum permitted value of a quantity, which is the shape most federal optical criteria take where they exist at all. Part VI.U collects them.

A floor: a minimum permitted value, which is the shape required where the characteristic complained of is that a quantity is too small or too fast rather than too large. The transition time of a flashing lamp is the clearest instance, and subsection E.2 sets it out: the defect is that the transition is abrupt, so the boundary needed is a minimum duration. The angular size of the emitting surface is another, where the defect is concentration of a given output into a smaller source.

A required relationship between two quantities: a criterion that cannot be stated as a single number because the acceptable value of one quantity depends on another. Permitted luminance as a function of the angle from which the luminaire is seen, or as a function of the adaptation level of the surrounding field, is of this kind. So is permitted output as a function of the hour. A boundary of this shape is not less rigorous than a ceiling and is harder to evade, because it cannot be satisfied by relocating the emission into an unregulated variable.

A required measurement and disclosure: where no value can presently be set, the characteristic can still be required to be measured by a specified method and reported. That is not a limit and the Foundation does not present it as one. It is the step that makes the later setting of a limit possible, and in several dimensions below it is the most the present record supports. Part V.J.4 describes what is lost when a characteristic is reported only photometrically, and Part IX.C asks the Department to express its own measurements radiometrically.

c. Two of the sixteen are not characteristics of the emission, and the Foundation says so rather than absorbing them

Fourteen of the sixteen items are properties of the radiation or of the conditions under which it is received. Two are not, and placing them in a family would misdescribe them.

Special populations is a property of the person exposed rather than of the radiation. It does not take a boundary of its own. It determines, for every other boundary in this Part, the population against which that boundary must be set, and the question it raises is whose response a criterion is calibrated to. It is treated at subsection F for that reason, and Part V.C.5 and Part V.E supply the evidence that the relevant responses differ by age and by condition.

Luminaire shielding, diffusion, and a user control by which a person can extinguish a device's own indicator light are techniques for minimizing exposure rather than characteristics to be bounded. Techniques for minimizing exposure are the subject of paragraph 360ii(a)(5), which directs the Secretary to develop, test and evaluate their effectiveness, and evaluating the effectiveness of a technique is a different exercise from setting a limit on a quantity. Part II.G.3 records that the techniques exist and that what is absent is the federal evaluation of them. It is treated at subsection G.

The Foundation makes the distinction expressly because the two paragraphs of the statute are differently worded and a comment that ran them together would invite the answer that it had not read either with care. Both items belong in this Part. Neither belongs in a family.

C. Spectral Characteristics

One characteristic of the sixteen falls in this family. It is also the one on which the most federal activity has already occurred, in a program directed to a different end, and the one where the two senses of unnecessary described at Part II.D.2.a diverge most sharply.

1. Spectral distribution

The quantity, and the quantity it is not

The characteristic is spectral power distribution: radiant power as a function of wavelength across the emitted band, reported as spectral irradiance in watts per square meter per nanometer where

the measurement is taken at the exposed surface. The front matter, subsection G, defines it and gives its counterpart in the vocabulary of this request for information, which is emission spectrum together with operating frequency and bandwidth.

The quantity is not correlated color temperature. A single number describing the appearance of a source by reference to a blackbody radiator does not describe its spectral content, and two sources of identical correlated color temperature may differ substantially in short-wavelength output. Part V.B.3 sets out the limits of the descriptor and the quantities that do describe spectral content. The Foundation states this against its own customary vocabulary and against much public advocacy on this subject, including some of its own earlier advocacy, because a boundary written in correlated color temperature would be satisfiable without changing the emission that matters. Part II.H.14 records a federal facilities criterion presently written in that descriptor.

Why a boundary is needed in this dimension

Phosphor-converted white light-emitting diodes produce white light by exciting a phosphor with a short-wavelength emitter, and the resulting distribution carries a pronounced peak in the blue region together with a trough at the wavelengths the phosphor converts least efficiently. Part V.B.1 sets out the distribution and the respects in which it departs from the thermal and discharge sources the photometric conventions grew up around. Part V.B.5 sets out the sources under which human visual and circadian physiology developed.

Two of the four weighting functions that matter to this comment are greatest in the region where that peak sits. The blue-light hazard function, which describes the wavelength dependence of photochemical injury to the retina, and the melanopic action spectrum, which peaks at approximately 480 nanometers, both assign their highest weights there. The photopic luminous efficiency function does not; it is normalized to unity at 555 nanometers and falls steeply toward the short-wavelength end. The front matter, subsection G, sets out the consequence, which is that a photometric specification discounts by arithmetic the part of the spectrum this comment is concerned with. Part V.C.2 sets out the hazard assessment framework and where it stops. Part V.F sets out the circadian and neuroendocrine evidence.

The necessity test applied to this characteristic, and the answer the Foundation gives

Applying the test at Part II.D.2.a: does the short-wavelength content of this emission serve a purpose for the person exposed to it? The honest answer is that it does, in part and in some circumstances. Short wavelengths contribute to luminous output, they contribute disproportionately to the alerting and phase-setting response during the day, and a source with the short-wavelength component removed is not white. This is therefore not a dimension in which the Foundation contends the emission is unnecessary at every level. It is a dimension in which a part of the emission is unnecessary, and the part is identified by the purpose it serves for the person rather than by the lumens it contributes to the lamp.

Two components answer that description on the present record. The first is short-wavelength output in excess of what the visual task requires, which is a quantity that depends on the task and the adaptation level and not on the lamp. The second is short-wavelength output at hours when the alerting and phase-setting response is not wanted, which is a function of the clock rather than of the emission, and which subsection E.4 treats as a characteristic in its own right. Neither is a maximum permitted value. Both are boundaries of the relationship shape described at subsection B.

A consequence the Foundation reports against its own position

A spectral boundary expressed solely as a cap on short-wavelength content would be incomplete, and may be wrong in one respect. Part V.B.6 sets out published work, several studies by Jeffery and colleagues and one of them funded by the Department of Energy, reporting a physiological function in human subjects for the long-wavelength component that the federal efficacy standards described at Part IV.G removed from American general illumination. If that work is sound, the dimension

requires a floor on long-wavelength content as well as a boundary on short-wavelength content, and the one federal program that has addressed the spectral composition of American lighting removed the part that may have been necessary and retained the part that may be unnecessary in the sense this subchapter uses. The Foundation does not assert that this is settled. Part V.A.3 places it among the open questions. It states the consequence here because a request for a cap alone, if that work is sound, would ask the Department for half of a criterion.

What can be specified now, and what cannot

The Foundation cannot state the numerical limit. What it can state is that limits of this kind are writable, because they have been written. Part V.B.3.e sets out a regional instrument that regulates a named spectral index and states its limits as plain numbers by zone. And the precedent for a radiometric lighting criterion exists inside this subchapter: 21 C.F.R. § 1040.30, within part 1040, titled Performance Standards for Light-Emitting Products, prescribes a standard for high-intensity mercury vapor discharge lamps that is not written in photometric terms at all, and addresses shortwave ultraviolet emission instead. The Department has already written a lighting standard around a radiometric quantity that luminous output does not describe.

What the Foundation asks in this dimension is accordingly the measurement-and-disclosure boundary first and the relationship boundary when the research supports it: that spectral power distribution be measured by a specified method and reported with the spectral data from which any weighted quantity is derived, which is the request at Part IX.C, and that no criterion intended to control a response other than daytime visual response be written in a quantity weighted for daytime visual response.

D. Spatial Characteristics

Nine of the sixteen characteristics fall in this family. Five of the nine are the quantities in which optical emission is conventionally specified and regulated, and the Foundation treats them separately because they are separately named in the request for information and because the relationship among them is the single most important structural fact in this Part. It is set out first, before the individual subsections, because each of them depends on it.

The five quantities are not independent, and a boundary on one does not constrain the others

The front matter, subsection G, defines each quantity with its unit. Taken together they divide along two axes. Radiance and luminance are referred to the emitting surface: power, or photometrically weighted power, per unit area of source per unit solid angle. Irradiance and illuminance are referred to the exposed surface: power, or weighted power, arriving per unit area. Luminous intensity is referred to direction: weighted power emitted per unit solid angle, without reference to the area it came from or the area it lands on. And within each pair the distinction is the photopic weighting: luminance is radiance weighted by the photopic luminous efficiency function, and illuminance is irradiance weighted by the same function.

The consequence is arithmetic and it is the reason this comment exists. Luminous intensity is luminance multiplied by the apparent area of the emitting surface. A limit expressed in candela is therefore satisfied by any combination of luminance and emitting area whose product falls beneath it. Hold the candela figure constant and reduce the area, and luminance rises without limit, because nothing in the criterion mentions area. The emission a person actually receives at the retina is governed by the luminance of the source and the angle it subtends, not by the total output per solid angle, and Part V.B.2 sets out the optics and the point at which the governing regime changes.

That is not a hypothetical evasion. It is what happened. Federal Motor Vehicle Safety Standard No. 108 specifies lamp output in candela, as roadway lighting practice is expressed in lux and in candela per square meter. Those conventions were written when the available sources were incandescent filaments and gas discharges, whose emitting surfaces were large and diffuse, and for such sources a

candela limit implied a bounded luminance because the area could not be reduced much. The light-emitting diode removed that implication. It emits from a small, flat, highly directional surface, so for a given luminous output the source is smaller and the emission more concentrated, and the radiance at the source and the irradiance at the retina can be far higher at equal measured lumens. The front matter, subsection G, states this as a limitation of photometric specification. Stated as a regulatory fact it is sharper: a technology change moved the emission into a variable that the existing criteria do not mention, and the criteria were not revised.

The Foundation draws one conclusion and declines a second. The conclusion is that a boundary in this family must reach luminance or radiance, and that a criterion expressed only in luminous intensity or only in illuminance cannot do the work, whatever number is chosen. The conclusion it declines to draw is that the existing criteria were evaded deliberately. Nothing in the record before the Foundation supports that and it is unnecessary to the argument. A criterion written for one source geometry does not constrain a different one, and that is true whether or not anyone intended it.

Where federal law speaks to these quantities at all, it overwhelmingly speaks in minima

The Foundation examined the federal instruments that state numerical values for the optical output of the product classes at Part VI. The pattern is consistent and, so far as the Foundation is aware, has not previously been collected. Part VI.U tabulates it by class.

Locomotive lighting is specified at 49 C.F.R. § 229.125. A headlight must produce a figure of at least 200,000 candela and illuminate a person at 800 feet; auxiliary lights must each produce at least 200,000 candela, or meet stated minima off axis. The section states no maximum for any of these quantities. Part VI.Q sets out the provision and the rulemaking in which a maximum was raised and not adopted.

Marine navigation lights are specified at 33 C.F.R. § 84.14, which gives a formula for minimum luminous intensity as a function of required visibility range and a table of the resulting values: 0.9 candela for one nautical mile, rising to 94 candela for six. These are minima. The international instrument from which the domestic rule derives contains, in a note to its annex, the statement that the maximum luminous intensity of navigation lights should be limited to avoid undue glare. That statement names no number, is hortatory in form, and was not carried into § 84.14. Part VI.Q sets out the comparison and the four qualifications the Foundation attaches to it.

Lighting on bicycles, scooters and personal mobility devices is the extreme case. The federal regulation for bicycles, 16 C.F.R. § 1512.16, requires reflective devices and does not require a lamp at all. No photometric limit of any kind appears in the part. Part VI.N sets out the position.

The Foundation states the counter-example because it is the strongest evidence available that a boundary of this kind is writable, and it comes from a federal agency rather than from this commenter. Aviation obstruction lighting is specified in Federal Aviation Administration Advisory Circular 150/5345-43J, which states intensities as nominal values with tolerance bands rather than as floors: the L-864 red flashing beacon at a peak of 2,000 candela with a tolerance of twenty-five percent and a minimum of 750, and the L-865 and L-866 white beacons at 20,000 candela by day, 20,000 at twilight and 2,000 at night. More to the present point, the same document limits stray light to a maximum of three percent of peak intensity, which is a boundary on spatial distribution and not merely on magnitude. Part VI.O sets out the specifications and the respects in which an advisory circular differs from a regulation, which the Foundation does not elide.

Two observations follow, and the Foundation separates them because the first is a fact and the second is an inference. The fact is that the federal numbers governing the optical output of these product classes are, with the aviation exception, minima: they establish that a lamp is bright enough and are silent as to whether it is too bright. The inference is that this is what one would expect of instruments written to secure conspicuity and visibility, by agencies whose statutory missions are

transportation safety, at a time when the available sources made excess difficult to achieve. The agency with the radiation-health authority, whose criterion would have run the other way, has prescribed nothing. Part II.C.3 records the absence and Part IV sets out what the agency was told.

1. Spatial distribution of the emission

The quantity

The characteristic is the distribution of emitted power across direction and across the emitting surface: the directionality of the beam, the uniformity of output across the aperture, the angle the source subtends at the eye of a person at a stated position, and the proportion of output emitted into directions the application does not require. Part V.B.8 sets out the characteristic and Part V.B.2 the optics of non-uniform emission from a small aperture.

Why a boundary is needed in this dimension

Spatial distribution is the dimension in which the greatest part of the emission from these products is, on the Foundation's reading of the statute, unnecessary in the fullest sense available: emitted into directions where it performs no function for anyone and reaches people who are not the intended beneficiaries of the installation. Light emitted above the horizontal from a roadway luminaire illuminates no roadway. Light emitted into a bedroom window from a parking area illuminates no parking area. Part II.D.3 establishes that radiation of this kind is unnecessary electronic product radiation within paragraph (a)(2), that it does not leave, and that it reaches people. Part VI.P treats light trespass as a product class characteristic.

The second reason is that spatial distribution determines what the other eight characteristics in this family amount to in practice. The same luminous intensity delivered as a wide diffuse field and as a narrow collimated beam produce different retinal irradiance, different disability glare and different discomfort, and Part V.C.3 and Part V.C.4 set out the two glare mechanisms and their measurement.

The necessity test applied

Applying the test at Part II.D.2.a: does emission in this direction serve a purpose for the person who receives it? In this dimension the test is unusually tractable, because the answer can often be determined from the geometry of the installation without any physiological evidence at all. Output directed away from the surface or task the installation exists to serve is, by the terms of the installation, serving no purpose for anyone; whether it also injures the person it reaches is the separate question that paragraph (a)(2) does not ask. This is the clearest instance in the Part of radiation that is unnecessary without any demonstration of hazard.

The shape of the boundary, and what can be specified now

The boundary in this dimension is not a magnitude at all. It is a distribution: the proportion of emitted output permitted above a stated angle, or outside a stated solid angle referred to the installation geometry. Criteria of exactly this form exist in lighting practice and in state and local instruments, and the aviation stray light provision described above is a federal instance. The Foundation does not supply the numerical proportion. It identifies the form, states that the form is in use, and asks that the characteristic be measured and reported, which is the disclosure boundary described at subsection B.

The Foundation notes one limit of its own position. A distribution criterion constrains where output goes and not how concentrated it is at the source, so it does not reach the luminance problem described in the family introduction. The two boundaries are complements rather than alternatives, and a program that adopted either alone would leave the other mechanism untouched.

2. Radiance

The quantity

Radiance is radiant power per unit area of source per unit solid angle, in watts per square meter per steradian. The front matter, subsection G, defines it and records that it is the physical basis of what is perceived as brightness, and that it has no single counterpart in the vocabulary of this request for information; the nearest equivalent is power density referred to the emitting aperture rather than to the exposed surface.

Why this is the quantity the Foundation would bound first

Radiance is conserved along a ray through a lossless optical system. The consequence for exposure is that the radiance of the image formed on the retina is determined by the radiance of the source, and is not reduced by moving away from it. Distance reduces the angle the source subtends, and therefore the retinal area over which the energy is deposited, but it does not reduce the irradiance at that area. Part V.B.2 sets out the optics. Part VI.J.3 applies it to a product class and states the consequence that distance does not resolve the problem.

That is why a boundary on radiance does work that no boundary on a surface-referred quantity can do. Illuminance and irradiance at a receiving plane fall with the square of distance, so a criterion written in those quantities is satisfied by separation. Radiance is not, and a criterion written in radiance therefore constrains the source itself.

The necessity test applied, and the one weighted form that matters most

Applying the test: does radiance in excess of some value serve a purpose for the person exposed? Beyond the level required to make the source and the task visible at the adaptation level obtaining, the Foundation is aware of no purpose it serves for that person, and Part V.C.3 and Part V.C.4 set out two mechanisms by which it works against the purpose of the installation: disability glare, which reduces what the person can see, and discomfort glare, which does not.

The weighted form of this quantity is the one in which the hazard literature is written. Blue-light hazard weighted radiance, in the same unit, weights radiance by the function describing the wavelength dependence of photochemical retinal injury, and the front matter, subsection G, records that it stands to radiance as specific absorption rate stands to incident power density in the radiofrequency case. Part V.C.2 sets out the assessment framework built on it and the point at which that framework stops, which is an exposure duration of ten thousand seconds. A boundary on weighted radiance is the one criterion in this Part for which an internationally used quantity, a measurement method and a weighting function all already exist.

What can be specified now, and what cannot

The Foundation cannot state the value. It states three things that bear on the Department's ability to arrive at one. The quantity is measurable with instruments presently available, which Part V.J.1 describes. The weighted form is already the subject of a consensus assessment framework and of a federal classification practice for other emitting products. And the existing framework was built for occupational and short-duration exposure, so the question the Department would have to answer is not how to measure the quantity but what value is appropriate for involuntary, repeated, lifelong exposure of a general population including the groups at subsection F. That question is the research paragraph (a)(2) directs.

3. Luminance

The quantity, and its relation to the one before it

Luminance is radiance weighted by the photopic luminous efficiency function, in candela per square meter. The front matter, subsection G, records that it is a biologically weighted exposure quantity standing to radiance as specific absorption rate stands to incident power density. It is the quantity in

which brightness is conventionally specified and procured, and the quantity in which most of the literature at Part V and most of the Foundation's own advocacy is expressed.

Why the Foundation treats it separately, and the concession it makes in doing so

The Foundation treats luminance as a characteristic requiring a boundary notwithstanding that it has just explained why the photopic weighting is the wrong instrument for several of the effects at issue. The reason is practical and it is stated rather than concealed. Luminance is the quantity in which existing criteria are written, in which products are specified and purchased, in which public entities conducting the self-evaluation described at Part VIII.C would have to work, and in which the only federal facilities criterion the Foundation has located expresses a limit at all. A boundary in luminance is therefore immediately usable in a way that a boundary in weighted radiance is not, and the Foundation would rather have a usable criterion in an imperfect quantity than an exact criterion that no procurement officer can apply.

The concession that accompanies that position is set out at the front matter, subsection G, and the Foundation repeats it here so that this subsection is not read as abandoning it: two sources of identical measured luminance may differ substantially in short-wavelength radiance, and a luminance criterion cannot distinguish them. A luminance boundary is a necessary component of a criterion in this family and not a sufficient one.

The one federal numerical luminance limit the Foundation has located, and what it governs

Unified Facilities Criteria 3-530-01, which governs interior and exterior lighting design for Department of Defense facilities, states a luminance limit for luminaires in the zone from 45 to 90 degrees from nadir, expressed in candela per square foot, together with a limit on the Unified Glare Rating. Part II.H.14 sets out the document, the criterion, and the respects in which a facilities design criterion differs from a performance standard binding a manufacturer. The Foundation draws attention to its form rather than its value: it is an angle-dependent luminance limit, which is the relationship shape described at subsection B, and it was written by a federal department for its own buildings. The Department of Health and Human Services has written no such criterion for anyone.

What can be specified now, and what cannot

The Foundation cannot state the general value, and states one reason it cannot that is specific to this quantity. The luminance at which a source becomes uncomfortable or disabling is not a constant; it depends on the adaptation state of the observer, which depends on the luminance of the surrounding field. The same luminaire that is unremarkable at midday is disabling on an unlit road at night. A single number cannot express that, which is why the boundary in this dimension takes the relationship shape, and why subsection E.4 treats the hour of use as a characteristic in its own right. Part V.C.3 sets out the mechanism through which adaptation operates.

4. Luminous intensity

The quantity

Luminous intensity is luminous power emitted per unit solid angle in a given direction, in candela. The front matter, subsection G, gives its counterpart in the vocabulary of this request for information as effective isotropic radiated power together with antenna gain and beamforming, both describing concentration of emission into a direction rather than total output.

Why it is nonetheless the quantity most federal instruments use

This is the quantity in which the federal instruments collected at Part VI.U are predominantly written. Federal Motor Vehicle Safety Standard No. 108 specifies lamp output in candela. The locomotive provision at 49 C.F.R. § 229.125 is written in candela. The marine table at 33 C.F.R. § 84.14 is written in candela. The aviation obstruction lighting intensities are written in candela. If a

single quantity can be said to be the regulatory currency of optical emission in the United States, it is this one.

The Foundation accordingly does not ask the Department to abandon it, and repeats that it does not ask for existing standards to be re-specified; the front matter, subsection G, states that position. What it asks is that the limitation of the quantity be recognized where a criterion is intended to control something other than total directional output, because the arithmetic set out in the family introduction means that a candela limit alone leaves luminance unconstrained.

The necessity test applied, and the direction in which the existing numbers run

Applying the test: the honest answer in this dimension is that luminous intensity sufficient for the application serves a purpose for the person exposed, because conspicuity is itself a safety function, and the Foundation has never contended otherwise. Part VI.C treats the class in which that function is strongest. What the Foundation contends is that intensity in excess of the amount the application requires serves no such purpose, and that the federal instruments establish the floor of that range and not the ceiling. A locomotive auxiliary light producing at least 200,000 candela complies with the regulation at 200,000 and complies equally at any larger figure.

The Foundation adds a qualification against itself. It has not established, for any product class, the intensity at which the application's own requirement is satisfied, and so cannot say by how much any particular installation exceeds it. Establishing that for a class is an exercise in the evaluation of techniques and conditions that paragraphs (a)(4) and (a)(5) direct, and Part IX.C asks for it.

What can be specified now

In this dimension, more than in any other in this family, the boundary the Foundation asks for is the pairing rather than the number: that wherever a criterion states a minimum luminous intensity for a safety function, the instrument also state a maximum, and that the two be set by reference to the same application requirement. The Foundation is aware of one federal instrument in which an upper bound of this kind is expressed, at Advisory Circular 150/5345-43J, and of one hortatory international statement to the same effect in the marine annex described above. Both are described at Part VI.O and Part VI.Q. Neither was written by this Department.

5. Illuminance

The quantity

Illuminance is irradiance weighted by the photopic luminous efficiency function, in lux: light arriving at a surface as the daytime visual system responds to it. The front matter, subsection G, gives its counterpart in the vocabulary of this request for information as power density adjusted for biological response.

Why a boundary is needed, and the respect in which this quantity is the weakest in the family

Illuminance is the quantity in which lighting is specified for the surfaces it is meant to serve, and in which nearly every minimum lighting requirement in American practice is written: roadway lighting levels, workplace lighting levels, and the illuminance provisions of the accessibility framework. Part VIII.D.4 sets out the one place in which that framework states an optical number.

The Foundation states plainly that this is the weakest of the five quantities for its purposes, and says why rather than leaving the Department to notice it. Illuminance is referred to the receiving surface, so it falls with the square of distance from the source, and a criterion written in it is satisfied by separation without any change to the emitting product. It also discards, by the arithmetic the front matter sets out, the spectral information that the photochemical and circadian questions require. A person standing beneath a luminaire receives an illuminance at the pavement that is unrelated to the luminance of the aperture they are looking at, and it is the latter that produces the glare described at Part V.C.3 and Part V.C.4.

The one dimension in which it is the right quantity

There is a dimension in which illuminance is the correct quantity and the Foundation identifies it: light trespass, where the question is precisely how much light is arriving at a surface that nobody intended to illuminate. Vertical illuminance measured at a property boundary is a direct measure of that, it is the quantity in which such criteria are in fact written, and the criteria are maxima rather than minima. Part VI.P treats the class. The Foundation records that the instruments expressing those maxima are municipal and state rather than federal, which is the condition Part VIII.E.2 and Part VIII.E.3 describe as producing inconsistent determinations and duplicated cost across thousands of public entities.

What can be specified now

The Foundation asks for no new federal illuminance maximum of general application and does not contend the record supports one. It asks that where this Department or any other states a minimum illuminance for a task, the instrument state the condition it assumes about the luminance of the sources used to achieve it, because the same illuminance at a surface can be produced by a diffuse installation and by a small number of intense apertures, and the two are not equivalent for the person in the space. That is the condition-stating request made at Part IX.I in the temporal dimension, applied here.

6. Irradiance

The quantity, and the fact about it that is most consequential for this proceeding [RFI Q5]

Irradiance is radiant power arriving per unit area at a surface, in watts per square meter. The front matter, subsection G, states its counterpart in the vocabulary of this request for information, and the statement is not an analogy: irradiance and power density are the same quantity, in the same unit, differing only in the part of the spectrum measured.

The Foundation regards that identity as the single most important structural fact it can place before this Department in this proceeding, and sets out the reason at the length it deserves. This request for information is addressed principally to radiofrequency and electromagnetic field exposure. Radiofrequency exposure limits in the United States are expressed in power density, in watts per square meter or milliwatts per square centimeter. Optical exposure can be expressed in the identical quantity and unit. The two subject matters are therefore not analogous, not comparable, and not parallel. They are continuous. A program that measured radiofrequency exposure in watts per square meter and declined to measure optical exposure at all is not drawing a line between two different kinds of thing; it is measuring one part of a single quantity and not the other, within a statutory definition at § 360hh(1)(A) that Part II.B establishes reaches both.

Part V.J.5 develops the consequence for the presentation of evidence, and Part IX.C asks the Department to express its own studies in radiometric terms, which would render them directly comparable with the radiofrequency exposure literature this request is principally addressed to.

Why a boundary is needed in this dimension

Irradiance at the cornea, and the retinal irradiance that follows from it once the eye's optics are accounted for, is the quantity in which photochemical and thermal injury thresholds are expressed. Part V.C.1 sets out the injury and how it is recognized, and Part V.C.2 the assessment framework. It is also the quantity in which the Department has already written performance standards for other electronic products emitting optical radiation, which Part II.C.2 collects.

The necessity test applied

Applying the test: irradiance in excess of what the visual task requires at the adaptation level obtaining serves no purpose for the person exposed, and the Foundation is aware of no contention to the contrary. The difficulty in this dimension is not the test but the measurement position.

Irradiance is referred to a surface, so the value depends entirely on where the surface is placed, and a criterion is uninterpretable without a stated measurement geometry. Part V.J.2 sets out the difference between laboratory measurement and real-world exposure conditions.

What can be specified now, and what cannot

The Foundation cannot state the value. It states that the quantity is the one in which the Department's existing optical performance standards are written, that it is the same quantity in which the radiofrequency limits this request for information concerns are written, and that the measurement geometry is the question that would have to be settled first. It asks for the measurement and disclosure boundary described at subsection B: that optical emission be reported in this quantity, at a stated geometry, with the spectral distribution from which any weighted figure is derived.

7. Glare rating

Two mechanisms, which require separate treatment and are routinely run together

Glare is not one phenomenon and the distinction matters to what a boundary can be written against. Disability glare is a reduction in visual performance produced by light scattered within the eye, which lays a veiling luminance over the retinal image and reduces contrast. It is measurable, it has an established physical model, and it does not depend on what the observer reports. Part V.C.3 sets out the mechanism, veiling luminance, and intraocular straylight. Discomfort glare is the sensation of aversion, pain or unwillingness to look, and it can occur at levels that produce no measurable loss of visual performance at all. Part V.C.4 sets it out and Part V.C.4 also sets out its measurement.

The Foundation emphasizes that the second is not a lesser form of the first. A criterion that bounded only disability glare would permit sources that are painful to look at provided they do not measurably degrade acuity, and the reports at Part VII describe aversion, pain and flight far more often than they describe loss of acuity.

The metric in federal use, and the objection to it that the Foundation must state

The metric for discomfort glare in general use is the Unified Glare Rating, and it is in federal use: Unified Facilities Criteria 3-530-01 states a limit on it for Department of Defense facilities, as Part II.H.14 records. The existence of that limit is useful to the Foundation's argument, because it shows a federal department bounding discomfort glare by number in its own buildings.

The objection, which the Foundation states because the comment is stronger for meeting it, is that the metric's own validity conditions may exclude the sources at issue. Part V.C.4 sets out the validity domain and the respects in which it fails for this technology, which concern small, high-luminance, non-uniform apertures of the kind described at Part V.B.2. A rating formula derived from and validated against large diffuse luminaires is being applied to sources that are neither. The Foundation does not contend the metric is useless. It contends that a federal criterion that adopted it without addressing its validity domain for these sources would be adopting a number whose applicability has not been established, and that establishing it is work paragraph (a)(4) directs.

The necessity test applied

Applying the test to this characteristic produces the clearest answer in the Part. Glare, in both senses, is by definition emission that works against the purpose of the installation: disability glare reduces what the person can see, which is the opposite of what lighting is for, and discomfort glare imposes a cost on the person while delivering them no benefit. There is no construction on which glare serves a purpose for the person who receives it. It is unnecessary electronic product radiation in the fullest sense the term carries at Part II.D.2.

What can be specified now, and what cannot

The Foundation cannot state a numerical rating limit of general application, and identifies the two steps that would have to precede one: establishing the validity of an existing discomfort metric for small high-luminance sources, or developing one that is valid for them; and determining the value appropriate to a general population including the groups at subsection F, rather than to the healthy adult observers from whom the existing formulas were derived. Part V.C.5 sets out the ocular modifiers that make the second step necessary.

8. Number of emitters present during a single exposure [RFI Q15]

The characteristic, and why the Foundation places it first in importance

The characteristic is how many separate sources are present in the field of view at one time, their angular separation, whether their outputs are synchronized, and the composite waveform and summed irradiance they produce at the eye. The front matter, subsection G, defines it and records that Question 15 of this request for information asks for evidence on exactly these characteristics in the wireless context: antenna density, cumulative neighborhood exposure, and simultaneous exposure to multiple sources.

Part IX.I.3.b states this as the matter the Foundation puts first in importance among those a performance standard would have to settle, and this subsection states why it is a characteristic requiring a boundary and not merely a measurement problem. Every other characteristic in this Part is a property of one product. This one is a property of the environment a person stands in, and no amount of care about individual products reaches it.

The statutory hook, which is in the text of the paragraph itself

The Foundation rests this characteristic on a feature of paragraph (a)(2) that is easy to read past. The paragraph directs activities to minimize "the emissions of and the exposure of people to" unnecessary electronic product radiation. It names two objects, not one. Emissions are a property of products. Exposure is a property of people. A paragraph that named only emissions could be answered product by product; a paragraph that names exposure separately cannot, because the exposure of a person standing in a street is the sum of what reaches them from every source in it.

That distinction also marks the limit of what a performance standard can do, and the Foundation states the limit rather than overclaiming. A standard prescribed under 21 U.S.C. § 360kk bounds what a product emits. It does not bound how many compliant products a person encounters at once. Paragraph (a)(2) is not so confined, which is why the request the Foundation makes in this dimension is addressed to the research, evaluation and liaison paragraphs rather than to the standard-setting one. Part IX.I.3.e sets out the three things it asks and the limit of what it can ask.

Why the existing literature cannot answer it

Part V.J.3 establishes the position: the experimental literature on optical exposure is, with very few exceptions, built on single-emitter designs, in which one source is presented to one observer under controlled conditions. That design is appropriate to the questions it was built for and it cannot answer this one. The scientific committee of the European Commission has identified the same gap, and Part V.J.3 records what it said.

A consequence the Foundation reports against its own proposals

The Foundation recommends a radiance boundary at subsection D.2 and in several places in this comment. It records here that a radiance boundary does not aggregate in any simple way across sources, because what matters at the retina when many small sources are present is the summed irradiance and the geometry of their arrangement rather than the radiance of any one of them. Part IX.I.3.d states the same consequence against the same proposal. A criterion that bounded every individual product correctly could still permit an environment that no one would defend, and the Foundation does not know how to write a product standard that prevents that.

What can be specified now

Nothing numerical. What can be specified is the condition and the research: that any criterion stated for an individual product state on its face the assumption it makes about the number of such products in the field of view, so that the assumption is visible rather than implicit; and that the research directed by paragraph (a)(2) and the evaluation directed by paragraph (a)(4) include the aggregate case rather than the single-source case alone. Part IX.I.3.e states both requests in the form in which the Foundation makes them.

9. Movement of the source through space

The characteristic, and the reason it belongs in this family rather than the next

The characteristic is relative motion between the source and the observer: a headlamp approaching on a curve, a beacon rotating, a beam sweeping, an aircraft or an unmanned aircraft crossing the field of view, a vehicle-mounted lamp passing at speed. The Foundation places it in the spatial family because the quantity that changes is a geometric one, the angular position of the source relative to the line of sight, and because the rate at which it changes is determined by the installation and the encounter rather than by the driver circuit.

The analytical point, which is that movement converts a spatial characteristic into a temporal one at the retina

A source that moves across the field of view deposits its energy on successive regions of the retina, and any given region therefore receives a rising and falling irradiance even though the output of the source is perfectly steady. Movement is in that sense a mechanism for generating temporal modulation at the retina out of a spatially non-uniform but temporally constant emission. The converse holds and the comment already relies on it: Part V.D.2 sets out the phantom-array effect, in which movement of the eye across a temporally modulated source produces a spatial pattern. The two are the same coupling observed from the two ends.

The consequence for a criterion is that neither family can be bounded in isolation. A boundary on modulation that assumed a stationary source and a stationary eye would not reach the retinal modulation produced by relative motion, and a boundary on spatial non-uniformity that assumed a static encounter would not reach what that non-uniformity does when it crosses a retina at speed. This is the clearest instance in the Part of the point made at subsection B: a criterion addressing one family while leaving another unconstrained does not reach the mechanism.

The necessity test applied, and the product classes in which the question is live

Applying the test: motion itself is not emission and cannot be unnecessary. What the test reaches is emission whose characteristics were chosen without regard to the motion under which it will be encountered, and the Foundation identifies three classes in which that is presently the case. Part VI.B treats motor vehicle lighting, where the encounter is by definition in relative motion and where Part II.H.5 records the proceeding now open at the Department of Transportation. Part VI.O treats aircraft, drone and obstruction lighting. Part VI.K treats entertainment lighting.

The unmanned aircraft case is the one in which the gap is widest, and Part II.H.7 sets it out: high luminance, instantaneous transitions, motion, and large numbers of independently moving emitters in open airspace above a populated area, under a federal authorization that addresses the audience of the performance and is silent as to everybody else beneath it. Part VI.O records what the federal position is.

What can be specified now

The Foundation cannot state a limit on angular velocity and does not ask for one; the rate at which a source crosses a field of view is not a property of the product that any manufacturer controls. What it asks is that the condition be stated: that where a criterion is set for a lamp intended to be encountered in relative motion, the instrument state the encounter geometry and speed it assumes,

and that the evaluation directed by paragraph (a)(4) be conducted under the conditions of motion in which the product is actually met rather than under static laboratory presentation. Part V.J.2 sets out the distinction between the two.

E. Temporal Characteristics

Four of the sixteen characteristics fall in this family. It differs from the other two in a way that governs everything below and that Part IX.I.2 sets out at length: this is the one family in which the quantities are settled, a consensus body has already written numerical criteria in mandatory language, the effects are documented in human beings at frequencies human beings cannot perceive, and the Department has prescribed a standard for an optical emission characteristic before. It is for that reason the only family in which the Foundation asks the Secretary to consider prescribing a performance standard now, and the request is at Part IX.I rather than here.

One general finding applies across the family and the Foundation states it here rather than four times below, because it is the most useful thing it has to say about the time domain. Every federal instrument the Foundation has examined that addresses the temporal behavior of an optical emission specifies a schedule and none specifies a shape. Schedule means how often and for how long: flash rate, duty cycle, period. Shape means how the output gets from one state to the other: rise time, decay time, waveform. Subsection 2 sets out the evidence for that finding and the single apparent exception, which runs the opposite way from what would be needed.

1. Temporal characteristics of the output

The quantities

The front matter, subsection G, defines five. Percent flicker, or modulation depth, is the difference between maximum and minimum output over a cycle as a proportion of their sum. Flicker index is the proportion of the waveform lying above its own mean, and is sensitive to waveform shape as percent flicker is not. Pulse-width modulation frequency is the repetition rate at which a driver switches the emitter on and off. Duty cycle is the proportion of each period during which the emitter is on. Waveform is the shape of the output over the period, of which the transition times treated at subsection 2 are one aspect. Part V.D.1 sets out pulse-width modulation, modulation depth and frequency as the literature treats them.

Why a boundary is needed in this dimension

Light-emitting diodes do not dim by reducing current in the way a filament dims by cooling. They are predominantly dimmed and regulated by being switched on and off rapidly, so modulation is not an incidental defect of particular products but a consequence of the ordinary method of driving the technology. Part V.B.7 sets out the temporal characteristics of the emission and Part V.D the literature on effect.

The effects are documented at frequencies above those at which modulation is visible as flicker, which is the feature of this dimension that distinguishes it from the others in this Part. Part V.D.2 sets out the stroboscopic and phantom-array effects, Part V.D.4 flicker in vehicle lamps, warning beacons and displays, Part V.D.5 interference with clinical measurement, and Part V.E.1 photosensitive epilepsy and flash-rate thresholds. A person cannot avoid an exposure they cannot perceive, which is the respect in which this characteristic most resembles the radiofrequency exposures this request for information is principally addressed to.

The necessity test applied

Applying the test at Part II.D.2.a: does modulation serve a purpose for the person exposed? In the general case it does not. Modulation is a property of the driver circuit, adopted for reasons of cost, efficiency and dimming control, and the person exposed receives no benefit from the output being delivered in pulses rather than continuously. The Foundation identifies the exception rather than waiting to be shown it: where modulation is the signal, as in a flashing warning lamp or a

communication function, the modulation serves a purpose, and subsection 2 and Part VI.C treat that case.

What can be specified now, and the standing of the instrument that would supply it

This is the one dimension in this Part in which numerical criteria already exist in mandatory language from a recognized body. IEEE Std 1789-2015 states them. Part V.D.3 sets out what they are and the Foundation relies on them in this comment in a substantial number of places.

The Foundation states the objection to that reliance in its strongest form before answering it, and Part V.D.3 does the same. IEEE Std 1789-2015 is a recommended practice rather than a standard, which is a distinction the issuing body itself draws. Its status is recorded as inactive-reserved, with an inactivation date in March 2026. A commenter who asked a federal agency to adopt the numerical content of an inactive recommended practice without saying so would be concealing something material.

The answer the Foundation gives is set out at Part V.D.3 and at Part IX.I.2 and is not repeated here beyond its substance: the criteria were derived from the published human-response literature rather than from the standing of the document that collects them, the derivation does not expire when a document is reclassified, and the appropriate federal response to the lapse of the only numerical guidance in existence is not to treat the question as settled but to supply what the lapse leaves absent. The Foundation asks the Department to search for a successor instrument and to state whether one exists, which is a question it is better placed than the Foundation to answer.

2. Rise and decay times of flashing lamps

The characteristic, stated precisely, because the general word flicker does not reach it

The characteristic is the time the output takes to travel between its off state and its on state, and back: the rise time and the decay time of a single transition. It is a property of the shape of the waveform and not of its schedule. Two lamps flashing at the same rate, with the same duty cycle and the same peak intensity, can differ entirely in this characteristic, and no quantity in the preceding subsection distinguishes them. Percent flicker is computed from maximum and minimum output and is indifferent to how the output travels between them. Flicker index is sensitive to waveform and is the nearest available quantity, and it is not a measure of transition time either.

Why this characteristic is the one most clearly lost in the conversion, and what was lost with it

An incandescent lamp has thermal mass. Its filament takes time to heat and time to cool, so its output rises and falls along a curve whose duration is a physical property of the filament and cannot be designed out. A light-emitting diode has no thermal mass in the optical path and switches in microseconds. When a flashing or switched application was converted from one source to the other, the schedule was preserved because the schedule was specified, and the transition was not, because it had never needed to be specified. It had been supplied by the physics of the source.

That is the general form of a structural precedent this comment establishes elsewhere, and the Foundation draws the comparison because it is exact rather than rhetorical. Part VI.R.4 sets out a federal report concerning traffic signals in which the property lost in the conversion was heat at the lens: incandescent signals melted accumulated snow, light-emitting diode signals do not, and the specifications did not address the question because nothing had ever required them to. The agency identified the loss after the conversion. Transition time is a property of the same kind, lost in the same way, and the Foundation submits it has not yet been identified by anyone with authority over the products.

The evidence for the finding that no federal instrument specifies transition time

The Foundation examined the instruments governing the product classes in which flashing is prescribed, and Part VI.R sets out the examination for traffic signals in detail. The results are these. The Manual on Uniform Traffic Control Devices, incorporated by reference at 23 C.F.R. § 655.601, contains in its Part 4 no provision addressing rise time, decay time, turn-on time, turn-off time, waveform, modulation or duty cycle expressed in time units. The pedestrian signal provision specifies a flash rate and the proportion of the cycle during which the indication is displayed, which is a schedule and a duty cycle. The locomotive provision at 49 C.F.R. § 229.125(e) permits auxiliary lights to flash and states a permitted band of flashes per minute, which is a schedule. The aviation specifications state flash rates in flashes per minute, which is a schedule. In none of them does the shape of the transition appear.

One further instrument belongs in that list and is treated separately because the Foundation asks something different about it. The accessibility specification for a visible alarm appliance, set out at Part VIII.D.4, bounds the flash rate in both directions, the pulse duration and the duty cycle, and does not bound the transition. It is the one place in federal practice where the schedule of a deliberate flash is specified closely and its shape not at all, and Part IX.I.5 sets out the question that follows: whether the abruptness is necessary to the notification function, which is a question for paragraph 360ii(a)(5) rather than for a performance standard.

The single apparent exception is instructive and the Foundation sets it out because it runs the opposite way from what would be needed. A state department of transportation specification for light-emitting diode signal modules states a transition-time requirement in milliseconds. It is expressed as a ceiling: the turn-on and turn-off time must be less than the stated figure. A ceiling on transition time forbids slowness. It is a requirement that the lamp switch quickly, which is the opposite of a requirement that it switch gently, and a lamp that switched instantaneously would satisfy it perfectly. Part VI.R sets out the provision, its source, and the reason the Foundation does not attribute it to the consensus document the Manual references.

The one federal document that raised the question, and what became of it

The Foundation has located one place in which the question was put. A federally funded lighting research report of 1999 observed that the faster rise time of a light-emitting diode signal may have an effect on reaction time and missed signals. Part VI.R.5 sets out the observation and what followed it, which so far as the Foundation can establish is nothing. A question identified in a federally funded report in 1999, concerning a characteristic of a product class that has since been converted in its entirety, has not been studied in the twenty-seven years since.

A finding that runs against the Foundation, stated here and not only where it is developed

The one government comparison of incandescent and light-emitting diode signal switching the Foundation has located did not measure transition time photometrically. It inferred it from video recorded at thirty frames per second and examined frame by frame, which bounds its resolution at about thirty-three milliseconds. On its own figures one light-emitting diode product had the longest fade-out time of any lens tested for the solid green indication, which is the opposite of the direction the Foundation's argument runs. Part VI.R.5 sets out the study, its method, and that finding. The Foundation reports it here because a reader who met it first in Part VI would be entitled to conclude that this Part had been written without it.

What can be specified now, and the shape the boundary must take

The boundary in this dimension is a floor and not a ceiling, which is the clearest illustration of the point made at subsection B. What is complained of is that transitions are too abrupt, so what is needed is a minimum transition duration, or equivalently a maximum rate of change of output. The Foundation cannot state the value. It states that the value is the sort of quantity the research directed by paragraph (a)(2) would establish, that the measurement is straightforward with a

photometric detector of adequate bandwidth, and that no such measurement of the converted product classes appears to exist.

The Foundation also records what it has deliberately declined to do. Figures exist for the rise and decay characteristics of low-voltage incandescent vehicle brake lamps from a study of the early nineteen nineties. They are not transferable to line-voltage signal and illumination products, the operating conditions differ in voltage, thermal mass and duty, and this comment does not use them. Part VI.R records the exclusion and the reason for it.

3. Cumulative exposure

The quantity

Cumulative exposure is total dose accrued across repeated exposures over time. The front matter, subsection G, defines it and records that Question 5 of this request for information names cumulative exposure over time among the characteristics a classification system should account for.

Why a boundary is needed, and the respect in which the existing framework already concedes the principle

The principle that optical exposure accumulates is not contested and is not the Foundation's invention. Part V.C.2 sets out the international assessment framework for the blue-light hazard and records that its exposure metric is a dose rather than an instantaneous value. Part V.C.2 also sets out an established cumulative-dose framework for one waveband, which the Foundation relies on as demonstrating that regulators have been willing to express an optical limit as accumulated dose where the evidence supported it.

The gap is one of duration rather than of principle, and it is specific and citable. The framework's dose limit is stated over an exposure of ten thousand seconds, which is under three hours. Part V.C.2 sets out where the framework stops. The exposure this comment concerns is involuntary, daily, and lifelong: street lighting encountered every night for decades, workplace lighting for a working life, vehicle headlamps on every drive. A framework that bounds a three-hour occupational exposure has not addressed that, and does not claim to.

The necessity test applied

Applying the test in this dimension requires care, and the Foundation states the difficulty rather than glossing it. Cumulative exposure is not a characteristic of an emission at all; it is an integral of exposure over time, and the same product can produce very different cumulative doses depending on how long a person is near it. The test therefore does not ask whether cumulative exposure is unnecessary. It asks whether the component of the accumulated dose contributed by emission that served no purpose for the person is unnecessary, which it is by the same reasoning as applies to each component characteristic. The practical consequence is that this characteristic does not take a boundary independent of the others; it takes an accounting method.

What can be specified now

Not a number. Two things of a different kind. First, that any criterion the Department states for an optical emission identify whether it is an instantaneous limit or a dose limit, and if a dose limit, over what integration period, because the existing framework's three-hour period is a limitation that is easy to overlook when the figure is quoted without it. Second, that the evaluation directed by paragraph (a)(4), which is directed to conditions of exposure and not only to emissions, address the duration and repetition structure of exposure to these products, which Part II.F.2 records that the Department already holds information bearing on.

4. Time of day and time of night at which the product is used

The characteristic, and why it is a characteristic of exposure rather than of the product

The characteristic is the hour at which the emission reaches the person. It is not a property of the product and the Foundation does not present it as one. It is a condition of exposure, and paragraph 360ii(a)(4) directs the Secretary to study and evaluate emissions of, and conditions of exposure to, electronic product radiation, which is the authority under which it belongs in this Part. Part II.F sets out that paragraph.

Why a boundary is needed in this dimension

Two independent mechanisms make the same emission a different exposure at a different hour, and they point the same way.

The first is adaptation. The visual effect of a source depends on the adaptation state of the observer, which depends on the luminance of the surrounding field. Subsection D.3 sets out the consequence: the luminaire that is unremarkable at midday is disabling on an unlit road at night, and the difference is a property of the hour rather than of the lamp. Part V.C.3 sets out the mechanism.

The second is the non-visual photoreceptive pathway. Short-wavelength light suppresses melatonin and shifts circadian phase, and the magnitude and direction of that response depend on the time at which the light is received relative to the person's own circadian phase. The same exposure that is benign or beneficial in the morning is disruptive at night. Part V.F sets out the evidence.

The necessity test applied, which in this dimension gives the sharpest available answer

Applying the test: does emission at this hour serve a purpose for the person exposed? In this dimension the test discriminates with unusual force, because the purpose of an installation is frequently satisfied for part of the night and not the rest of it. Lighting installed to serve pedestrian or vehicle traffic serves no one at an hour when there is no pedestrian or vehicle traffic, and the emission it continues to produce at that hour is unnecessary in the fullest sense the term carries at Part II.D.2, without any need to establish that it harms anybody. Part II.D.5 records the existing mitigations, which include controls of exactly this kind.

What can be specified now, and the one dimension in which the Foundation believes a federal criterion is nearly writable

The boundary in this dimension is a relationship: permitted output as a function of the hour, or permitted output conditioned on the presence of the use the installation exists to serve. The Foundation submits this is the dimension in which a federal criterion is closest to writable on the present record, for three reasons. The technique is established and in wide use; Part II.G.3 records that the techniques exist and that what is absent is the federal evaluation of them. The capability is already built into the products, since adaptive and scheduled control is a standard feature of light-emitting diode drivers. And paragraph (a)(5) directs the Secretary to develop, test and evaluate the effectiveness of exactly this kind of procedure, which makes it the characteristic in this Part most squarely within a paragraph the Department has not performed.

The Foundation accordingly asks, in this dimension, for the evaluation rather than for a limit: that the ambient-sensing and default-low capability described at Part IX.J be evaluated for effectiveness under paragraph (a)(5), and that the Department state whether any such evaluation has been performed. It also records one federal document that bears directly on the question and that it has not yet been able to read, which is the circadian lighting appendix to the Department of Defense facilities criteria described at Part II.H.14.

F. The Exposed Person: Special Populations [RFI Q11]

This is the first of the two items that are not characteristics of the emission, and subsection B states why it is nonetheless in this Part. It does not take a boundary of its own. It determines, for every boundary in the three families above, the population against which that boundary is set, and the question it puts to each of them is the same: whose response is this number calibrated to?

a. The statutory basis for asking the question

Paragraph 360ii(a)(2) directs the minimization of the exposure of people to unnecessary electronic product radiation. It does not say the average person, the typical person, or the healthy adult. Paragraph (a)(4) directs the study and evaluation of conditions of exposure, and the condition that a person's eye transmits more short-wavelength light than another's, or that their nervous system responds to modulation that another's does not, is a condition of exposure.

Two further sources of duty apply to this Department specifically and are set out at Part VIII.B. Section 504 of the Rehabilitation Act reaches the Department's own programs, and the Department is a designated agency under Title II of the Americans with Disabilities Act for a class of public entities. Part VIII.B.2 and Part VIII.B.3 set out each. A criterion written to the comfort of an unimpaired observer, adopted by a Department carrying those duties, would be a criterion that excluded by construction the people the duties exist to reach.

b. The groups the record identifies, and where the evidence sits

The Foundation does not present a list of protected categories. It identifies the groups for which the published literature or its own record shows a different response to one or more of the sixteen characteristics, which is a narrower and more useful claim.

Children. The crystalline lens yellows with age, and a younger lens transmits more short-wavelength light to the retina. The consequence is that for the same incident exposure a child receives a larger retinal dose in precisely the waveband in which the hazard function is greatest. Part V.C.2 sets out the age-dependent ocular transmission figures and the question of who actually receives the dose. Part VI.M treats products intended for or used by children, and records that the federal standard governing toys in the United States does limit an optical quantity, which makes the absence of any limit for the general case harder to account for.

Older adults. The same yellowing reduces short-wavelength transmission, but intraocular scatter increases with age and with cataract, and scattered light is the mechanism of disability glare. Part V.C.5 sets out age, astigmatism, cataract and intraocular lenses as modifiers, and Part V.C.3 the straylight mechanism. The direction of effect differs between the photochemical and the glare questions, and the Foundation states that rather than asserting that older adults are uniformly more affected.

People with photosensitive epilepsy, migraine or photophobia. Part V.E.1 sets out photosensitive epilepsy and flash-rate thresholds and Part V.E.2 migraine and photophobia. These are the groups for which the temporal family at subsection E matters most, and for whom the relevant thresholds are already partly quantified.

Autistic people and people with sensory processing differences. Part V.E.3 sets out the literature. Part VII.A.4 records the self-identified condition categories in the Foundation's incident report database.

People who have had intraocular lenses implanted. Part V.C.5 sets out the position. The Foundation notes the feature of this group that makes it distinctive: the implanted lens does not carry the natural lens' short-wavelength absorption unless it was specified to, so the exposure of these eyes was altered by a medical intervention this Department regulates.

c. What the Foundation asks in respect of this item

Two things, neither of which is a number. First, that any criterion the Department states for an optical emission identify on its face the population whose response it is calibrated to, which is the condition-stating request made in the temporal dimension at Part IX.I applied to the receiving population. A criterion calibrated to unimpaired adult observers is not thereby wrong, but it is a different criterion from one calibrated to the population that actually encounters street lighting, and the difference should be visible rather than implicit. Second, that the research directed by paragraph (a)(2) and the evaluation directed by paragraph (a)(4) include these groups rather than treating them as a source of variance to be controlled for.

G. Techniques of Minimization [RFI Q5.o]

This is the second item that is not a characteristic of the emission. It is a technique for minimizing exposure, and techniques for minimizing exposure are the subject of a paragraph of their own: paragraph 360ii(a)(5) directs the Secretary to develop, test and evaluate the effectiveness of procedures and techniques for minimizing exposure to electronic product radiation. The Foundation therefore asks for something different in respect of this item than in respect of the fourteen characteristics: not a boundary, but the evaluation the statute already directs.

1. Luminaire shielding and diffusion

a. What the two techniques do, in terms of the characteristics above

Shielding operates on spatial distribution. A shield, a cut-off optic or a house-side reflector removes output from directions in which it serves no function, which is the dimension treated at subsection D.1 and the dimension in which the Foundation submits the emission is most clearly unnecessary.

Diffusion operates on luminance, and it does so by the only mechanism available. Luminance is luminous intensity divided by apparent emitting area, so for a fixed luminous output the way to reduce luminance is to increase the area over which the output appears to originate. That is what a diffuser does. The Foundation draws attention to the consequence: diffusion is the technique that acts directly on the variable which, as the introduction to subsection D establishes, the existing candela-based criteria leave entirely unconstrained. It is the specific remedy for the specific gap this Part identifies.

b. The trade-offs, which the Foundation states because an evaluation that ignored them would be worthless

Neither technique is free and the Foundation does not present either as costless. Diffusion scatters output in all directions from a larger apparent source, so a diffuser applied without shielding increases light trespass and skyglow even as it reduces luminance; the two techniques are complements and applying one alone can worsen the dimension the other addresses. Both reduce the proportion of generated light that reaches the intended surface, which raises the energy consumed per unit of delivered illuminance and therefore engages the efficacy metric described at Part IV.G.4, under which both techniques register as loss. And a diffuser is a component that ages, discolors and is sometimes removed in maintenance, so the technique's effectiveness in service is not its effectiveness when new.

Those trade-offs are precisely why the statute directs an evaluation of effectiveness rather than an endorsement. The Foundation is not in a position to quantify any of them, and says so.

c. The state of the record, and what the Foundation asks

Part II.G.3 records the position: the techniques exist, they are in commercial use, and what is absent is the federal evaluation of them. Part II.D.5 records the existing mitigations. Part II.G.2 records that the Final Response of May 24, 2024 asserted the effectiveness of existing mitigations, which is the conclusion of the evaluation paragraph (a)(5) directs the Secretary to perform.

The Foundation accordingly asks the Department to state whether the evaluation underlying that assertion exists, and if it does, to produce it, in which case the Foundation's complaint under this paragraph as to these two techniques falls away. If it does not, the Foundation asks that shielding and diffusion be among the first techniques evaluated under paragraph (a)(5), for the reason given above: diffusion acts on the one quantity that the existing federal criteria do not reach at all.

2. User control of the indicator light on a mains-powered device

a. The technique, and the one respect in which it differs from everything else in this Part

The technique is a control: a switch, a button, or a setting by which the person who lives with a device can extinguish or dim the indicator light on it, at their own discretion, without disabling the device. The products are those at Part VI.G.1, which sets the class out by naming it: the indicators on appliances, tools, chargers, outlets, alarms and routers, together with televisions and other equipment that continue to indicate while in standby.

Every other technique in this subsection, and every boundary in the three families above, reduces a quantity. This one removes the emission altogether, and it does so at the election of the person exposed rather than by the judgment of a regulator about what level is acceptable. The Foundation draws attention to that difference because it is the reason the technique is worth separate treatment: it is the only proposal in this Part whose operation requires nobody to determine a number.

b. Which characteristics it acts on, and which it leaves untouched

A control of this kind acts on two of the sixteen. It acts on the hour of use at subsection E.4, by allowing the person to remove the emission at the hours when the non-visual photoreceptive pathway is most sensitive and when the surrounding field is darkest; Part V.F sets out the circadian evidence and subsection D.3 the adaptation point. And it acts on cumulative exposure at subsection E.3, by reducing the duty of the emission to zero rather than reducing its instantaneous magnitude, which is the only mechanism in this Part that bears on an accumulated dose without requiring a dose limit to have been established.

The Foundation states what it does not act on, so that the technique is not mistaken for a substitute for a boundary. A control does not change the spectral distribution of the emission, its source luminance, or its beam angle. A device whose indicator has been switched off emits nothing, so those characteristics do not arise; but a device whose indicator is merely dimmed retains all three, and Part VI.G.2 sets out why the beam angle of an indicator is the characteristic nobody who meets the appliance can obtain. A control is a remedy available to the person in the room. It is not a remedy for the product.

c. Why the necessity test is satisfied more cleanly here than anywhere else in this Part

An indicator light communicates a state. Once the person has read the state, continued emission conveys nothing further to them. A router that reports, continuously and through the night, that it has power, to a person who knows it has power and cannot turn the report off, is emitting to no purpose for that person.

Applying the test at Part II.D.2.a: does the emission serve a purpose for the person exposed to it? For an indication the person does not wish to receive, in a room they are trying to sleep in, the answer is no on the face of it, and no finding about hazard is needed to reach it. Part II.D.2 establishes that unnecessary and hazardous are separate categories under this paragraph and that the duty to minimize attaches to the first without waiting on the second. This is the cleanest application of that distinction in the comment, and the Foundation says so plainly: it is the one place where the statutory test is satisfied by the election of the person exposed rather than by evidence the Foundation would have to supply.

d. The state of the record, and what this subsection adds to what the comment already asks

The Department has already been asked for this, in a different form and under a different authority, and the Foundation identifies the overlap rather than presenting the point twice as though it were two. Part IX.J.2 asks the Secretary to recommend, under § 360ii(b)(1), that an indicator lamp on a household appliance be capable of being dimmed or extinguished by the user, and records why that recommendation is available now: it asserts nothing about whether the lamp is harmful, it requires no finding about anyone's health, and it costs the manufacturer very little.

What this subsection adds is the paragraph (a)(5) character of the same thing. A user control is a procedure or technique for minimizing exposure to electronic product radiation, and paragraph 360ii(a)(5) directs the Secretary to develop, test and evaluate the effectiveness of such techniques. That duty does not depend on whether the Secretary chooses to recommend the technique under § 360ii(b)(1), and it is not discharged by declining to. The technique is in commercial use: products in several of the classes at Part VI already provide a control of this kind, which is the general position Part II.G.3 records, that the techniques exist and what is absent is the federal evaluation of them.

e. Two strengths of the same technique, which are not the same ask

The technique admits of two forms and the Foundation separates them because they differ in what they require of a manufacturer and in how defensible each is.

The weaker form is a control that permits the user to extinguish an indicator that is illuminated by default. This is the form Part IX.J.2 presently asks the Secretary to recommend. It is close to costless, it defeats no expectation, and the Foundation is aware of no argument against it.

The stronger form is an indicator that is dark by default and is illuminated only when the user elects to have it illuminated. It is the form that actually delivers what a person seeking relief from these emissions wants, because it does not require them to discover and operate a control on every device they own, and because the default is what the great majority of devices will be left at. The Foundation states the objection to it as well: a person who cannot tell at a glance whether a device is powered may be worse off in some circumstances, and the Foundation has not established for which product classes that matters. It does not ask the Department to resolve that here. It asks that both forms be within the technique whose effectiveness paragraph (a)(5) directs be evaluated, because the evaluation is what would settle which products can bear the stronger form.

f. The limit, which the Foundation states because a control that defeated a safety function would be worse than the emission

The technique does not extend to an indication that is itself a safety function required by another authority. A smoke alarm or a carbon monoxide alarm that indicates its own operating condition is the obvious case, and the Foundation does not ask that any such indication be capable of being defeated. Part IX.J.2 states the same limit and records that the Foundation has not established which household products carry such a requirement. Part IX.J.2 also records a federal instance in which a visible notification quantity is specified, which establishes that the government does specify quantities of this kind when it chooses to.

Nor does it extend to an indication the user wants. Nothing in this subsection asks that any indicator be removed, or that any person be deprived of one. The whole of the request is that the person in the room be given the choice, and the Foundation puts it in the terms its correspondents use: a person should be able to be free of the light in their own home without unplugging the device or covering it with tape. Part VII.B.5 sets out the reported sleep disruption and Part VII.D what reporters describe themselves doing about it.

g. What the Foundation asks in respect of this technique

That a user control over an indicator light be among the first techniques evaluated for effectiveness under paragraph 360ii(a)(5), for the reason given at item a: it is the only technique in this Part that

reduces an exposure to zero at the election of the person exposed, and the only one that requires no number to have been determined first. And that the Department state whether any evaluation of this technique has been performed, which is the question Part IX.G asks of the mitigations generally.

3. Substitution of the source technology

a. The technique, and the characteristic it acts on

The third technique is to replace the source with one whose spectral distribution differs, rather than to treat the emission of the existing source optically. It acts on the spectral characteristic at subsection C.1, where the two techniques above act on geometry and on duty, and it is the only one of the three that changes what is emitted rather than where it goes or when.

b. One documented instance, stated with its provenance first

The Foundation sets out the provenance before the instance, because the provenance bears on the weight. On April 3, 2026 the city of Ketchikan, Alaska enabled three low-pressure sodium streetlights in place of cool-white light-emitting diode streetlights. The account the Foundation relies on is published by the company that supplied the lamps, ballasts and components, and that sells them. The account describes the installation as a community-led pilot supported by the Soft Lights Foundation. The Foundation is therefore citing a supplier's published account of a project the Foundation supported, and it says so here rather than leaving the Department to discover it. The Foundation states, for completeness, that it has no financial relationship of any kind with that supplier and received and provided nothing of value in connection with the project.

The published account does not record why the substitution was made, and the Foundation supplies that from its own knowledge rather than from the source. Its account is that a resident whose dwelling overlooks the street requested an accommodation under the Americans with Disabilities Act, on the basis that the blue-rich light-emitting diode installation was producing adverse reactions in them, and that the city provided the accommodation requested by replacing those sources with the amber low-pressure sodium sources. The Foundation treats that resident's account of their own reactions exactly as it treats the 593 accounts at Appendix A, which Part VII.A.5 governs: it is that person's statement of their own experience and belief, it is not a finding, and the Foundation does not advance it as one. Applying a lower standard to this account because the Foundation knows of it directly would be noticed, and the Foundation does not. The Foundation does not identify the requester and does not state the interval between the request and the response, because it has not documented it.

The Foundation is exact about the standing of that account, because the distinction matters to how much weight the Department can give it. It is a statement of fact within the knowledge of the Foundation's president, offered as the Foundation's own statement and not as a citation to a document. No record of the request, of the city's response to it, or of any municipal determination has been obtained, and the published account of the installation does not mention a request at all. A commenter may state facts within its own knowledge and the Foundation does so here. It does not represent the account as independently documented. It also separates two characterizations that a reader would otherwise run together. The word pilot is the supplier's. It appears in the supplier's published account and it is the word of a party describing an installation of its own products. It is not the city's word, and the Foundation is not aware of any public characterization by the city of what it did or why. So the position is this: the Foundation states that the city provided an accommodation that had been requested; the supplier states that there was a community pilot; the city has said nothing the Foundation has found; and all three statements concern the same three luminaires.

With that said, the instance carries more than the availability point stated above. It is the only instance known to the Foundation in which a request under a disability provision produced a change in the optical characteristics of a public lighting installation, and Part VIII.A and Part VIII.F.5 set out what follows from it for the disability argument.

What the instance establishes is narrow and the Foundation claims no more. A substitution of this kind is procurable, and it has been performed by a municipality in the United States. That is a fact about availability rather than about effect, and it bears on two things in this comment: the technical achievability and practicability criterion of § 360kk(a)(2), which Part IX.I.4 addresses, and the evaluation of techniques that § 360ii(a)(5) directs.

What it does not establish is a longer list. No measurement of any optical quantity was made or reported, before or after. There is no independent evaluation, and none by the municipality. The account contains no statement from the city, names no official and names no authorizing body. The resident response it reports is qualitative and anonymous. The number of luminaires is three. And the account does not record that the substitution was requested as a disability accommodation; Part VIII.A states the consequence of that for the disability argument, which is that the instance cannot carry it.

c. Why the substitution is nonetheless the right kind of thing to evaluate

Low-pressure sodium is a narrow-band source at a long wavelength. Part V.B.3 sets out the difference between a narrow-band source and a warm white one, which is a distinction this comment insists on elsewhere because low correlated color temperature is not the same thing as low short-wavelength content. Part V.B.6 reports published work, some of it funded by the Department of Energy, on a physiological function for long-wavelength content in human subjects. A substitution of this kind therefore moves the emission in the direction the necessity test at Part II.D.2.a points. That is a reason to evaluate it. It is not a finding that it works.

d. The qualification, which the Foundation states because the technique is not costless

A near-monochromatic source renders color poorly, and color discrimination has uses on a roadway that the Foundation does not dismiss. Part V.B.3 sets out the spectral position of low-pressure sodium among common sources and Part V.M treats the safety benefits claimed for outdoor lighting, including a study that reports fewer incidents under low-pressure sodium at a significance the Foundation states rather than rounds. The Foundation does not assert that substitution is costless and does not propose it as a general remedy for any product class. It asks that it be among the techniques whose effectiveness paragraph (a)(5) directs the Secretary to evaluate, alongside shielding, diffusion and user control, and it notes that an evaluation would have to weigh the loss as well as the benefit.

H. Summary: The Sixteen Characteristics, the Shape of the Boundary Each Requires, and What Can Presently Be Stated

The table collects the Part. The third column states the form a criterion would have to take, which the Foundation asserts. The fourth states what the Foundation is presently able to supply, which in most rows is not a number, and the reason it is not is the same in every such row: the research paragraph (a)(2) directs and the evaluation paragraph (a)(4) directs have not been conducted as to this radiation.

Characteristic	Family	Shape of boundary required	What the Foundation can presently state
1. Spatial distribution	Spatial	Distribution: proportion of output permitted outside a stated solid angle referred to installation geometry	Form is in use, including in a federal aviation specification limiting stray light to 3% of peak. No proportion supplied. Asks measurement and disclosure.
2. Spectral distribution	Spectral	Relationship: short-wavelength content referred to task requirement and to hour; possibly a floor on long-wavelength content	Numerical spectral limits exist in a regional instrument, and 21 C.F.R. 1040.30 is a radiometric lighting standard. No value supplied. Not CCT.

Characteristic	Family	Shape of boundary required	What the Foundation can presently state
3. Temporal characteristics	Temporal	Ceiling on modulation depth as a function of frequency	The only dimension in which numerical criteria already exist from a recognized body, in mandatory language. Standing of that instrument stated at Part V.D.3.
4. Rise and decay times	Temporal	Floor: minimum transition duration, or maximum rate of change of output	No federal instrument specifies it. The one apparent exception is a ceiling, forbidding slowness. No value supplied.
5. Luminance	Spatial	Relationship: permitted luminance as a function of viewing angle and of adaptation level	One federal numerical instance located, in Department of Defense facilities criteria, in angle-dependent form. No general value supplied.
6. Radiance	Spatial	Ceiling, in the blue-light-hazard weighted form for the photochemical question	Quantity, measurement method and weighting function all already exist. Existing framework is bounded at an exposure of 10,000 seconds. No value supplied.
7. Luminous intensity	Spatial	Ceiling, paired with every existing minimum	The regulatory currency of optical emission in the United States, and almost everywhere expressed as a minimum only. Asks that minima be paired with maxima.
8. Illuminance	Spatial	Maximum at a boundary, for light trespass only; otherwise a stated condition	The weakest of the five quantities for these purposes, and the Foundation says why. Trespass maxima exist, but municipally rather than federally.
9. Irradiance	Spatial	Ceiling at a stated measurement geometry	The same quantity and unit as radiofrequency power density. The quantity in which the Department has written optical standards before. Geometry unsettled.
10. Glare rating	Spatial	Ceiling, on separate metrics for disability and for discomfort glare	A metric is in federal use in facilities criteria. Its validity domain may exclude these sources, which the Foundation states against itself.
11. Cumulative exposure	Temporal	An accounting method rather than an independent boundary: stated integration period	Dose-based optical limits exist for one waveband, so the principle is conceded. The existing period is under three hours; the exposure is lifelong.
12. Number of emitters	Spatial	A stated assumption on each product criterion, plus research reaching the aggregate	Rests on paragraph (a)(2) naming exposure separately from emissions. Outside what a product standard can reach, and the Foundation says so.
13. Movement through space	Spatial	A stated encounter geometry and speed, not a limit on motion	Converts a spatial characteristic into a temporal one at the retina. The only characteristic here with no federal numerical criterion in either direction.
14. Special populations	Not a characteristic of the emission	No boundary of its own: fixes the population every other boundary is set against	Groups identified with the evidence for each. Asks that each criterion name the population it is calibrated to.
15. Techniques of minimization: shielding, diffusion, and user control of indicator lights	Not a characteristic of the emission	Not a boundary: techniques, whose effectiveness paragraph (a)(5) directs be evaluated	Diffusion acts on luminance, which existing federal criteria do not reach. A user control over an indicator light is the only technique here that reduces an exposure to zero at the election of the person exposed. Asks for the evaluation, not a limit.
16. Time of day or night	Temporal	Relationship: permitted output as a function of hour or of the presence of the use served	The dimension closest to writable: technique established, capability already in the products, and squarely within paragraph (a)(5).

Two characteristics the Foundation expects will have to be added, identified now rather than defended later

Subsection A states that the list is not represented as exhaustive. The Foundation identifies the two omissions it regards as most likely to matter, so that the list is not later described as having been presented as complete.

The luminance ratio between a source and its immediate surround. Every discomfort glare formulation the Foundation is aware of depends on the luminance of the background against which the source is seen, and no characteristic in the list above captures that relationship. The same luminaire against a bright ceiling and against a night sky is two different exposures, and the quantity that distinguishes them is a ratio rather than either luminance alone. It is adjacent to the hour of use at subsection E.4 and to the adaptation point at subsection D.3 but is not the same as either, because the relevant surround is the immediate field rather than the general ambient level.

The phase relationship among wavelength channels. Products that generate white or tunable light from separate colored emitters, and displays that illuminate color channels in sequence, can modulate their channels out of phase with one another. The result is a modulation in chromaticity as well as in magnitude, and a product can present a modest modulation depth in luminance while modulating strongly in color. None of the temporal quantities at subsection E.1 is computed per wavelength channel, so a criterion written in them would not reach it. Part VI.H treats displays, screens and personal devices, and Part VI.K treats the entertainment class in which color-changing products are common.

IV. LITIGATION, REGULATORY PETITIONS, AND CONGRESSIONAL ACTION

A. Purpose and Scope of This Part [RFI Q5, Q18]

1. Why the administrative and judicial record is responsive to this RFI

Most of what a request for information of this kind receives is scientific literature. The Foundation supplies that too, at Part V. This Part supplies something a literature search cannot produce: the record of what has been asked of the federal government about this radiation, by whom, when, and what was answered.

That record is responsive for three reasons.

It is evidence about the state of federal knowledge and activity, which is what a request for information on a regulatory question is for. The Department is asking what is known. Part of the answer is what the government has been told, what it has been asked, and what it has said in reply.

Much of it is already in the Department's possession. The Foundation is not asking the Department to accept its account of these events. It is identifying documents in the Department's own files and in those of other agencies, by date and where possible by control number, so that each can be retrieved and read.

And it bears on questions the Department has asked directly, including those concerning surveillance and reporting, the characterization of exposure, and coordination among federal agencies.

There is a further reason, and it is the one the Foundation thinks explains why the record looks as it does.

Visible light is electronic product radiation within the meaning of § 360hh(1)(A), as Part II.B sets out, and the Foundation has met no serious argument to the contrary. But it is not generally thought of that way. A lamp is treated as a household object, a headlamp as part of a car, a streetlight as municipal infrastructure. Each is in law an electronic product emitting electronic product radiation, and almost no one outside this program describes them in those terms. The consequence shows in the correspondence collected at Part II.H.21: agency after agency, asked about LED products, answered in terms of lighting and of its own subject matter rather than in terms of radiation, and each correctly concluded that radiation from electronic products is not its responsibility.

That conceptual habit was not costly while the sources in ordinary use were large, diffuse and limited in output. It has become costly because the characteristics of the emitters changed. Part V.B describes the change: emission concentrated in a small area, at high radiance, with a narrow short-wavelength peak and a switched temporal structure. Those are properties that the vocabulary of lighting does not capture and the vocabulary of radiation does. The Foundation submits this record so that the Department can see how a question framed in the wrong vocabulary came to be addressed by no one.

2. Capacities: filings by the Soft Lights Foundation and filings by Mark Baker individually

This comment is submitted by the Soft Lights Foundation. The filings described in this Part were not all made by the Foundation, and the comment identifies the capacity in each instance, because the two are not interchangeable and the distinction has consequences that bear on what the Department is being asked to do.

The following were made by the Foundation:

- the regulatory petitions to the Food and Drug Administration under the electronic product radiation control program, and the petition of December 30, 2025 for a report to Congress under 21 U.S.C. § 360jj(a)(2). Part IV.C;
- the petitions to the National Highway Traffic Safety Administration, the filings before the Federal Communications Commission, and the petitions and correspondence addressed to the Occupational Safety and Health Administration between 2022 and 2024. Part IV.C and Part II.H.10;
- the request of May 30, 2023 that the Department of Energy comply with 21 U.S.C. § 360ii and establish a liaison with the Food and Drug Administration; the appeal of July 10, 2022 to that Department's Office of Hearings and Appeals; the petition to repeal the general service lamp rules decided at 88 Fed. Reg. 16,869; and the two requests under the Freedom of Information Act of January 24 and January 25, 2025. Part IV.G.7;
- the transmittal of the LED Incident Reports and the related correspondence with agencies and manufacturers. Part IV.B.

The following were brought by Mark Baker individually:

- the three federal actions described in Part IV.D, including the action under the Freedom of Information Act for records of the Center for Devices and Radiological Health.

One request was made in both capacities. The Freedom of Information Act request that became FDA Control No. 2025-3046 was submitted by Mr. Baker individually as a consumer requester and, in the accompanying cover letter, by him as President of the Foundation. Part IV.D.3.

The reason the comment is careful about this is not formality. Two different bodies of standing doctrine apply to the two capacities, and they do not overlap.

The claims that rest on exposure — the discrimination and access claims, and the claims of injury from electronic product radiation — rest on Mr. Baker's own physiological response to the

radiation at issue. They have been brought individually, because that injury is his and not the Foundation's.

The claims that rest on a request for records run the other way. Under the Freedom of Information Act the person who may sue to compel a determination is the person who made the request. The requests to the Department of Energy were made by the Foundation, and any action to compel a determination on them would be the Foundation's to bring; Mr. Baker could not bring it individually, not having been the requester. The request for the records of the Center for Devices and Radiological Health was made in both capacities, which is why the action at Part IV.D.3 could be and was brought individually.

The practical consequence for this request for information is narrow and worth stating. The Department will find in Part IV a record of requests made to several agencies by two different requesters over several years. Whether any particular one of them could be enforced in court, and by whom, is a question about remedies. It is not a question about whether the agency received the information, and the Foundation does not offer the record for the former purpose. Every filing described in this Part reached the agency it was addressed to, and the Department's own files will confirm it.

3. Sources and availability of the underlying documents

Every document described in this Part belongs to one of four categories, and the Foundation states them so that the Department can judge what it would take to verify any particular item.

- Filings in public agency dockets, including the petitions to this Department and the comments on them, which are retrievable by docket number.
- Documents on public court dockets, retrievable by case number through the federal and state electronic filing systems.
- Correspondence between the Foundation, or Mr. Baker, and a federal or state agency. Where an agency assigned a control, case or reference number, this comment gives it.
- Documents issued by this Department or by the Food and Drug Administration, which are in the Department's own files whether or not they have been published.

The Foundation holds copies of all of them. Those cited in this comment are submitted as exhibits, and the exhibit list at the end identifies each by the Part that cites it.

Two practical notes about the exhibits. They are submitted as separate files rather than appended to this document, because of the file size limit applicable to submissions in this docket. And where a document is already in the possession of this Department or of another federal agency, the Foundation has said so in the text, so that the Department may verify it against its own records rather than relying on the copy submitted here.

Where the Foundation relies on a document it has not been able to obtain, or on a description of a document rather than the document itself, this comment says so at that point. Where it has been unable to establish something it would have liked to establish, it says that too.

B. Notice to the Agencies: Transmittal of Reports of Harm and Acknowledgment of Receipt

1. The LED Incident Report submission form and the Foundation's transmittal practice

The Foundation maintains a reporting form through which members of the public describe their experience of exposure to light emitted by light-emitting diode products. Part VII.A.1 describes the form, what it asks, and the limits of data collected that way. This subsection is concerned with a narrower question: what the Foundation did with the reports after receiving them.

The practice has been to compile the reports periodically and transmit the compilation to the Food and Drug Administration, and in some periods to the National Highway Traffic Safety Administration as well. The compilations are prepared by period rather than by incident, and alongside the incident reports the Foundation has transmitted compilations of the comments filed on a public petition concerning vehicle headlamps and, in some periods, material drawn from public discussion forums.

The Foundation does not characterize these transmittals as reports under 21 C.F.R. § 1002.20. That section imposes its duty on manufacturers, and Part II.L explains why a submission from an organization is not and cannot be a report under it. What the transmittals accomplish is simpler and is not in dispute: they put the material in front of the agency.

2. Transmittal to the Food and Drug Administration at RadHealthCustomerService@fda.hhs.gov

Transmittals to the Food and Drug Administration have been made to the customer service address of the Center for Devices and Radiological Health. Each of the compilations listed below was transmitted to that address. They cover the following periods, which the Foundation lists so that the Department can locate the corresponding material in its own records

2024: April; April to May; July; August; September; October; November; December.

2025: January; February; March; April; May; June to July; August to September; October to November; and a consolidated transmittal dated December 1, 2025.

2026: December 2025 to February 2026; March to July 2026.

The compilations fall into four categories: the LED Incident Reports submitted through the Foundation's form; the comments filed on the public petition concerning vehicle headlamps; material drawn from two public discussion forums hosted on a social media platform, one of them an online community concerning vehicle headlamps, transmitted in some periods between October 2024 and September 2025; and, for the period August to September 2025, a compilation described as LED Radiation Reports.

The Foundation distinguishes that last category from the others and invites the Department to do the same. The LED Incident Reports were submitted to the Foundation through a form that asks particular questions, and Part VII.A describes what the form asks and what the resulting data can and cannot support. The forum material was not submitted to anyone. It consists of posts written by members of the public to each other, collected by the Foundation and forwarded. It is anonymous, unverified, written without any question having been put, and drawn from a community constituted around a grievance.

The Foundation offers it for one purpose and no other: as part of the record of what was placed before the agency during the period in question. It is not offered as evidence of the prevalence, the severity, or the cause of any effect, and the Foundation does not rely on it anywhere in this comment for any of those purposes.

Separately from the periodic compilations, the Foundation has submitted individual radiation reports on the agency's own form. One concerning light-emitting diode lamps on an emergency vehicle was assigned case number COR22000194 in October 2022, and is described at Part VII.I.2.

3. The FDA's acknowledgments of receipt

Acknowledgment matters here for a particular reason. The Foundation does not need the Department to agree with anything in the reports. It needs only to establish that the material arrived, because Part II.E.6 turns on the distinction between information received under § 360ii(a)(3) and information evaluated under § 360ii(a)(4), and that distinction presupposes receipt.

The acknowledgment returned from the Center for Devices and Radiological Health reads, in full:

> *"Thank you for your email. We will process your request as soon as possible."*
>
> *"Rad Health Customer Service"*
>
> *"FDA Center for Devices and Radiological Health"*

4. Transmittal to the National Highway Traffic Safety Administration

The letter of December 1, 2025 described at Part II.J.1.c was addressed jointly to the Commissioner of Food and Drugs and to the Administrator of the National Highway Traffic Safety Administration, and transmitted the same three compilations to both. The Foundation has also corresponded with that agency separately, as Part IV.C describes.

5. Transmittal of the petition comments and signature totals

A distinction has to be drawn here, because two different bodies of comment are easily conflated and the comment should not conflate them.

The first is the comments filed on the Foundation's citizen petitions to this Department, which appear on the public dockets at regulations.gov under the docket numbers given at Part IV.C.1. Those are already in the Department's possession as a matter of course, because they were filed with it.

The second, and the subject of this subsection, is the comments left on a public petition hosted on a commercial petition platform and addressed to the Department of Transportation, concerning the brightness of vehicle headlamps. Those comments are not filed with any agency by the people who write them. The Foundation has compiled them and transmitted them to this Department repeatedly since 2022, most recently as part of the periodic transmittals described at subsection 2 and in the consolidated letter of December 1, 2025, which covered comments from November 17, 2016 through November 30, 2025 and recorded that the petition had reached 75,000 signatures on November 28, 2025 and that the comments exceeded 4,700.

The Foundation states the limits of that material here rather than leaving them to Part VII. Signatures on a public petition establish that a number of people were willing to sign it. Comments on such a petition establish that those who wrote them described what they describe. Neither is a sample of anything, neither was collected under any protocol, and neither establishes the prevalence or the cause of any effect. Part VII.A.5 and Part VII.G set out what the Foundation does and does not claim from self-reported data.

What the material is offered for in this Part is narrower. It is evidence of what has been placed before the agency. A body of several thousand first-hand accounts, transmitted periodically over more than two years to the agency holding the authority at § 360ii(a)(4), is a fact about the agency's information position whatever is made of the accounts themselves.

6. Correspondence to other agencies and to manufacturers

The Foundation has corresponded with other federal agencies and with manufacturers and operators on the same subject. Part II.H.21 and Part IV.C describe the correspondence with agencies. Two sequences belong in this subsection because they concern the transmittal of information rather than requests for action.

The first is a document titled Notice of Dangerous Condition, sent in late June 2024 to a number of federal agencies including the Environmental Protection Agency, the Consumer Product Safety Commission, the Federal Aviation Administration, the Federal Highway Administration, the Access Board, the Department of Labor and the Food and Drug Administration.

The second is a document titled Compliance with 21 U.S.C. § 360ii, sent to the same agencies and to others in late June and early July 2024, in the weeks following the Final Response of May 24, 2024.

The Foundation has also written to utilities, to municipalities and to manufacturers concerning particular installations and products. Part IV.C and Part IV.E describe those where they bear on the matters in this comment.

7. Consequence: the reports are records within the Department's own possession

The consequence is the one this Part exists to establish, and the Foundation states it without embellishment.

The material described above is in the Department's own records. It was not published and then pointed to; it was sent to the agency, periodically, over a period exceeding two years, at an address the agency maintains for the purpose. The Department does not have to accept the Foundation's account of what the reports say in order to verify that they were received, and it does not have to accept the reports themselves in order to answer the question this comment asks about them.

That question is not whether the reports prove anything. It is what was done with them. Section 360ii(a)(3) directs the Secretary to receive information from organizations on present and future potential electronic product radiation. Section 360ii(a)(4) directs the study and evaluation of emissions and of conditions of exposure. The first of those appears to have been satisfied. The Foundation has found no evidence that the second was, and Part II.F explains why a literature review of published health effects is not it.

The Foundation accordingly asks the Department to state what was done with the material after it was received: whether any evaluation of it was undertaken, by whom, and with what result; and if none was, what the Department understands § 360ii(a)(3) to require once information has been received. Part IX.H.4.

8. Summary table: date, material transmitted, recipient, form of acknowledgment

The table is to be built from the transmittal record described in subsections 2 through 6, with one row for each transmittal.

C. Regulatory Petitions Submitted by the Soft Lights Foundation

1. Petitions to the FDA under the Electronic Product Radiation Control Program

Four citizen petitions were submitted to this Department under 21 C.F.R. § 10.30, each concerning a different class of light-emitting diode product, and all four were disposed of in a single letter.

Docket No. FDA-2022-P-1151, submitted June 13, 2022, seeking regulation of LED products generally. An interim response issued November 7, 2022. The Foundation filed an update to the petition in October 2022 and a further update in 2023.

Docket No. FDA-2023-P-0233, submitted January 22, 2023, concerning LED strobe and flashing lights. An interim response issued June 30, 2023.

Docket No. FDA-2023-P-3828, concerning LED vehicle lights, published on the docket September 7, 2023, with an acknowledgment letter of the same period. An interim response issued in early 2024.

Docket No. FDA-2023-P-3879, concerning LED street lights, published on the docket September 11, 2023. An interim response issued in early 2024.

The Final Response of May 24, 2024 denied all four. It is examined at Part I.C and its stated grounds are tested throughout Part II.

2. Petition to report to Congress under 21 U.S.C. § 360jj(a)(2), submitted December 30, 2025

The fifth petition to this Department is described in full at Part II.I.5, and is summarized here only so that this list is complete. Submitted December 30, 2025 by the Foundation and by Mr. Baker jointly, under 21 C.F.R. §§ 10.25 and 10.30, it asks the Secretary to conduct the study directed by

21 U.S.C. § 360jj(a)(2) and to report to Congress. It was acknowledged on January 2, 2026, a tentative response issued June 18, 2026, and it remains pending.

a. Relief requested

The petition states its request in these terms:

> "Petitioner requests that the Health and Human Services (HHS) Secretary comply with 21 U.S.C. 360jj(a)(2), which directs HHS and its implementing agency, the Food and Drug Administration (FDA), to conduct '[a] study to determine the necessity for the development of standards for the use of nonmedical electronic products for commercial and industrial purposes' and provide a report to Congress."

The report sought is one addressing the photobiological, neurological, psychological, hormonal and other hazards of LED products; the measures necessary to protect the public; and the cooperation required with other federal agencies. The petition also invokes 21 U.S.C. § 360ii(a)(6)(A), under which the Secretary is to establish and maintain liaison with other federal agencies having related radiation control programs, and it asks that the report be provided within 365 days of submission.

b. Docket number and filing date

The petition is dated December 30, 2025 and was submitted by the Soft Lights Foundation and Mark Baker that day.

The Food and Drug Administration acknowledged it by letter of January 2, 2026, signed by Dynna Bigby, Lead Administrative Proceedings Specialist, Office of Operations, Office of Management and Enterprise Services. The letter states that "Your petition dated 12/30/2025 was received by this office on 12/30/2025" and assigns Docket No. FDA-2026-P-0028. It adds that "the acceptance of this petition for filing is a procedural matter and in no way reflects the Agency's decision on the substantive merits."

That letter fixes the date from which the response period runs. Under 21 C.F.R. § 10.30(e)(2) the Commissioner is to furnish a response to each petitioner within 180 days of receipt of the petition. Receipt was December 30, 2025. The response date was therefore June 28, 2026.

c. The interim response of June 18, 2026

The agency responded on June 18, 2026, by letter from Ellen J. Flannery, J.D., Deputy Center Director for Policy and Director of the Office of Policy, Center for Devices and Radiological Health. The operative paragraph reads in full:

> *"FDA has been unable to reach a decision on your petition because it raises issues requiring further review and analysis by agency officials. This interim response is provided in accordance with FDA regulations on citizen's petitions (21 CFR 10.30(e)(2)). We will respond to your petition as soon as we have reached a decision on your request."*

d. What the interim response establishes, and what it does not

The response was furnished on the one hundred and seventieth day of the one hundred and eighty available, and it is the fourth of the four dispositions 21 C.F.R. § 10.30(e)(2) permits: a tentative response. The Foundation does not contend that the agency missed the deadline or departed from the regulation in furnishing an interim response rather than a decision.

What the regulation asks of a tentative response is that it indicate "why the agency has been unable to reach a decision on the petition, e.g., because of the existence of other agency priorities, or a need for additional information." The reason given is that the petition raises issues requiring further review and analysis by agency officials. The regulation further provides that a tentative response may indicate the likely ultimate agency response and may specify when a final response may be furnished. The letter does neither.

3. Petitions to NHTSA for non-compliance orders — 49 U.S.C. § 30162, 49 CFR part 552

The Foundation has also petitioned the National Highway Traffic Safety Administration, under that agency's rulemaking and defect petition procedures at 49 C.F.R. part 552 and under 49 U.S.C. § 30162. Its filings there fall into three groups: petitions concerning individual vehicle models, petitions seeking generally applicable limits, and the defect notifications treated at subsection 6.

The model-specific petitions, filed during 2022 and 2023, concerned the headlamps of particular vehicles then on the market. The Foundation lists them here for completeness rather than because this comment relies on them, and they are of limited relevance to a Department whose authority runs to the emission rather than to the vehicle.

Three of those petitions were decided together, and the Foundation treats them here at some length for a reason that has nothing to do with their outcome. They were denied. The denial was published in the Federal Register, and in the course of explaining it the agency made four statements about the reach of federal law over light-emitting diode products that bear directly on the questions this Request for Information asks. The Foundation relies on those statements and not on the disposition.

The petitions were filed under 49 U.S.C. § 30162(a)(2) and 49 C.F.R. part 552 on August 5, 2022, as to a model year 2021 Ford Bronco; on August 11, 2022, as to a model year 2021 Tesla Model 3; and on September 9, 2022, as to a model year 2022 Rivian R1T. Each asserted that the vehicle did not conform to Federal Motor Vehicle Safety Standard No. 108, and each asked the agency to issue an order of non-compliance. They were denied together in Soft Lights Foundation, Denial of Petition for Decision of Non-Compliance Order, 87 Fed. Reg. 75,327 (Dec. 8, 2022), Docket No. NHTSA-2022-0109, signed by the Associate Administrator for Enforcement.

First: the agency placed the authority with this Department, and stated that it has not been exercised

The published analysis opens with the question of who regulates the emission, and answers it in two sentences that the Foundation asks the Department to read as the statement of a sister agency rather than as the argument of a petitioner. The first:

> "First, the FDA has authority to regulate certain aspects of LED products as radiation-emitting devices. 21 U.S.C. 360kk states that the Secretary of Health and Human Services shall by regulation prescribe performance standards for electronic products to control the emission of electronic product radiation from such products if the Secretary determines that such standards are necessary for the protection of the public health and safety."

The second, after noting that the Food and Drug Administration issued part 1040 pursuant to that authority:

> "Currently, there is no FDA performance standard for LED products in Part 1040."

That is the proposition this comment advances, stated by the Department of Transportation in a published decision document four years before this Request for Information issued. The Foundation does not characterize it further. It observes only that the sentence is not contested anywhere in the record this comment describes, and that the agency which wrote it was at the time declining to act on the ground that the subject belonged elsewhere.

Second: the agency rejected the proposition that the standard is confined to point sources

The Foundation records the adverse holding in full, because Part V.B.8 advances a related proposition and the Department is entitled to see the answer the responsible agency gave to it. The petitions asserted that only vehicles using spherical or point light sources can comply with Federal Motor Vehicle Safety Standard No. 108. The agency disagreed:

> "FMVSS No. 108 is not limited to 'spherical/point light sources.' Specifically, regardless of the light sources used in headlamps, headlamps all have an area from which they emit light and they all emit different intensities of light in different directions. A key to understanding this topic is that the integral beam photometry requirements are for the lamp, not the light source."

The Foundation accepts that this is the agency's position and does not ask this Department to disturb it. It asks the Department to notice what the position concedes. Photometry of the complete lamp, in candelas at specified test points, is a measurement of what leaves the assembly in a given direction. It is not a measurement of the luminance of the emitting surface within the assembly, and the same agency said so in writing fourteen months later in the terms set out at subsection 9. The two statements are not inconsistent. Taken together they establish that the only federal instrument setting numerical limits on the output of these products limits a quantity which is not the quantity at issue in Part V.B.8, and that the agency administering it knows this.

Third: the agency disposed of flicker in one sentence, by assertion

The petitions raised square wave flicker. The published answer, in full, is this:

> "With respect to flicker, FMVSS No. 108 requires that 'modulating light from the lamp [must be] perceived to be steady burning.' LED integral beam headlamp systems can meet this requirement."

The Foundation makes three observations and no accusation. The first is that the requirement is quoted from an interpretation letter of November 5, 2005 rather than from the text of the standard, which is the point developed at Part VI.C.1. The second is that the test stated is one of perception. Part V.D establishes, from the published literature and from the specifications of the instruments built to measure the quantity, that modulation at the frequencies at which these products operate is by design not perceived as flicker by a stationary observer, while remaining detectable by the moving eye and resolvable by the retina. A criterion of perception is therefore satisfied by precisely the modulation that the literature identifies as the concern. The third is that the second sentence is an assertion of fact, unaccompanied by any measurement method, any threshold, any frequency range or any citation. Part V.D.1 establishes that no standardized field measurement method for these quantities exists, that the commercially available instruments are specified to five kilohertz, and that they require on the order of one hundred lux to resolve a modulation signal at all.

Fourth: the agency held that a federal qualification scheme has no category into which a light-emitting diode fits

The last holding is narrow in its application and broad in what it demonstrates. It concerns replaceable bulb headlamps, which are qualified through a submission under 49 C.F.R. part 564:

> "The design information that must be submitted is set out in part 564 and includes information regarding the filament or discharge arc and the filament capsule. Because an LED light source lacks these components, an LED light source may not be submitted for inclusion in the Part 564 docket; and, because it cannot be submitted to the part 564 docket, a replaceable bulb headlamp may not use an LED replaceable light source."

The Foundation asks the Department to read that passage as a worked example rather than as a vehicle lighting rule. A federal scheme for qualifying a light source was written around the physical features of the sources then in use: a filament, a discharge arc, a capsule enclosing them. A source lacking those features cannot be described in the terms the scheme requires, and therefore cannot enter it at all. The agency did not treat this as a defect to be corrected. It treated it as the operation of the rule. The same structural problem is what this comment describes at Part I.B and Part II.B in relation to part 1040, where the classes of light-emitting product are defined by the characteristics of the sources that existed when the sections were written.

What the Foundation does not claim from this document

Three limits, stated so that the Department is not left to find them. The agency recorded that its Office of Vehicle Safety Compliance has found evidence that light-emitting diode headlamp assemblies can meet the current requirements of the standard, and cited two compliance test reports. The Foundation does not dispute that finding, which is a finding about conformity with photometric limits and not about effect on a person. The agency also stated that it believes the current research supports that the standard contains the appropriate requirements to address glare, non-uniform luminance, peak luminance and flicker; the Foundation disagrees but records that the agency said it. And the decision is expressly confined to integral beam headlamps using light-emitting diode technology.

One feature of the glare answer is worth stating precisely, because it is easy to read it as addressing more than it does. The agency relied on a 2007 report to Congress for the propositions that beyond approximately one hundred feet the size of a headlamp has little impact on discomfort, and that no research has identified any impact of oncoming headlamp size on the visibility of the person experiencing glare. Both propositions concern the apparent size of the lamp. Neither concerns the luminance of the emitting surface or its spatial non-uniformity, which are the quantities Part V.B.8 is about, and the second is a statement that research has not been done rather than a statement of what research has found.

4. Petition to NHTSA to limit vehicle headlamp intensity

On March 1, 2024 the Foundation petitioned that agency to set an overall limit on the intensity of vehicle headlamps. Notice of the petition was published in April 2024. The Foundation wrote again in October 2024 concerning the absence of a decision.

The relevance of that petition to this comment is set out at Part II.G.3 and Part VI.B.1. The limit sought was expressed in the units Federal Motor Vehicle Safety Standard No. 108 uses, which are photometric. Nothing in that petition, and nothing that agency could have granted, would have addressed the luminance of the emitting surface, the spectral content of the emission, or its temporal structure, because that agency's standard does not speak in those terms and it holds no authority to evaluate the biological effects that would justify limits expressed in them.

5. Petition to NHTSA to limit correlated color temperature of vehicle headlamps

On May 15, 2024 the Foundation petitioned the same agency to limit the correlated color temperature of vehicle headlamps. That petition is the closest any filing by the Foundation has come to asking a transportation agency to regulate a spectral characteristic, and the difficulty with it illustrates the point this comment makes about measurement conventions.

Correlated color temperature is a descriptor of the appearance of a source and not of its spectral content, as Part V.B.3 sets out. Two lamps of identical correlated color temperature may differ substantially in the short-wavelength emission that bears on the effects described at Part V.C. The Foundation petitioned in those terms because they are the terms in which the industry and the regulator describe a lamp. A petition framed in terms of spectral power distribution would have asked an agency with no photobiological authority to adopt a criterion no federal body has published. That gap is what Part IX.C asks this Department to close.

6. Petitions and notifications under 49 U.S.C. § 30118

Three filings invoke the defect provisions of 49 U.S.C. § 30118, and they are described at Part II.J.1.d because their significance for this comment lies in the comparison with 21 U.S.C. § 360ll.

November 16, 2024: notification to a vehicle manufacturer, copied to the agency, of non-compliance under § 30118.

June 30, 2025: a petition under § 30118(e) requesting that the agency hold a hearing to determine whether manufacturers have reasonably met the notification requirements of § 30118 for LED vehicle headlamps.

December 1, 2025: the Notice of Defective Technology addressed jointly to the Commissioner of Food and Drugs and to the Administrator, described at Part II.J.1.c.

In December 2025 the Foundation also published a form of letter and invited members of the public to send it to the Administrator seeking a hearing under § 30118(e). Part II.J.1.d.

7. Filings before the Federal Communications Commission

The Foundation sets out what this comment establishes about that Commission and states expressly what it does not reproduce here.

What the record establishes. Part II.H.8 identifies the Commission among the federal agencies with which this Department is directed to consult and maintain liaison, and sets out its public request for comment. Part II.H.20 sets out the one documented instance of consultation between this Department and that Commission in the history of the program, which was a letter of April 24, 2019 from the Director of the Center for Devices and Radiological Health to the Chief of that Commission's Office of Engineering and Technology, and which concerned radiofrequency energy rather than optical radiation. Part VI.L treats the product class that emits both.

What is open now. Part IX.E.4.b sets out Public Notice DA 26-997, released on September 17, 2026 in ET Docket No. 13-84, and the request the Foundation makes of this Department in respect of it. That request is the operative one and it is addressed to this Department rather than to the Commission.

What this subsection does not contain. The Foundation's own filings before that Commission, if any, are not reproduced in this comment. The reason is one of scope rather than of reticence: the subject of that docket is radiofrequency energy, the subject of this comment is visible light, and Part IX.E.4.b states both that the Foundation recognizes the difference and why it regards the Department's participation in that proceeding as material notwithstanding. A reader who wishes to know what the Foundation itself has filed with that Commission should not infer it from this Part, which documents what was asked of federal agencies about these products and what resulted.

8. Petitions and proceedings before state regulatory bodies

The Foundation has petitioned a substantial number of State bodies, and this comment does not describe them individually. Three categories are relevant to a federal department and are summarized here.

Public utility commissions, concerning the conversion of street lighting. Proceedings include a matter before the New York State Public Service Commission and a petition before the Idaho Public Utilities Commission, which was denied by final order.

State emergency medical services boards and departments of motor vehicles, concerning the lamps on emergency and public-safety vehicles. Petitions were filed in a number of States during 2023 and 2024 and were denied, several on the ground that the body had no authority over the subject.

The California Highway Patrol, concerning auxiliary and flashing lamps, in a sequence of petitions and appeals running through 2024 and 2025.

The Foundation includes this category for a reason connected to Part II.E.3. Paragraph 360ii(a)(3) directs the Secretary to maintain liaison with and receive information from State departments and agencies. These proceedings are where the question has in fact been litigated at the State level, and the records of them are in the hands of the State bodies this Department is directed to receive information from.

9. Requests for agency interpretation and the interpretations issued

One interpretation has been obtained and read in full, and it is the most useful single document the Foundation holds from this agency. On February 13, 2024 the Acting Chief Counsel of the

National Highway Traffic Safety Administration replied to a letter of June 27, 2021 and an email of October 31, 2021 from Mark Baker, which had asked whether Federal Motor Vehicle Safety Standard No. 108 regulates peak luminance, absolute spectral power distribution or flicker, and what the agency's position is on the safety of light-emitting diode light sources in headlamps.

The Foundation sets out what the reply states, in four parts.

The standard contains no performance requirement for the light source at all

> "The standard does not contain performance requirements for a light source that is part of an integral beam headlamp, but instead specifies performance requirements for the complete headlamp. These include (among other things) photometry, through minimum and maximum candela at specified test points, color, which must remain within specified boundaries, and that the headlamp be steady burning."

Read with the passage from the Federal Register denial quoted at subsection 3, this establishes the position without ambiguity. There is no federal performance requirement for a light-emitting diode used as the light source in a vehicle headlamp. There are requirements for the assembly that contains it. The source itself is governed by no federal emission standard under the transportation authority, and, by the same agency's account of part 1040, by none under this Department's authority either.

The two quantities at issue in this comment are expressly outside the standard

> "FMVSS No. 108 does not directly regulate what you describe as peak luminance as measured in nits or the spectral power distribution of the headlamp light source. However, this is indirectly regulated through the headlamp performance requirements, such as the photometry and chromaticity requirements. Additionally, flicker is regulated through the requirement that lower beam headlamps be steady burning."

The Foundation quotes the qualification as well as the admission, because the qualification is where the disagreement lies and the Department should see both. The agency's position is that peak luminance and spectral power distribution are regulated indirectly, through photometry and chromaticity. Part V.B.2 and Part V.B.8 set out why the Foundation regards that as unsound: luminous intensity integrated over a lamp aperture does not constrain the luminance of a small bright region within it, and chromaticity, being a two-coordinate summary of appearance, does not constrain the spectral power distribution that produces it. Two sources of identical chromaticity can differ substantially in short-wavelength content. That is the whole of the Foundation's objection, and it is an objection to a stated agency position rather than to a silence.

The flicker sentence should be read narrowly. What it asserts is that flicker is regulated through the requirement that lower beam headlamps be steady burning. It is confined to the lower beam, it is a requirement of operation rather than a limit on a measured quantity, and the meaning the agency gives to it is set out next.

What steady burning means, in the agency's own words

The letter defines the term in a footnote, locating the requirement in Tables I-a and I-c of the standard, and the Foundation regards this as the single most useful sentence it has obtained from the agency:

> "NHTSA has stated that 'steady burning' means 'light that is essentially unvarying in intensity.'"

That definition is attributed to a letter of the Chief Counsel dated February 9, 1982. The footnote adds two glosses. A device may fail to meet the requirement where the driver would not see a signal that was consistent or reliable in its meaning, from a letter of September 7, 1990 applied in a tail lamp context. And, in the context of a modulating motorcycle headlamp, the agency has stated that there is no failure to conform if the modulating light from the lamp is perceived to be a steady beam, from a letter of March 10, 1994.

The Foundation asks the Department to hold the definition and the gloss side by side, because the two are not the same test and the difference is the subject of Part V.D. Light that is essentially unvarying in intensity is a statement about the light. Light that is perceived to be a steady beam is a statement about an observer. A lamp driven by pulse-width modulation at a few hundred hertz, which Part V.D.1 establishes is the ordinary arrangement in these products and which by the definition of the technique extinguishes completely between pulses, is not light that is essentially unvarying in intensity. It is light that is perceived by a stationary observer to be steady. Under the 1982 definition it would not qualify. Under the 1994 gloss it does.

The provenance of the gloss is worth stating. It was given about a motorcycle headlamp modulator, a device deliberately designed to vary its output at a few hertz so as to be conspicuous, where the question was whether deliberate conspicuity modulation defeated the steady burning requirement. It is that interpretation which the agency applied in 2022, in the Federal Register, to dispose of flicker in light-emitting diode headlamps operating three orders of magnitude higher in frequency. The Foundation does not suggest the extension was made in bad faith. It observes that a perception test devised for a low-frequency conspicuity device, where perception was the hazard, has been carried over to a high-frequency modulation where the absence of perception is the reason the modulation is used, and that no one appears to have examined whether the test still measures anything.

The deferral, and an acknowledgment of the subject matter

The letter closes on the health questions put to the agency:

> "We are aware of concerns raised about possible adverse effects of certain LED devices, particularly as used in street lighting that emits excess blue light. NHTSA's focus is on automotive safety, but the agency recognizes that separate expertise resides in sister agencies that are health-focused, such as the Food and Drug Administration."

The first sentence is supported in the letter by a citation to the guidance adopted by the American Medical Association on June 14, 2016 to reduce harm from high intensity street lights. The Foundation notes the citation because it is an instance of a federal agency, in correspondence, identifying a health concern about this product class by reference to the position of a national medical body, and because the Department is asked at Part II.E to receive information of exactly that kind.

The second sentence is the second of the two deferrals set out at Part II.H.5. It was given fourteen months after the first, by the Office of the Chief Counsel rather than by the Office of Enforcement, in response to a different inquiry, and in substantially the same terms.

One further concession, on color

A footnote to the same letter addresses the white boundary, quoting an interpretation of July 4, 2000 to the effect that it is possible to design a headlamp that emits a light that approaches the blue boundary and is perceived as having a blue tint but which nevertheless remains within the boundaries that define white, and that such headlamps would comply with the color requirements of the standard. The letter states the same point in its own voice: although the standard requires that the light emitted by headlamps be white, the permissible boundary of white includes colors that may be perceived by the human eye as white with a yellow tint and white with a blue tint. Part V.B.3 and Part V.F rely on that concession. A chromaticity boundary wide enough to admit a visibly blue headlamp is not a constraint on short-wavelength content, and the agency has said so.

D. Litigation Brought by Mark Baker Individually Against the FDA

1. Baker v. FDA, No. 2:24-cv-00278-DC-SCR (E.D. Cal.) — filed January 22, 2024; voluntarily dismissed September 26, 2024

The action sought to compel the Food and Drug Administration to publish performance standards for light-emitting diode products under § 360ii(a). It was dismissed voluntarily after the hearing on the motion to dismiss and before any adjudication on the merits.

The Foundation records one point of disagreement on the record rather than resolving it. The findings in the later action treat the two proceedings as substantively related. The objection filed in that action disputes that characterization. Both characterizations are in the record and the Foundation does not ask this Department to prefer either.

2. Baker v. FDA and NHTSA, No. 2:24-cv-02558-DC-SCR (E.D. Cal.) — the § 360ii(a)(6)(A) liaison duty; pending

Filed September 23, 2024. Findings and recommendations recommending dismissal issued September 16, 2025; objections were filed September 23, 2025; the matter is pending before the district judge.

Two holdings in the findings and recommendations bear on this comment and they cut in different directions, so the Foundation states both. On the liaison claim the court found standing, including redressability, and found the claim insufficient under Rule 12(b)(6). On the claim concerning the Safety Committee the court found no standing, for want of redressability.

The Foundation draws from the first of those only what it says: that a claim resting on the liaison duties of § 360ii was held to be one a court could redress. Part I.C sets out the positions the United States has taken on this record and Part II.M sets out what the Foundation makes of them.

3. Baker v. FDA, No. 2:26-cv-02776-DJC-CSK (E.D. Cal.) — FOIA action for CDRH records on LED visible light products

The chronology of the Request

The Foundation sets the sequence out as a chronology. What the Request sought is described in the preceding paragraphs of this subsection.

Capacity in which it was submitted. Request No. 2025-3046 was submitted by Mr. Baker individually as a consumer requester and, in the accompanying cover letter, by him as President of the Foundation. Two signature blocks appear on it, which the agency admits.

Acknowledgment. The Request was acknowledged and assigned FOIA Control No. 2025-3046.

Expedited processing was denied on April 4, 2025.

No determination was made on the fee waiver request.

A status communication followed on July 16, 2025.

A complaint was filed on August 12, 2026, pleading three counts: three counts under 5 U.S.C. §§ 552(a)(6)(A), 552(a)(3), and 552(a)(6)(E).

The Answer of September 14, 2026, and the admission at paragraph 32

Paragraph 32 of the Complaint alleges:

> *"As of the filing of this Complaint, Defendant has not made a determination on the Request, has not produced any records responsive to the Request, and has not asserted any FOIA exemption with respect to any responsive record."*

The Answer responds, in full:

"Defendant admits the allegations of this paragraph."

Affirmative defenses were asserted in the Answer.

Status. No record has been produced and no search has been described.

Capacity. The litigation is Mr. Baker's individually. The Foundation is not a party to it, and Part IV.A.2 records the distinction between the two capacities.

4. What the agency has and has not made available

Records produced in response to Request No. 2025-3046 to date: none. No search declaration has been filed, and the agency has not described the scope or the method of any search it has conducted.

The Foundation states why that bears on this comment rather than on the litigation. A sworn account of what the agency searched and what it holds would go directly to the subsections of Part II concerning the duty to study and evaluate: Part II.F establishes that the Foundation has identified no study or evaluation of the optical emissions of these products, and that is a statement about what the Foundation has been able to find. An account from the agency of what it holds would either confirm it or displace it, and no other document available to any member of the public would.

E. Related Litigation and Administrative Proceedings Concerning LED Exposure

1. Federal actions concerning flashing LED devices in public rights-of-way

The proceedings in this subsection concern rectangular rapid-flashing beacons at pedestrian crossings and auxiliary flashing warning lamps on municipal vehicles. They are brought by Mr. Baker in his individual capacity, as Part IV.A.2 explains, and the Foundation's role in them is limited to the publications and the correspondence identified below.

Baker v. City of Woodland, No. 2:26-cv-00091-DAD-AC (E.D. Cal.), before District Judge Dale A. Drozd and Magistrate Judge Allison Claire. A Title II action concerning auxiliary flashing warning lamps on City vehicles. The operative pleading is a Second Amended Complaint organized around the self-evaluation obligation of 28 C.F.R. § 35.105. Part VIII.

A Title II action against the City of Davis concerning the City's rectangular rapid-flashing beacons, in preparation as of the date of this comment. A government claim was presented to the City on August 21, 2026 concerning an incident of August 20, 2026.

Administrative requests to the City of Davis, each submitted individually: a request for reasonable modification and effective communication under Title II dated September 20, 2026; a request that the City evaluate its use of flashing lights under 28 C.F.R. § 35.105 dated October 3, 2026; and a request under the California Disabled Persons Act, Civil Code §§ 54 and 54.1, dated October 4, 2026.

A request to the City of Elk Grove under Civil Code §§ 54 and 54.1, modeled on the Davis request, concerning the flashing lamps the City operates in the public way.

Correspondence in the Foundation's capacity to the city attorneys of Davis, Woodland, Winters and West Sacramento, to Yolo County Counsel and to the Yolo County Public Agency Risk Management Insurance Authority, dated August 28, 2026, and to the League of California Cities. The Foundation has also furnished its papers to individuals pursuing accommodation requests in their own names in other States, including a matter before the City of Sanford, Florida.

The determination of the Minnesota Department of Human Rights, June 15, 2023

One document in this Part is not a filing by the Foundation or by Mr. Baker. It is a determination by a State civil rights enforcement agency, issued after investigation into the charge of a private

individual for whom the Soft Lights Foundation acted as an advocate. The Foundation discloses that role at the outset and places the determination here because of what it decided and what it declined to treat as an answer.

On June 15, 2023 the Minnesota Department of Human Rights issued a memorandum in its file REF: 74059. The charging party is a woman whose disability-related symptoms are triggered by high-luminance strobing LED light. The respondent is a Minnesota city of approximately 10,500 residents, which installed a rectangular rapid-flashing beacon system at a crosswalk near her home. The memorandum opens:

> The Commissioner determines: 1. There is PROBABLE CAUSE to find that Respondent discriminated against Charging Party because of her disability.

And concludes, at page 6:

> THEREFORE, MDHR finds that there is PROBABLE CAUSE to find that Respondent discriminated against Charging Party, in violation of the MHRA.

The Foundation is precise about what that is and is not. A probable cause determination under the Minnesota Human Rights Act is a threshold finding by an enforcement agency that a charge warrants proceeding. It is not an adjudication of liability, it was not made under federal law, and it is not a finding that LED light is hazardous to the general population. It concerns one person, one installation and one city. The Foundation does not present it as more than that.

What makes it material to this request for information is the reasoning. The city defended on the ground that its beacon complied with the applicable federal criterion. The Department addressed that defense at page 4:

> Respondent's contention that the RRFB's "flash rate" was consistent with federal guidelines is irrelevant to the determination of whether providing an accommodation would have imposed an undue hardship.

That sentence describes the condition this comment is addressed to. A federal criterion existed and the city invoked it. The criterion governed flash rate. It said nothing about the luminance of the emitting surface, nothing about the spectral content of the emission, and nothing about the characteristics that produced the symptoms at issue, because no federal criterion addresses those characteristics for this class of product. Parts II.C.3 and V.J.

The consequences fell where the absence of a standard places them. The memorandum records that on February 8, 2022 a vendor quoted $8,616.45 to replace the existing beacon lights, that the quote was never formally evaluated, and that the city's director concluded the city would "stick with what we have," explaining that further exploration of alternatives appeared unnecessary because the city "still get[s] a lot of good comments on [the existing module] and the person causing all of the trouble hasn't sent anything in a while." The memorandum also records that the charging party's symptoms on one occasion "continued into the next day, and Charging Party was unable to go to work."

The Foundation draws three propositions from this determination.

- A State enforcement agency, applying a State civil rights statute after investigation, found probable cause that the operation of an LED flashing beacon in the public way discriminated against a person with a disability. Whatever the eventual disposition of that charge, the determination is of record.
- Compliance with the one federal criterion available to the respondent was held irrelevant to the question the agency had to decide. A party in that position has nothing else federal to point to, and a charging party has nothing else federal to cite.
- The city was left to evaluate an $8,616.45 equipment change with no federal measurement, no criterion of acceptable exposure and no federal evaluation of whether the alternative would

have reduced exposure at all. Paragraph 360ii(a)(5) directs the Secretary to develop, test and evaluate the effectiveness of procedures and techniques for minimizing exposure. Part II.G.

The Foundation identifies neither the charging party nor the respondent city beyond what the published memorandum itself discloses, consistent with Part I.F.

The Foundation states these matters because they establish where this question is presently being decided, not because it asks the Department to take any view of them. Part IV.E.4.

2. Proceedings concerning LED streetlights and area lighting

The proceedings in this subsection concern the conversion of street lighting to light-emitting diodes. They were brought before State utility regulators and addressed to utilities, and they are the clearest illustration in this comment of a question arriving in a forum that cannot answer it.

a. New York State Public Service Commission, Case 23-E-0727

On December 13, 2021, fifty-two residents and customers of the Village of Cambridge, Washington County, New York, filed a complaint concerning National Grid's conversion of the Village's streetlights to light-emitting diodes. The complaint invoked New York Public Service Law § 71, which provides that upon the written complaint of a village's trustees, or upon the written complaint of not less than twenty-five customers or purchasers, "the commission shall investigate as to the cause for such complaint."

The Commission issued its Order Denying Petition on November 14, 2025, three years and eleven months after the complaint was filed. The ground of the denial was that the petitioners were not the utility's customers. The Order states, at pages 7 and 13:

> "Here, National Grid's customer is the Village. The Village can choose the service it wants to receive from National Grid within the confines of National Grid's tariff."

On November 23, 2025 the Foundation wrote to the Attorney General of New York concerning that interpretation. On November 30, 2025 the Foundation and Mr. Baker as its President filed a Petition for Rehearing under 16 N.Y.C.R.R. §§ 3.7 and 3.8. The petition is directed to the construction of § 71 and not to the photobiology, because the construction of § 71 is what the Commission decided.

The Foundation offers this proceeding for a single proposition, and it is not a criticism of the Commission. A State public service commission determines what service a tariff permits a utility to supply and to whom. Nothing in its jurisdiction equips it to determine the photobiological effect of a spectral power distribution, and nothing in the record before it supplied a federal criterion by which such an effect could have been assessed. The question that fifty-two people raised in 2021 was resolved in 2025 on the identity of the customer.

b. Oregon Public Utility Commission

The Foundation filed materials with the Oregon Public Utility Commission in June 2022 and submitted public comments in September 2022. On September 12, 2022 Administrative Law Judge Nolan Moser wrote to the Foundation as follows:

> "Staff have seriously reviewed your materials and determined that they will not open an investigation at this time, but will instead monitor the investigations in other jurisdictions and the reviews conducted in other agencies. Additionally, they welcome the submission of any new completed medical study material that may be completed, and will review that if it is submitted to them. In short, Staff is willing to review materials in the future, but does not see the need for an Oregon-specific investigation at this time."

The Foundation draws attention to the second clause. The Commission did not conclude that the materials were without substance; it concluded that it would await the investigations of other

jurisdictions and the reviews of other agencies. That is the pattern Part II.H documents at the federal level, appearing here at the State level, and paragraph 360ii(a)(3) directs the Secretary to maintain liaison with and receive information from State departments and agencies. Part II.E.3.

On October 22, 2024 the Foundation renewed the request, addressed jointly to the Commission and to the Oregon Health Authority, on the express ground that new material had become available. The material it submitted was the report described at Part V.C.2.f. The Commission had invited the submission of new study material and the Foundation supplied it.

c. Other State utility regulators and correspondence with utilities

The Foundation has filed with or written to utility regulators in a number of other States, and in July and August 2023 it wrote to the operators of street lighting systems directly, including Pacific Gas and Electric, Southern California Edison, Sempra, Duke Energy Carolinas, FirstEnergy and Chelan County Public Utility District. Those letters stated that the Food and Drug Administration has published no performance standard governing the visible light emitted by LED street lighting and asked the recipients to account for operating the products in the absence of one.

The Foundation also brought a complaint against Duke Energy Progress before the utility regulator in North Carolina in 2022, in which discovery was taken and a hearing was requested and refused.

3. Proceedings concerning high-intensity LED deterrent lighting

Two actions concern high-intensity blue-rich LED units installed for deterrent and surveillance purposes on commercial property. Both are brought by Mr. Baker individually.

Baker v. Regency Centers Corporation and LiveView Technologies, Inc., No. 2:26-cv-00017-TLN-JDP (E.D. Cal.), before District Judge Troy L. Nunley and Magistrate Judge Jeremy D. Peterson. Commenced in the Superior Court of California, County of Yolo, and removed. The property at issue is Oakshade Town Center in Davis. The first cause of action arises under Title III of the Americans with Disabilities Act; the remaining causes of action arise under the Unruh Civil Rights Act, the Disabled Persons Act, and the law of public nuisance. On August 31, 2026 the Magistrate Judge issued revised findings and recommendations recommending dismissal of the federal claim for lack of standing and remand of the State claims.

Baker v. LiveView Technologies, Inc., No. CU25-06372 (Super. Ct. Cal., Solano County), arising from a blue LED deterrent lighting installation at a shopping center in Vacaville. Three other defendants have settled and LiveView Technologies remains. Mediation is set for December 2026.

One item in the record of those proceedings bears on Part V.J rather than on the litigation. The Foundation commissioned an independent measurement report on the units from Ken Walczak of Night/Light Consulting, LLC. The Foundation commissioned it because no federal measurement convention existed to which a complaint could refer, and because no federal body measures these products. A private party had to pay for the measurement that Part II.F asks the Department to perform.

4. Relevance of these proceedings to the Department's inquiry

The Foundation does not ask the Department to intervene in any of these proceedings, to take a view of their merits, or to treat their outcomes as findings. Most of them have been unsuccessful, and the Foundation states that plainly because it is the point rather than a concession.

What the proceedings have in common is the forum's inability to reach the question. Each tribunal has jurisdiction over something adjacent to the emission and over nothing that would resolve it.

A State public service commission can determine what service a tariff permits and who the customer is. It cannot determine whether a spectral power distribution is hazardous.

A federal court hearing a Title II claim can determine whether a public entity evaluated its services and programs as 28 C.F.R. § 35.105 requires. It cannot prescribe an emission limit, and it has no criterion by which to assess one.

A State court in nuisance can determine whether a particular installation is unreasonable as against a particular neighbor. It cannot establish a criterion of general application, and the next installation is unaffected by its judgment.

A utility, asked to account for operating a product, can answer that no federal requirement governs its optical output. That answer is accurate.

In every one of these matters the tribunal had to proceed without a federal performance standard, without a federal measurement convention, without a federal evaluation of emissions or conditions of exposure, and without any federal determination of what level of optical exposure is acceptable. The absence of those things is not a grievance about the proceedings. It is a description of the material a tribunal would need and does not have, and 21 U.S.C. § 360ii assigns the production of that material to the Secretary.

Two of the proceedings add a further element. The Oregon Public Utility Commission stated in terms that it would await the reviews conducted in other agencies. The New York Commission took three years and eleven months and then decided the matter on the identity of the customer. Neither disposition reflects a judgment that the underlying question is unimportant, and neither could have been a judgment on the underlying question, because the material on which such a judgment would rest does not exist.

That is the whole of what the Foundation asks the Department to take from this Part. Not that any of these tribunals erred, but that the question has been put to a State utility regulator, to federal and State courts, to a State civil rights agency, and to the operators of the systems themselves, and that it cannot be answered in any of those places until the Department does the work 21 U.S.C. § 360ii directs. Part IX.

F. Congressional Action [RFI Q5.n, Q17]

1. The FY2026 appropriations directive on low beam headlamp brightness

The directive, as carried in H. Rept. 119-212, reads:

> *Headlight brightness.–The Committee urges the Secretary of Transportation to report to Congress on what gaps may exist related to the impact of the brightness of low beam headlamps on the vision and safety of drivers, pedestrians, and other road users, including the effect of varied terrain, including hills and curves.*

2. Why the enacted directive matters to the Department

Congress has directed a report on the vision and safety effects of light emitted by an electronic product. The Foundation asks the Department to attend to the measurand Congress named. Brightness is a property of optical radiation, and optical radiation emitted from an electronic product as a result of the operation of an electronic circuit is electronic product radiation within § 360hh(1)(A), which Part II.B establishes.

The consequence is a liaison consequence rather than a jurisdictional complaint. The subject matter Congress assigned for study in that directive is this Department's subject matter under § 360ii, and the agency directed to perform the study holds no authority over the emission. Part II.H.5 sets out that agency's own statements that the expertise relevant to the health questions resides in this Department. Part IX.E.4.a asks this Department to consult it, and identifies the proceeding in which the question is live.

3. The April 2026 House amendment directing study of LED headlamps

A House amendment directing study of light-emitting diode headlamps is recorded in the Foundation's correspondence file. The Foundation does not state its date, vehicle or citation in this comment, because it has not established them to the standard the rest of this Part observes, and a congressional action stated with the wrong vehicle or date is worse for this record than one not stated at all.

What the Foundation does record is that the enacted directive at Part IV.F.4 and the correspondence at Part IV.F.5 are the items in this Part on which it relies, and that neither depends on this one. Part IV.F.6 sets out the implementation question.

4. H.R. 7772, the LIGHT Safety Act, 119th Congress

S. 1568 and H.R. 3341, the LIT Act of 2025

A bill now before the Senate would repeal the rules examined at Part IV.G. The Liberating Incandescent Technology Act of 2025, S. 1568, was introduced on May 1, 2025 by Senator Mike Lee, with Senators Justice, Cotton, Schmitt, Curtis and Hagerty as cosponsors. Its long title is "To amend the Energy Policy and Conservation Act to modify standards for general service lamps, and for other purposes." It was referred to the Committee on Energy and Natural Resources and reported favorably by that Committee on September 30, 2026. A House companion, H.R. 3341, has not advanced.

The bill would strike section 325(i) of the Energy Policy and Conservation Act, the general service lamp efficiency provision, and would terminate three Department of Energy rules: those published at 87 Fed. Reg. 27,439 and 87 Fed. Reg. 27,461, both of May 9, 2022, and 89 Fed. Reg. 28,856 of 2024. Those are the same three rules described at Part IV.G.2 and whose environmental determinations are examined at Part IV.G.7.

The Soft Lights Foundation supports S. 1568. Its ground is narrow, and it is the ground of this comment rather than of the debate surrounding the bill.

The rules the bill would terminate had the practical effect of replacing the incandescent lamp with the light-emitting diode in American homes, schools and workplaces. Before they took effect, no federal body determined whether the replacement emission was safe for the people who would live under it. The consultation directed by 21 U.S.C. § 360ii(a)(6) — between this Department and other appropriate Federal departments and agencies, on techniques, equipment and programs for testing and evaluating electronic product radiation and on the development of performance standards — did not take place. The Foundation has sought records of any such consultation, including by request under the Freedom of Information Act, and none have been produced. Parts II.H.4, IV.D.3 and IV.G.6.

The Foundation is careful about where it places that failure, and its position here is the same as the one it takes at Part IV.G.6. The Energy Policy and Conservation Act imposes no duty on the Secretary of Energy to consult this Department. The duty runs the other way: § 360ii places it on the Secretary of Health and Human Services. The Foundation does not contend that the Department of Energy acted improperly. It contends that a federal measure which determined in practice what technology would illuminate the country took effect without the evaluation Congress assigned to this Department, and that the measure ought not to remain in force while that evaluation remains undone. The specific defect is set out at Part IV.G.4.d. The standard imposes a single parameter, lumens per watt, and no other, with the consequence that every emission characteristic bearing on human response was left to the manufacturer, unconstrained by any federal requirement.

Two things follow from the narrowness of that ground, and the Foundation states both so that its position is not mistaken for a larger one. It takes no view on the energy, cost, manufacturing or trade questions that occupy the remainder of the debate. And it does not contend that repeal

would answer the health question. Repeal would not produce the study. Only this Department can produce the study, and Part IX asks it to.

The legislative record shows something further, which is the terms on which the question is being argued, and they bear on this request for information independently of the bill's merits. The case made for the bill is consumer choice and the proper limits of federal energy policy. The case made against it, by the National Electrical Manufacturers Association and others, is product quality, household energy cost and foreign competition. Neither side's argument reaches the question whether the transition those rules produced had any effect on human health, because no federal evaluation of that question exists to be cited.

That is the condition this comment describes, appearing in a third place. Congress is now considering whether to repeal the measures that produced a nationwide change in the spectral composition of artificial light. Whichever way it decides, it will decide without any federal study of what that change did to the people exposed to it, because 21 U.S.C. § 360ii(a)(2) and (a)(4) have not been carried out as to this radiation. Part IV.G.5.

5. Congressional correspondence and requests for inquiry

Two items of congressional correspondence bear directly on this Department, and both precede the determination of May 24, 2024.

a. Representative Mike Thompson to Commissioner Califf, July 28, 2023

On July 28, 2023 Representative Mike Thompson of the Fourth District of California, Ranking Member of the Subcommittee on Health of the Committee on Ways and Means, wrote to Robert M. Califf, Commissioner of Food and Drugs. After describing constituent concern about excessively bright automotive headlights, the letter stated:

> The Radiation Control provisions of the Food, Drug, and Cosmetic Act (FDCA), under 21 USC 360ii(a) direct the Secretary of FDA to establish an electronic product radiation control program by, among other things, promulgating performance standards for electronic products. Under 21 USC 360kk(a) the Secretary of the FDA "shall by regulation prescribe performance standards for electronic products to control the emission of electronic product radiation from such products if he determines that such standards are necessary for the protection of the public health and safety."

The letter closed:

> I ask you to provide full and fair consideration to prescribing performance standards for automobile LED headlights that would address the health and safety issues related to excessively bright headlights.

The Foundation notes what the letter demonstrates and nothing beyond it. A Member of Congress identified this Department as the authority over the emission, identified the statutory provisions by section, and asked the Commissioner to consider prescribing a standard. He did so ten months before the Final Response issued. Whatever weight a single letter carries, the proposition that the subject had not been drawn to the agency's attention is not available.

b. The agency's representation relayed through Senator Maria Cantwell, March 21, 2023

On February 16, 2023 Senator Maria Cantwell inquired of the Food and Drug Administration on behalf of a constituent as to the status of citizen petition FDA-2022-P-1151. On March 21, 2023 the Senator's office relayed the agency's reply, which read in part:

> FDA provided an interim response to the citizen petition (FDA-2022-P-1151) on November 7, 2022, in accordance with the regulations at 21 CFR 10.30(e)(2)(iv). Our interim response informed the petitioner that FDA has been unable to reach a decision on the petition because it raises issues requiring further review and analysis by agency officials. Please be assured that we

> are working diligently and considering carefully the scientific and other information that was submitted in the citizen petition, as well as information submitted to the public docket by interested persons. After FDA has considered the available scientific data and other information, we intend to issue a response to the citizen petition.

The Foundation does not suggest that the representation was inaccurate. The agency did consider the petition and did issue a response. The Foundation relies on the representation for a narrower purpose, and it is the ground of the request made at Part IX.H.2.

The agency told a Member of the Senate that its decision would follow its consideration of the available scientific data. The decision, when it came, rested in part on a literature search and systematic review performed by an organization the agency has not named, under a protocol it has not published, reaching a conclusion about the quality of the evidence that no reader can evaluate. A representation to Congress that a determination will rest on the scientific record carries with it, in the Foundation's submission, a reason to publish the record the determination rested on. That is all the Foundation asks under this head.

6. Implementation status: whether NHTSA has begun the directed report

Congress has directed the Secretary of Transportation to examine low beam brightness. The Foundation has not established whether that examination has begun, and states the question rather than an answer.

The point it does press is the one at Part IV.F.2. The emission to be examined is optical radiation from an electronic product, which is this Department's statutory subject matter under § 360ii, and the examination is directed to a Department that holds no authority over it. That is the circumstance in which the liaison duties at § 360ii(a)(3) and (a)(6) operate, and Part II.H.5 sets out the record of consultation between the two Departments on vehicle lighting. Part IX.E.4.a asks that the consultation be established and that the Department state on the record whether any has occurred.

G. Department of Energy Actions and the Federal Lamp Efficiency Framework

1. EISA 2007 and the statutory 45 lumens-per-watt backstop — 42 U.S.C. 6295(i)(6)

Section 321 of the Energy Independence and Security Act of 2007, Pub. L. 110-140, added what is now 42 U.S.C. § 6295(i)(6)(A). Clauses (i) through (iv) directed the Secretary of Energy to conduct rulemakings on standards for general service lamps. Clause (v) supplied the consequence of not doing so. As the Department of Energy later described it, if that Department fails to complete a rulemaking in accordance with clauses (i) through (iv), or if the final rule from the first rulemaking cycle does not produce savings greater than or equal to the savings from a minimum efficacy standard of 45 lumens per watt, the statute requires that Department to prohibit the sale of general service lamps that do not meet a minimum efficacy of 45 lumens per watt, effective beginning January 1, 2020.

The Foundation states two things about that provision at the outset, because the rest of this Part depends on the distinction.

> Congress chose the figure and the metric. Forty-five lumens per watt is a statutory number, and lumens per watt is the unit Congress wrote into the United States Code. Nothing in this comment asks the Department of Health and Human Services to question the authority of Congress to set an efficiency standard for lamps, and nothing in it asks that the figure be revisited as a matter of energy policy.
>
> The Department of Energy chose the rest. Which lamps fall within the definitions to which the standard applies, when the backstop was triggered, and what levels would succeed it were determined by agency action across the rulemakings set out in the next subsection.

The Foundation also accepts, without reservation, that lumens per watt is a well-constructed measure of what the Energy Policy and Conservation Act is concerned with. That Act is an energy conservation statute, the quantity it seeks to conserve is electrical power, and the quantity it seeks to deliver is useful light. A ratio of the second to the first is the natural expression of that purpose. The criticism in subsection 4 is not that Congress chose the wrong metric for energy conservation. It is that a measure framed in that metric functioned in practice as a determination of which technology would illuminate the country, and that the consequences of that determination outside energy were evaluated by no one.

2. DOE general service lamp definition and standards rulemakings, 2017–2024

The administration of that provision took seven years and reversed direction twice. The sequence is set out below because it establishes both how many opportunities for the consultation described at subsection 6 arose, and what each proceeding was about.

January 19, 2017. Two final rules, 82 Fed. Reg. 7,276 and 82 Fed. Reg. 7,322, amended the definitions of general service lamp and general service incandescent lamp so as to bring within them categories of lamps that had been excluded by statute.

September 5, 2019. 84 Fed. Reg. 46,661 withdrew those definitions and restored the statutory definitions.

December 27, 2019. 84 Fed. Reg. 71,626 determined that, because the Department of Energy had decided not to amend standards for general service incandescent lamps, it had been under no obligation to issue a final rule by January 1, 2017, and the backstop requirement had therefore not been triggered.

May 9, 2022. Two final rules reversed that position. 87 Fed. Reg. 27,461 restored the broader definitions, and 87 Fed. Reg. 27,439, RIN 1904-AF09 in docket EERE-2021-BT-STD-0005, effective July 25, 2022, gave effect to the 45 lumens-per-watt backstop. These are the two rules the Foundation challenged, as Part IV.G.7 describes.

April 19, 2024. 89 Fed. Reg. 28,856, RIN 1904-AF43, effective July 3, 2024, adopted higher efficacy standards for general service lamps, with compliance required for products manufactured in or imported into the United States beginning July 25, 2028.

Each of those proceedings was conducted as an energy conservation proceeding, and properly so, because that is the authority under which the Department of Energy acts. The point of listing them is not that any was wrongly decided. It is that between January 2017 and April 2024 the federal government conducted five rulemakings that determined which lighting technology would be lawful to sell for general illumination in the United States, and that the question of what the surviving technology emits was not before the agency in any of them.

3. Effect: nationwide displacement of incandescent and halogen lamps by LED products

The effect of the framework was the removal of the alternative. A standard expressed as a minimum efficacy does not name a technology, but incandescent and halogen lamps for general service do not meet 45 lumens per watt and cannot be made to. The practical consequence of the backstop was therefore that the general service incandescent lamp ceased to be lawfully sold, and that the lamp available to replace it, in substantially every socket in the country, was the light-emitting diode.

The Foundation is careful not to overstate the causal claim. Price, service life and consumer preference moved the market toward light-emitting diodes independently of any federal requirement, and a large share of the conversion would have occurred without it. What the federal framework did was different in kind and is not a matter of degree: it removed the choice. A person who prefers an incandescent lamp for general illumination, including a person whose reason for preferring it is a response to the emission of the alternative, cannot obtain one.

That distinction matters to this Department rather than to the Department of Energy. Where a technology prevails in a market, a person adversely affected by its emission retains the ordinary remedy of not buying it. Where the alternative has been removed by federal operation, that remedy is gone, and the question whether the mandated emission is safe for the people exposed to it is no longer answerable by individual choice. Part VII describes who those people are.

4. Lamp efficacy in lumens per watt is silent as to what the selected technology emits

This subsection states the technical proposition on which much of this comment depends, and the Foundation asks that it be read carefully, because it is not an argument about policy. It is an argument about what a unit of measurement contains.

a. What a lumen is

The lumen is not a unit of radiation. It is a unit of radiation after weighting. Radiant flux, measured in watts, is multiplied wavelength by wavelength by V(λ), the photopic luminous efficiency function standardized by the International Commission on Illumination in 1924, and the result is scaled so that one watt at the peak of that function corresponds to 683 lumens. V(λ) describes the relative sensitivity of foveal cone vision for brightness matching at moderate luminance in a standard observer. It peaks at 555 nanometers.

Lumens per watt therefore expresses how efficiently a source produces a visual brightness response, in one standard observer, per unit of electrical power consumed. For the purpose of conserving electricity while delivering usable illumination, it is the correct quantity. The Foundation says so without qualification.

b. What the metric does not contain

A figure in lumens per watt is silent as to the spectral power distribution of the emission, the peak luminance of the emitting surface, the apparent size and geometry of the source, and the temporal structure of the output. Two lamps of identical efficacy may differ in every one of those respects. Parts V.B.1, V.B.2 and V.B.7 set out why each of them bears on human response.

It is also silent as to every biological response other than the one V(λ) was constructed to describe. Visual brightness matching is not the only response of the human organism to optical radiation. Light is the principal entraining stimulus of the human circadian system, acting through intrinsically photosensitive retinal ganglion cells and the photopigment melanopsin by a pathway distinct from the cone pathway V(λ) describes. Photochemical injury to the retina proceeds by a third mechanism with a weighting function of its own. Part V.C and Part V.F.

c. The weighting functions do not coincide, and the divergence runs the wrong way

The decisive point is not that lumens per watt omits these responses. It is that the function from which the metric is built assigns its lowest weights in the region where those responses are strongest.

V(λ), which defines the lumen, peaks at 555 nanometers and falls steeply toward the short-wavelength end of the visible band.

The blue light hazard function B(λ) of IEC 62471, which defines the photochemical retinal hazard, reaches its maximum at 445 nanometers, on the guidelines of the International Commission on Non-Ionizing Radiation Protection of 2013.

The melanopic action spectrum, which governs the non-image-forming responses including the suppression of nocturnal melatonin, peaks at approximately 490 nanometers.

At 440 nanometers, the wavelength of maximum photochemical hazard, V(λ) stands at roughly two percent of its own maximum. One watt of radiant power delivered at that wavelength therefore contributes on the order of fifteen lumens, against 683 lumens for the same watt

delivered at 555 nanometers. The same watt contributes the maximum possible value of the hazard-weighted quantity. Radiation that is nearly invisible to the metric is maximal to the hazard function.

There is a further relationship, and the Foundation states it with appropriate caution because it is the strongest form of the argument and must not be overstated. In phosphor-converted white light-emitting diodes, light is produced by a short-wavelength emitter and converted in part by a phosphor, and the conversion is lossy. Devices of higher correlated color temperature convert a smaller proportion of the emitter output and incur smaller conversion losses, and they generally achieve higher luminous efficacy as a result. If that relationship holds as generally as the Foundation understands it to, then a design change that increases the short-wavelength content of the emission can improve the figure the federal standard measures.

d. The standard imposes one parameter and no other

The preceding point concerns what the metric can register. This one concerns what the regulation requires, and it is the more consequential of the two.

A manufacturer placing a general service lamp on the United States market must meet a minimum efficacy expressed in lumens per watt. That is the requirement. Federal law imposes no requirement as to the spectral power distribution of the lamp, the luminance of its emitting surface, the apparent size of that surface, the modulation depth or frequency of its output, or its behavior when dimmed. The standard has one parameter.

Every other characteristic of the emission is therefore determined by the manufacturer, on commercial criteria, unconstrained by any federal requirement. Flicker is whatever the driver circuit produces at the price point. Spectral content is whatever the emitter and phosphor combination yields. Source luminance is whatever follows from the package geometry chosen. None of these is a lapse by any manufacturer. They are the predictable result of a regulatory instrument that specifies one quantity and is silent as to the rest, and the single quantity it specifies exerts design pressure of its own.

The design pressure runs in a particular direction, and on one point it runs directly against the characteristic described at Part V.B.6. Radiation outside the band the eye uses reduces lumens per watt by definition: it consumes power and contributes no lumens. A lamp that emits appreciable long-wavelength content is, by the federal metric, a less efficient lamp.

The efficacy standard therefore does not merely fail to require the long-wavelength content whose physiological function is described at Part V.B.6. It affirmatively selects against it. A manufacturer who added that content to a general service lamp would move the lamp toward noncompliance, and in the limit out of the market.

The Foundation states the consequence carefully. This is not an allegation that the Department of Energy acted improperly; the metric is the one Congress wrote and the loss is real in energy terms. It is an observation that two federal interests are in tension on this point, that the tension is not a matter of opinion but follows from the definition of the metric, and that it was never identified in any federal proceeding because the agency holding the health authority was not in the room. Subsection 6.

There is a further fact about that tension, and the Foundation offers it without any suggestion of impropriety, because there is none. The experiment described at Part V.B.6, which measured the physiological and emotional effects of adding near-infrared radiation to indoor lighting, was paid for by the Department of Energy. The funding statement reads:

> “This work was supported by the U.S. Department of Energy’s Lighting R&D Program, part of the Building Technologies Office within the Office of Energy Efficiency and Renewable Energy (EERE).”

The Office of Energy Efficiency and Renewable Energy is the office that promulgated the general service lamp rules described at subsection 2. One of the authors is a researcher at Pacific Northwest National Laboratory, a Department of Energy laboratory, and the study protocol was approved by that laboratory's institutional review board. The Department's lighting research program funded an investigation into the human consequences of a characteristic that the Department's lighting standards select against.

The Foundation draws two conclusions from this, both narrow. The first is that a research office and a standards office may properly do different things, and the Foundation does not contend otherwise. The second is that the subject matter cannot have been unknown. Whatever else may be said about the absence of the consultation that § 360ii(a)(6) directs, it cannot be said that no one in the federal government was aware that the spectral consequences of the efficacy standard were a live question. The Department of Energy was paying to investigate them.

The investigators themselves draw the line between the regulation and the research question. Writing of the implications of their findings for architectural lighting, they observe that, given the recent implementation of energy efficiency regulations that have effectively banned incandescent and halogen lamps, such lighting presently provides little if any radiation in the near-infrared or far-red regions; that this constitutes a substantial change in the indoor environment; and that the long-term consequences of the removal of near-infrared and far-red are unknown. They conclude that it will be important to determine the extent of the physiological and psychological responses, to establish dose-response relationships, and then to make decisions about how energy should be used in buildings.

The Foundation adopts that sequence and observes only that Congress has already assigned the first two steps in it. Determining the extent of physiological response to an emission, and establishing dose-response relationships for it, is what § 360ii(a)(2) and (a)(4) direct the Secretary to do. The researchers funded by one Department have identified the work that a different Department's statute assigns. What is missing is not the recognition of the question. It is the program.

This is the condition that paragraph 360ii(a)(6) exists to prevent, and the Foundation states the mechanism precisely because it is often misunderstood. The complaint is not that the Department of Energy should have regulated spectral content or flicker. That Department has no authority to do so and no expertise with which to do it. The two authorities are complementary and were always meant to be: the Energy Policy and Conservation Act governs how much power a lamp may draw for the light it delivers, and 21 U.S.C. § 360kk governs what the lamp may emit. A general service lamp sold in the United States was always going to be subject to the first. It was never made subject to the second.

The result is not a conflict between two federal programs. It is half a framework. A mandatory federal floor was built on the energy side and nothing was built on the emission side, and the consultation directed by § 360ii(a)(6)(B), which concerns in terms the development of performance standards pursuant to § 360kk, is the mechanism by which this Department would have learned that the first half was being built. Subsection 6.

e. What the Foundation asserts and what it does not

The Foundation does not assert that the efficacy standards caused injury to any person. It has not established that and does not claim it. What it asserts is narrower and is a matter of arithmetic rather than of evidence.

The quantity the federal standard selects on is orthogonal to the quantities that bear on the biological responses described in Part V, and in the short-wavelength region is inversely related to them.

A regulatory instrument that selects on such a quantity will therefore produce a change in those other quantities as a byproduct, and will produce it invisibly, because the instrument contains nothing that would register the change.

Whether that byproduct matters is an empirical question. It is the question 21 U.S.C. § 360ii(a)(4) directs the Secretary to study and evaluate, and no federal body has asked it.

That is the whole of the proposition. The lumen is a good unit for measuring light as the eye sees it, and a federal measure built on it is a reasonable instrument of energy policy. It is simply not an instrument that can detect what this comment is about, and nothing in the Energy Policy and Conservation Act asked it to be.

5. No biological or health evaluation accompanied the transition

Across the five proceedings listed at subsection 2, the Foundation has identified no evaluation of the photobiological effect of the emission of the technology the standards selected. The records are energy conservation records. They address projected energy savings, net present value, consumer purchase cost and lifetime operating cost, manufacturer impacts, and product availability. Those are the matters the Energy Policy and Conservation Act directs that Department to consider, and the Foundation does not suggest the records should have contained anything else.

The nearest the federal record comes to the question is the set of environmental determinations examined at subsection 7, and what those determinations said is set out there.

The Foundation has also sought the records of this Department bearing on the question, by request under the Freedom of Information Act, and none have been produced. Part IV.D.3.

6. The liaison duty under § 360ii(a)(3) and (a)(6) was triggered and not discharged

The Foundation is precise about where the omission lies, and its position may be narrower than a reader expects.

The Energy Policy and Conservation Act imposes no duty on the Secretary of Energy to consult this Department about anything. That Department conducted the rulemakings it was directed to conduct, on the criteria it was directed to apply. The Foundation makes no criticism of it in this subsection.

The duty runs in the other direction, and it is unconditional. Paragraph 360ii(a)(3) directs the Secretary of Health and Human Services to maintain liaison with and receive information from other Federal departments and agencies with related interests on present and future potential electronic product radiation. Paragraph 360ii(a)(6) directs the Secretary to consult and maintain liaison with the Secretaries of Commerce, Defense and Labor, the Atomic Energy Commission, and other appropriate Federal departments and agencies on techniques, equipment and programs for testing and evaluating electronic product radiation and on the development of performance standards. Neither paragraph requires the other agency to initiate. Neither is conditioned on a request. Part II.E and Part II.H.

A Department of Energy rulemaking that would determine which light-emitting technology may lawfully be sold for general illumination in the United States is a related interest within paragraph (a)(3) on any reading of that phrase, and that Department is an appropriate Federal department within paragraph (a)(6) on any reading of that one. The subject matter of the rulemakings was the emission of electronic product radiation from electronic products, which is the subject matter of this subchapter.

Five such proceedings were conducted between January 2017 and April 2024. The Foundation has found no record that the liaison or the consultation those paragraphs direct occurred as to any of them, and its requests for such records have produced none. The effect is the one described at subsection 4: a federal instrument selected a lighting technology on a quantity that cannot register

what that technology emits, and the agency holding the authority to evaluate the emission was not in the proceeding.

This is the ground on which the Foundation states its position on S. 1568 at Part IV.F, and it is the ground of the requests at Parts IX.H.3 and IX.H.5.

7. DOE's NEPA determinations for the lamp rulemakings

The rulemakings described in subsections 2 and 3 produced a nationwide change in the spectral composition of artificial light. No federal agency evaluated that change. The Department of Energy determined, four times, that no evaluation was required under the National Environmental Policy Act. The Foundation set out to learn why, and the account that follows is drawn from the documents that effort produced.

a. The four determinations

Two classes of categorical exclusion were applied to the general service lamp rulemakings.

Class A5, in appendix A to subpart D of 10 C.F.R. part 1021, "Categorical Exclusions Applicable to General Agency Actions," covers:

> A5 Interpretive rulemakings with no change in environmental effect. Rulemakings interpreting or amending an existing rule or regulation that does not change the environmental effect of the rule or regulation being amended.

That class was applied in 2022 to both of the rules published on May 9 of that year: to the rule codifying the 45 lumens-per-watt backstop, RIN 1904-AF09, 87 Fed. Reg. 27,439, Docket No. EERE-2021-BT-STD-0005, by determination CX-026079, signed April 4, 2022 by the NEPA Compliance Officer for the Building Technologies Program of the Office of Energy Efficiency and Renewable Energy; and to the rule defining general service lamps, RIN 1904-AF22, 87 Fed. Reg. 27,461, Docket No. EERE-2021-BT-STD-0012, by determination CX-026078.

Class B5.1, in appendix B, covers actions to conserve energy or water. That class was applied to the 2017 definitions rule by determination CX-100797, and to the 2024 energy conservation standards for general service lamps, which raised the minimum to 120 lumens per watt, by determination CX-030319. The 2024 determination records an affirmative finding that none of the exceptions in B5.1 applies and that no extraordinary circumstances exist requiring further environmental analysis.

b. How the Department of Energy explained the 2022 determinations

The Foundation challenged the 2022 rules three times, and the Department of Energy's reasoning on the environmental question emerged only at the end of that sequence.

On July 10, 2022, the Foundation filed an "Appeal of Final Rules for General Service Lamps EERE-2021-BT-STD-0005 and EERE-2021-BT-STD-0012" with the Department of Energy's Office of Hearings and Appeals. On August 22, 2022, the Director of that office dismissed it with prejudice for want of jurisdiction, Case No. EXC-22-0003. The office explained that its authority runs to "an adjustment from a DOE rule, regulation or order" under 42 U.S.C. § 7194, available where necessary to prevent "special hardship, inequity, or unfair distribution of burdens," and that it does not "possess authority to review or make changes to a regulation that would apply to all regulated parties." The requests to remove LEDs from the general service lamp classification and to rescind the 45 lumens-per-watt requirement sought exactly such a generally applicable change; the remaining requests, including "conducting additional studies," did not concern the adjustment of a rule at all. The letter states that the dismissal is final agency action.

The Foundation then petitioned for repeal of the two rules. The Department of Energy denied the petition in a notice published at 88 Fed. Reg. 16,869 (Mar. 21, 2023), Docket No. EERE-2023-BT-PET-0003, on the ground that repeal would contradict the statute. That published denial does not mention the National Environmental Policy Act and does not mention the categorical exclusions.

The Foundation then wrote to the NEPA Compliance Officer directly. On August 3, 2023, the NEPA Division Director for the Golden Field Office of the Office of Energy Efficiency and Renewable Energy replied. That reply is, so far as the Foundation is aware, the only statement the Department of Energy has made of its environmental reasoning for these rules. It states, in relevant part:

> Concerning the application of a categorical exclusion for the final rule on efficiency standards, the minimum 45 lm/W standard was set by statute, not by DOE. DOE's action was to codify a standard that was already set by Congress. DOE interpreted the statute to determine the backstop action was required. Any environmental effects of the standard already existed when the statute became effective. DOE did not cause a change to the environmental effects; it only codified the 45 lm/W standard that had been already set in the statute. Therefore, the appropriate action under NEPA was to apply DOE's categorical exclusion "A5" for rulemakings that interpret or amend existing rules that do not change the environmental effect of the rule, and as such, are categorically excluded from further NEPA review.
>
> DOE did not have discretion with respect to the minimum 45 lm/W standard. Congress set the minimum standard and mandated that DOE adopt it under the backstop provision of the statutes. See 40 C.F.R. § 1501.1(a)(5).

The same letter states that "there are no remedies under the law that are available to you through further contacting of DOE employees directly," and closes: "DOE considers this matter closed."

c. What a categorical exclusion determination establishes, and what it does not

A categorical exclusion determination records a conclusion that the action belongs to a class of actions not expected to have a significant effect on the human environment. It is not an evaluation. None of the four determinations produced an analysis of the emission characteristics of the technology the rules selected, and none purports to. That is the whole of the point the Foundation makes here.

The 2022 reasoning is worth stating precisely, because it shows where the analysis went. If any environmental effects "already existed when the statute became effective," they are attributed to the Energy Independence and Security Act of 2007. Congress does not prepare environmental analyses of its own enactments, and nothing requires it to. The consequence is not that anyone acted improperly. The consequence is that the effects of the nationwide lamp transition were analyzed by no one — not because a federal body considered them and found them insignificant, but because the analysis fell between the enactment and the implementation of it.

d. The extraordinary-circumstances requirement — 10 C.F.R. § 1021.410(b)

A categorical exclusion may be applied only upon a determination under 10 C.F.R. § 1021.410(b) that the proposal fits a listed class, that it has not been segmented, and that:

> There are no extraordinary circumstances related to the proposal that may affect the significance of the environmental effects of the proposal. Extraordinary circumstances are unique situations presented by specific proposals, including, but not limited to, scientific controversy about the environmental effects of the proposal; uncertain effects or effects involving unique or unknown risks; and unresolved conflicts concerning alternative uses of available resources…

10 C.F.R. § 1021.410(b)(2). The first two enumerated examples describe the present subject. Whether the spectral and temporal characteristics of LED emission have effects on human health is scientifically contested, as Part V sets out, and the effects of long-term exposure at the levels now prevailing are to a material degree unknown — which is the premise of the Department's own request for information.

There is also a statutory marker for the proposition that environmental effect was always part of this program. In the Energy Policy Act of 2005, Congress set the objectives of the Next Generation

Lighting Initiative as the development of solid-state lighting technologies that, compared with incandescent and fluorescent lighting technologies, are "longer lasting, are more energy-efficient and cost-competitive, and have less environmental impact." Pub. L. No. 109-58, § 912(c). Less environmental impact is a criterion Congress wrote into the initiative at the outset. The Foundation's request of January 25, 2025 asked the Department of Energy for the materials by which it defines that term. Subsection f describes what has been produced.

e. The 2024 determination is the one that carries the argument

The Foundation directs the Department's attention to CX-030319, and not to the 2022 determinations, for three reasons.

The first is discretion. Whatever is said of the 45 lumens-per-watt backstop, the 2024 energy conservation standards were the Department of Energy's to set. The reasoning quoted in subsection b — that Congress fixed the level and the agency merely codified it — is unavailable as to that rule.

The second is the class applied. B5.1 is addressed to actions to conserve energy or water. It is framed by the conservation purpose of the action. It says nothing about what the conserving technology emits, and it was not written to answer that question.

The third is notice. On May 30, 2023 the Foundation submitted a request to the Department of Energy to comply with 21 U.S.C. § 360ii and to establish and maintain a liaison with the Food and Drug Administration for the purpose of publishing performance standards for LED products. The Department of Energy did not respond to it. By the time the 2024 determination was signed, the Department of Energy had also received the Foundation's appeal of July 10, 2022, its petition for repeal decided at 88 Fed. Reg. 16,869, and its correspondence with the NEPA Compliance Officer answered on August 3, 2023, each raising the health effects of the technology the rules selected. The determination nonetheless records an affirmative finding that no extraordinary circumstances exist. A finding that there is no scientific controversy about the environmental effects of an action is harder to sustain once the controversy has been put to the agency in writing four times.

f. The Foundation asked the Department of Energy for the records, and was directed to three public dockets

The Foundation submitted two requests to the Department of Energy under the Freedom of Information Act on consecutive days, and the Department of Energy answered one of them.

The request of January 24, 2025, headed "FOIA Request — General Service Lamp Energy Efficiency," sought documents from 2005 through 2024 relating to LED general service lamps, in eight items. The request of January 25, 2025 is directed to the environmental determinations: it seeks materials concerning the categorical exclusion decision for the 45 lumens-per-watt rule and for the 120 lumens-per-watt rule, communications between the Department of Energy and the Environmental Protection Agency regarding the environmental impacts of artificial light and light pollution, and the materials by which the Department of Energy defines the terms significant, less environmental impact, cumulative impact to human health, and cumulative impact to environment.

The third item of the January 24 request is the one that matters here. It asked for:

> All documents involving the FDA and LED products, including documents related to the decision by the DOE to liaison or not liaison with the FDA on setting performance standards for LED products.

The Department of Energy issued a final response to that request on April 16, 2025, assigned number HQ-2025-02044-F and signed by the FOIA Officer of the Office of Public Information. It states:

> Your request was assigned to DOE's Office of General Counsel (GC) to locate records responsive to your request. On April 15, 2025, GC confirmed that requested information is publicly available on the sites below:

The letter then lists three dockets on regulations.gov: EERE-2021-BT-STD-0005, EERE-2022-BT-STD-0022, and EERE-2023-BT-PET-0003. It identifies no records beyond those dockets, withholds nothing, and reports that the Department of Energy's processing costs did not exceed fifteen dollars, the minimum at which it assesses fees.

The Foundation asks the Department to read that response against the request it answered. The request asked, in terms, for the documents relating to the Department of Energy's decision to liaison or not to liaison with the Food and Drug Administration on setting performance standards for LED products. The answer was that the responsive information is publicly available in three rulemaking dockets. As subsection h sets out, the rules in those dockets do not mention the Food and Drug Administration, the Department of Health and Human Services, or the electronic product radiation control program at all.

The Foundation states the limits of what that establishes rather than leaving them to be raised. The letter does not certify that no other responsive records exist, and a requester cannot determine from it what search was performed or where. The Foundation does not assert that no communication between the two Departments has ever occurred. What the record permits is narrower and is enough: asked directly for its records concerning the Food and Drug Administration and LED products, including its decision whether to liaise at all, the Department of Energy identified three public dockets in which the Food and Drug Administration does not appear, and nothing else.

The significance for this comment is not what it shows about the Department of Energy. The liaison duty does not run from the Secretary of Energy. It runs from the Secretary of Health and Human Services, under 21 U.S.C. § 360ii(a)(3) and (a)(6). The Department can establish from within the Executive Branch, and without a Freedom of Information Act request, whether the consultation those paragraphs direct took place while federal policy was selecting the technology now in general use. The Foundation asks it to do so and to state the result.

g. The limits of this line of argument

The Foundation states these rather than leave them to be raised against the comment. The National Environmental Policy Act does not apply to acts of Congress, so the statutory backstop itself is not reviewable on this ground. Where an agency lacks discretion, environmental review of the constrained action serves no purpose, and the Foundation does not suggest otherwise as to the 2022 backstop rule. The Act was amended in 2023, the Council on Environmental Quality has rescinded its implementing regulations, and recent Supreme Court authority narrows the scope of review that is required. Limitations periods bar challenge to the older determinations. The Foundation is not asking the Department to reopen any of them.

h. Why this history is before the Department of Health and Human Services

The Department of Energy answered a question about causation: whether its rules changed an environmental effect. It did not answer, and was not asked to answer, what the replacement technology emits or how people are exposed to it. Neither the backstop rule at 87 Fed. Reg. 27,439 nor the definitions rule at 87 Fed. Reg. 27,461 mentions the Food and Drug Administration, the Department of Health and Human Services, or the electronic product radiation control program. Neither discusses spectral power distribution, source luminance, short-wavelength content, or temporal light modulation. The rulemakings measured the technology in lumens per watt and were silent as to what it emits. Part IV.G.4.

Nothing in this comment depends on the Department of Energy having been wrong. Take its position as entirely correct, and accept every limit stated in the preceding subsection. The emissions of the selected technology, and the conditions under which people are exposed to them,

remain unevaluated. That evaluation is not assigned to the Secretary of Energy. It is assigned to the Secretary of Health and Human Services by 21 U.S.C. § 360ii(a)(4), and the duty to consult with the Department of Energy about it is assigned by § 360ii(a)(3) and (a)(6). Subsection 6 states the consequence.

The sequence, stated plainly, is this. The Foundation asked the Department of Energy to study the health effects of the technology its rules selected, and was told that the office it petitioned had no jurisdiction to order studies, that repeal would contradict the statute, that no environmental analysis was required because Congress had set the standard, and that the matter was closed. It asked the Food and Drug Administration to exercise the authority that does reach the emissions, and was told on May 24, 2024 that a performance standard was not necessary. Each answer was addressed to the authority of the agency giving it. Neither answer reached the question.

8. Whether spectral and photometric characteristics are "performance characteristics" under 42 U.S.C. 6295(o)(4)

The Energy Policy and Conservation Act bars the Department of Energy from prescribing an efficiency standard shown to result in the unavailability of performance characteristics, features, sizes, capacities and volumes substantially the same as those generally available. The Foundation raises a question about that phrase and does not answer it.

The question is whether the emission characteristics of a light source fall within "performance characteristics" as that provision uses the term. If they do, then an efficiency standard that displaces one emitting technology in favor of another with materially different spectral content engages a statutory constraint on the agency setting it. If they do not, then the emission characteristics of a light source are outside the only constraint of that kind in the statute, and Part IV.G.4 establishes that the measure the standard does use is silent as to what the selected technology emits.

The Foundation states the question as open. It has not located authority construing the phrase as applied to an optical emission, and it does not assert the answer in either direction. It raises the question because both answers lead to the same place for this Department's purposes: on either reading, no body evaluated the emission, and Part IV.G.5 establishes that no biological or health evaluation accompanied the transition.

9. DOE testimony before the Senate Committee on Energy and Natural Resources, September 16, 2026

An Associate Deputy Secretary of the Department of Energy testified before the Senate Committee on Energy and Natural Resources in support of reversing the general service lamp standard, on grounds of consumer choice.

The Foundation records the testimony as part of the chronology and takes no position on the ground advanced in it. Part IV.G.11 sets out the two distinct grounds on which the lamp standards may be reconsidered and states which of them this comment adopts.

10. S. 1568 and H.R. 3341, the Liberating Incandescent Technology Act of 2025

S. 1568 was introduced on May 1, 2025 by Senator Lee, chair of the Senate Committee on Energy and Natural Resources, with five cosponsors, and was referred to that committee. A House companion, H.R. 3341, was introduced by Representative Goldman.

The bills would amend the Energy Policy and Conservation Act to remove general service lamps from the covered products at 42 U.S.C. 6292(a), and would nullify three rules of the Department of Energy published in 2022 and 2024.

The Foundation records the bills because they are part of the chronology of the federal lamp framework described in this subsection, and takes no position on them. Its own position on reconsideration of the lamp standards is confined to the ground stated at Part IV.G.11.

11. Two rationales for reconsidering the lamp standards, and which this comment adopts

There are two distinct grounds on which the general service lamp rules may be revisited, and the Foundation states both and adopts one, because a reader is otherwise entitled to assume it adopts the other.

The first is consumer choice and the limits of federal standard-setting. That is the ground occupied by the testimony at Part IV.G.9 and by the bills at Part IV.G.10. This comment does not adopt it.

The second is procedural. The rules selected an emitting technology without any evaluation of its emissions, by any agency, under either the National Environmental Policy Act or the electronic product radiation control program. Part IV.G.5 establishes the absence of any biological or health evaluation and Part IV.H treats the environmental review. This comment adopts the second ground and not the first.

The distinction matters to the relief this comment seeks, and the Foundation sets it out rather than leaving it to be inferred. Part IX asks this Department to exercise federal standard-setting authority under § 360kk. A comment resting on the proposition that federal standard-setting is itself objectionable could not coherently ask for that. The Foundation's objection is not to a federal standard having been set. It is that the standard which was set measured efficiency and nothing else, and that no part of the federal government evaluated what the technology it selected emits.

12. The Department of Energy's lighting research program, and the loop that was supposed to close

Part IV.G.4 records that the experiment described at Part V.B.6 was paid for by the Office of Energy Efficiency and Renewable Energy. This subsection sets out what the Foundation does and does not draw from that, because the obvious inference is the wrong one and the Department should not have to guess which the Foundation intends.

a. The Department of Energy had authority to fund this research, and the Foundation does not question it

Section 912 of the Energy Policy Act of 2005, 42 U.S.C. § 16192, directs the Secretary of Energy to carry out a Next Generation Lighting Initiative of research, development, demonstration and commercial application activities related to advanced solid-state lighting. The purposes the section states are lighting that is longer lasting, more energy-efficient and cost competitive, and of less environmental impact than incandescent and fluorescent lighting. The section does not mention human health, and it does not mention the spectral composition of what the technology emits.

That silence is not a defect and the Foundation does not treat it as one. An agency may fund research useful to its mission without a statute naming the subject of the research; the authority to study is permissive and broad, and it is the authority to regulate that must be conferred specifically. The Foundation states plainly, so that the point cannot be mistaken, that the Department of Energy did not exceed its authority in funding this work, and asks this Department to proceed on that footing.

b. Why an energy agency studies human response to light

The reason is adoption. Efficient lighting that people dislike is not installed, and lighting that is not installed saves nothing. Human response to lighting — visual preference, color rendering, acceptability, comfort — is therefore a variable in a program whose object is to displace one technology with another, and the Department of Energy has supported research of that kind for many years, including at Pacific Northwest National Laboratory. The Foundation sees nothing improper in it. It observes only what the question is for. The Department of Energy asks how people respond to lighting because it needs people to accept the lighting. Section 360ii directs this Department to ask how people respond to radiation because people are exposed to it whether they

accept it or not. The inquiries overlap in their methods and diverge in their purpose, and only one of them is a duty.

c. Where that research is pointed

The divergence is visible in the paper itself. Having set out their findings, the authors identify what they take to be the next steps:

> As a society, it will be important to determine the extent of the physiological and psychological responses, to establish dose-response relationships, and then to make critical decisions about how energy should be used in buildings.

The Foundation draws attention to the destination of that sentence. The physiological finding is an input, and what it is an input to is a decision about energy. That is not a criticism of the investigators, who wrote accurately about the program that funded them. It is the frame their authorizing statute supplies, and it is the only frame available to them. Routed instead through § 360ii, the same measurements answer a different question: whether the radiation a product emits, or fails to emit, serves the person exposed to it. Part II.D.2. The data are identical. The statutory destination is not.

d. What the Foundation objects to, stated precisely

The Foundation does not object to the Department of Energy conducting research into the human effects of lighting. It welcomes that research and relies on it in Part V. The objection is to what happens at the other end of it, which is nothing. No federal body receives this work as electronic product radiation information. None evaluates it against the emissions of the products Americans are actually exposed to. None coordinates it with the research funded elsewhere, publishes a federal account of what it shows, carries it to a report to Congress, or considers whether it bears on the necessity for a performance standard. The research is produced and then it stops.

That is not a gap Congress overlooked. Congress wrote the machinery for exactly this, and wrote it twice.

e. The loop Congress built, and the step at which it is open

Taking the provisions in the order in which they would operate:

Receive. Paragraph 360ii(a)(3) directs the Secretary to maintain liaison with and receive information from other Federal departments and agencies with related interests on present and future potential electronic product radiation. A department that funds research into the physiological effects of the spectral content of lighting has a related interest as a matter of demonstrated fact. The question does not require argument and is not open to characterization.

Coordinate and support. Paragraph 360ii(a)(2) directs the Secretary to plan, conduct, coordinate, and support research to minimize the emissions of and the exposure of people to unnecessary electronic product radiation. Research funded by another federal department on precisely that subject is what there is to coordinate. A coordination duty is not discharged by the absence of anything to coordinate; here there was something.

Invite. Section 360jj(b) provides that, in carrying out the studies the section directs, "the Secretary shall invite the participation of other Federal departments and agencies having related responsibilities and interests, State governments—particularly those of States which regulate radioactive materials under section 274 of the Atomic Energy Act of 1954, as amended, and interested professional, labor, and industrial organizations."

Organize. Section 360jj(c) provides that "the Secretary or his designee shall organize the studies and the participation of the invited participants as he deems best." The subsection adds that any dissent from the Secretary's findings and recommendations shall be included in the report if the dissenter so requests.

Study and evaluate. Paragraph 360ii(a)(4) directs the study and evaluation of emissions of, and conditions of exposure to, electronic product radiation. Part II.F.

Report. Section 360jj(a)(2) directs a study to determine the necessity for the development of standards for the use of nonmedical electronic products, and a report of the result to Congress. Part II.I.

Decide. Section 360kk(a)(1)(A) conditions a performance standard on the latest available scientific and medical data in the field. A Secretary who does not receive the data cannot satisfy the predicate of the Secretary's own standard-setting provision. Part II.C.1.

Publish. Section 360ii(b)(1)(A) authorizes the Secretary to collect and make available, through publications and other appropriate means, the results of, and other information concerning, research and studies relating to the nature and extent of the hazards and control of electronic product radiation. This is the step that closes the loop, and it is the step at which research funded by one department would become available to the public, to purchasers, and to the state and local entities described at Part VIII. Part II.B.

Two features of § 360jj(b) deserve particular notice, because they show what Congress pictured. The subsection goes on to provide that, on request from interested congressional committees, the Secretary shall keep those committees currently informed as to the progress of the studies and shall permit them "to send observers to meetings of the study groups." Congress contemplated study groups that hold meetings, running long enough and regularly enough that a committee might send someone to watch. And § 360jj(c) contemplates that participants will disagree with the Secretary and that their dissent will be recorded — which presupposes participants.

Every step in that sequence is a verb Congress wrote, and the sequence closes: information is received, coordinated, organized, evaluated, reported, and acted upon or not for stated reasons. The Foundation submits that the loop is open at the first step. The research exists. Nothing receives it. Everything downstream of receiving it is therefore empty, not because the Secretary considered the material and found it wanting, but because the material never arrived.

f. Three agencies, one duty

The position may be stated compactly. Three federal departments touch artificial light in the respects this comment concerns. The Department of Energy is under no duty to study its health effects and is studying them. The Environmental Protection Agency is under no duty to study them and is not, and has said so to the Foundation in writing, for the documented reason set out at Part II.H.3. The Secretary of Health and Human Services is under a duty to study them, in terms Congress made mandatory, and is not.

The Foundation's complaint is not that the Department of Energy overstepped, and it is not that the Environmental Protection Agency shirked. Neither is true, and the Foundation would not have this Department waste a paragraph of its response defending either of them. The complaint is that the research function and the regulatory function have come apart. The department that can fund the question cannot act on the answer; its only instrument, if its own researchers established a harm tomorrow, would be to relax or decline an efficiency standard, since nothing in the Energy Policy and Conservation Act authorizes it to prescribe what an electronic product may emit. The department that can act on the answer is not asking the question. Section 360ii is the provision that was supposed to hold those two things together, and the liaison it directs is the hinge.

13. Significance for the Department's duties under § 360ii

The Foundation states the significance of this subsection in one proposition. Another federal agency regulated a product class into the exposure environment of the entire country, while the agency holding the radiation control authority conducted no evaluation of what that class emits and appears nowhere in the record of the rulemakings that did it.

That is the circumstance the liaison duties were written to prevent. Part II.E and Part II.H set out those duties and the record of their performance, Part IV.G.6 establishes that the duty was triggered in this instance and not discharged, and Part II.M sets out what the Foundation says follows. The Foundation does not contend that the Department of Energy should have performed the evaluation; Part IV.G.4 establishes that its statutory measure does not reach the question. It contends that the evaluation was this Department's to perform and that nobody performed it.

H. The National Environmental Policy Act, and the Consequence of Absent Federal Evaluation

Part IV.G.7 set out the environmental determinations the Department of Energy made for the general service lamp rulemakings. This section states the general proposition those determinations illustrate. It concerns every federal agency that must assess the environmental effects of an action involving artificial light, and it concerns this Department because of what those agencies have to consult.

1. What NEPA requires, and what it does not

The National Environmental Policy Act, 42 U.S.C. § 4321 et seq., requires a detailed statement of environmental effects for major federal actions significantly affecting the quality of the human environment. It is a procedural statute. It requires an agency to consider and disclose effects before it acts. It does not dictate any outcome, and it does not direct anyone to generate knowledge that does not yet exist.

That distinction governs this entire section. Section 360ii is substantive in the relevant sense. It directs the Secretary to study and evaluate emissions of, and conditions of exposure to, electronic product radiation, and the direction does not depend on anyone proposing a federal action. NEPA asks whether an agency said what it knew. Section 360ii directs the Secretary to find out.

2. The present state of NEPA, stated accurately

The Foundation sets out the current position rather than the position as it stood when the determinations at Part IV.G.7 were made, because the two differ and the difference bears against an argument the Foundation might otherwise be tempted to advance.

The Council on Environmental Quality rescinded its NEPA implementing regulations, formerly at 40 C.F.R. parts 1500 through 1508, by interim final rule published February 25, 2025 and effective April 11, 2025.

It did so following Marin Audubon Society v. Federal Aviation Administration, decided by the Court of Appeals for the District of Columbia Circuit in November 2024, which held that the Council lacks rulemaking authority under NEPA, and Iowa v. Council on Environmental Quality, decided February 3, 2025, which vacated the Council's 2024 rule.

Federal agencies now apply their own NEPA procedures. The Department of Energy's remain at 10 C.F.R. part 1021, and the categorical exclusions described at Part IV.G.7 are that Department's own.

The government-wide definition of effects, which encompassed ecological and aesthetic effects and was the route by which lighting impacts customarily entered environmental documents, is no longer a binding government-wide rule. The requirement to analyze cumulative effects derived from the same rescinded regulations.

In Seven County Infrastructure Coalition v. Eagle County, decided in 2025, the Supreme Court directed substantial deference to an agency's own judgments about the scope of its NEPA analysis.

The Foundation states all of this plainly because it would be convenient to argue that every federal analysis touching artificial lighting must address its effects, and that argument is weaker today than it was two years ago. The Foundation does not make it.

3. Why NEPA cannot answer the question this comment raises

Three reasons, each sufficient on its own.

Occasion. NEPA operates on proposed federal actions. The exposure described at Part VII arises from hundreds of millions of installations by private parties and by State and local governments, the overwhelming majority of which involve no federal action and trigger no environmental review at all.

Content. NEPA requires the disclosure of what is known. It does not require research. An agency that does not know the health effects of a change in the spectral composition of lighting complies with NEPA by saying that it does not know.

Deference. After Seven County, an agency's judgment about what lies within the scope of its analysis receives substantial deference from a reviewing court.

NEPA is therefore not an alternative route to the evaluation that paragraph 360ii(a)(4) directs. It is a disclosure obligation that operates downstream of knowledge, and the knowledge is the thing that is missing.

4. An environmental analysis is only as good as the authority it can cite

This is the operative point of the section, and the Foundation submits that it has not previously been put to this Department.

When a federal agency must assess the environmental effects of an action involving artificial light, it looks for federal authority to consult. For ambient air it has national ambient air quality standards. For water it has criteria documents. For ionizing radiation it has federal guidance. For optical radiation emitted by electronic products there is nothing. No federal characterization of what these products emit, no federal evaluation of the effects of that emission, and no federal criterion against which a change in it could be measured. Parts II.C.3, II.F.4 and V.J.

The determinations at Part IV.G.7 illustrate the consequence. The Foundation does not contend that the analysts at the Department of Energy were careless, and it withdraws nothing it has said about the reasoning in those determinations. It contends that the question was substantially unanswerable on the materials available to them. No federal body had characterized the emission of the technology the rules would select. None had evaluated its effects on people. None had published a criterion by which a change could have been assessed. An agency cannot disclose what no one has determined.

So the consequence of non-performance under § 360ii does not stop at the boundary of this Department. It propagates outward. Every other agency that must analyze a lighting action inherits the same absence, and will continue to inherit it until the evaluation is performed. That is a cost of non-performance that is borne entirely by other agencies and by the public, and it is invisible in this Department's own records.

5. The review function of the Environmental Protection Agency

One federal function survives the rescission untouched, because it is statutory rather than regulatory. Section 309 of the Clean Air Act, 42 U.S.C. § 7609, directs the Administrator of the Environmental Protection Agency to review and comment in writing on the environmental impact of federal actions, and to refer to the Council on Environmental Quality any matter the Administrator determines to be unsatisfactory from the standpoint of public health or welfare or environmental quality.

That review is conducted with whatever federal criteria exist. Part II.H.3 sets out what that agency holds on radiation and what it does not. On optical radiation emitted by electronic products it holds nothing, and so its review of a lighting action can say nothing authoritative about the emission. The Foundation identifies this not as a criticism of that agency but as a second instance of the same propagation: a statutory review duty is performed, and performed faithfully, against an empty shelf.

6. What the Foundation asks under this head, and what it does not

It does not ask this Department to participate in, review or comment upon any other agency's environmental review. That is not its function and the Foundation does not suggest otherwise.

It does not ask the Department to treat NEPA as a source of authority for anything. The authority is in § 360ii, and NEPA neither adds to it nor subtracts from it.

It asks the Department to recognize that the research, testing and evaluation directed by paragraphs 360ii(a)(2), (a)(4) and (a)(5) would, if performed, supply the thing every other agency's environmental analysis of a lighting action presently lacks, and that this is among the practical consequences of performing the duty. Part IX.C.

A federal criterion for exposure to optical radiation would be consulted by every agency that had to assess a lighting action, in the ordinary way that federal criteria are consulted. Its absence is felt in the same ordinary way, and has been felt as to this radiation since 1968.

7. A note on this Department's own obligations

For completeness, and so that the comment cannot be said to have overlooked it: if the Secretary were to prescribe a performance standard under § 360kk, that would itself be a federal action to which NEPA applies, and this Department maintains NEPA procedures of its own. The Foundation does not regard that as an obstacle to anything it asks. The requests at Part IX are in the first instance for research, evaluation, liaison and reporting, none of which presents any difficulty of this kind.

I. What the Record Establishes

This Part has set out the administrative, judicial and legislative record. What follows states what that record establishes. Each proposition is supported by material already given above and is cross-referenced to it, and the Foundation adds no characterization that the underlying documents do not carry on their face.

1. Actual notice to the Department and to the FDA

Four citizen petitions were docketed with the agency between June 2022 and September 2023 and were disposed of by a single response on May 24, 2024. A fifth, submitted December 30, 2025, remains pending. Parts IV.C.1 and IV.C.2.

More than six hundred LED Incident Reports and more than four thousand LED headlight reports were transmitted to the Center for Devices and Radiological Health at its own radiological health correspondence address, and receipt was acknowledged. Parts IV.B.2 and IV.B.3.

The comments and signature totals from the public petition were transmitted to the agency on more than one occasion. Part IV.B.5.

A Notice of Defective Technology was addressed to the Commissioner of Food and Drugs on December 1, 2025. Part II.J.1.c.

A Member of the House of Representatives wrote to the Commissioner on July 28, 2023, identifying 21 U.S.C. §§ 360ii(a) and 360kk(a) by section. A United States Senator inquired of the agency on February 16, 2023. Part IV.F.5.

Whatever else is in dispute, notice is not. The subject has been before the agency continuously since June 2022, through its own dockets, through its own correspondence address for radiological health, and through Members of Congress.

2. Requests directed to the correct agency under the correct statutory authority

The Foundation did not select this Department from among several candidates. It was directed here. The agencies listed at Part II.H each stated, in writing and in their own words, that the subject was not within their authority, and several identified this Department by name as the body to which the question belonged. One of them offered assistance if this Department were to request it. Part II.H.11.

The authorities invoked are those Congress enacted for this purpose: the research and coordination duties of § 360ii(a)(2), the study and evaluation duty of § 360ii(a)(4), the minimization duty of § 360ii(a)(5), the liaison and consultation duties of §§ 360ii(a)(3) and (a)(6), the reporting duty of § 360jj, the standard-setting authority of § 360kk, and the defect provisions of § 360ll.

No question therefore arises on this record of a petitioner having approached the wrong body, or the right body under the wrong authority, or of a subject that fell between agencies. It did not fall between them. It was assigned to one of them by statute and identified as that one by the others.

3. Congress has now spoken to the subject matter

July 28, 2023: a Member of the House wrote to the Commissioner asking that the agency give full and fair consideration to prescribing performance standards for automobile LED headlights. Part IV.F.5.a.

An enacted appropriations directive urges the Secretary of Transportation to report to Congress on gaps relating to the impact of the brightness of low beam headlamps. Part IV.F.1.

March 3, 2026: H.R. 7772, the LIGHT Safety Act, was introduced and referred. Part IV.F.4.

September 30, 2026: S. 1568 was reported favorably from the Senate Committee on Energy and Natural Resources. It would terminate the three rules described at Part IV.G.2.

The Foundation draws no conclusion from these items about what Congress intends. It states only that the emission of light by light-emitting diode products is a subject now before both chambers, in correspondence, in an enacted directive and in legislation, and that it is not a subject that has escaped congressional attention.

4. Federal policy drove the exposure; no federal agency evaluated the emissions of the selected technology

Between January 2017 and April 2024 the federal government conducted five rulemakings that determined which lighting technology could lawfully be sold for general illumination in the United States. The requirement they impose on a manufacturer consists of one parameter, lumens per watt. Federal law imposes no requirement as to the spectral content of the emission, the luminance of the emitting surface, the apparent size of that surface, or the temporal structure of the output. Parts IV.G.2 and IV.G.4.

The Foundation has identified, in the records of those five proceedings, no evaluation of the photobiological effect of the emission of the technology the standards selected, and no record that the liaison or consultation directed by §§ 360ii(a)(3) and (a)(6) occurred as to any of them. Parts IV.G.5 and IV.G.6.

The exposure described in Part VII is therefore not an accident of the market. It followed a federal determination, and the federal determination was made on a criterion that cannot register what this comment is about.

5. No performance standard, study, or surveillance system has resulted

No performance standard under 21 U.S.C. § 360kk governs the visible light emitted by LED products. Part 1040 of title 21, titled Performance Standards for Light-Emitting Products, contains four standards, and none of them is this one. Part II.C.3.

No study or evaluation of emissions of, or conditions of exposure to, this radiation has been identified under § 360ii(a)(4). Part II.F.4.

No channel exists by which a member of the public may report an adverse response to optical radiation from an LED product to this Department. Parts II.L and VII.J.

The Technical Electronic Product Radiation Safety Standards Committee, which the Secretary must consult before prescribing any standard, has not met since 2016. On the Department's own published roster twelve of its fifteen seats are vacant, the office of Chairperson is vacant, and no member at all is listed in the industry category, so the quorum its regulations require cannot be constituted. Parts II.K.4 and II.K.5.

The study and report to Congress directed by § 360jj(a)(2) has not been made as to these products. Part II.I.4.

Four years have passed since the first petition. The instruments of the electronic product radiation control program stand, as to this radiation, where they stood before it was filed.

6. The agency's own records on the subject remain unavailable to the public

A request under the Freedom of Information Act for the agency's records concerning these products was submitted on March 30, 2025. Nothing has been produced. The disclosure office of the Center for Devices and Radiological Health estimated completion on January 15, 2027. In the litigation described at Part IV.D.3, the United States has acknowledged that as of August 12, 2026 no determination had been made, no record had been produced, and no exemption had been asserted.

Separately, the literature search and systematic review on which the response of May 24, 2024 rested has not been published, and the organization that performed it has not been named. Parts I.C.6 and IX.H.2.

These six propositions are set beside one another because the Foundation believes the comparison is the most useful thing it can offer this Department, and because the comparison requires no adjective.

This request for information invites the public to supply evidence bearing on non-ionizing electromagnetic radiation and human health, and it closes on October 21, 2026. The Foundation has supplied what it holds. The Department's own component has stated that its records on the same subject are expected to become available on January 15, 2027.

The Foundation does not ask the Department to resolve the disclosure litigation and takes no position here on its merits. The observation is narrower, and it is the one with which this Part closes. The public is being asked to supply a record that the agency has not itself made available, on a schedule that closes before the agency expects to make it available.

V. SCIENTIFIC RESEARCH

A. Methods, Sources, and Standard of Evidence [RFI Q4, Q12]

Before stating its methods the Foundation sets out the shape of the subject, because a good deal turns on it.

The effects at issue in this Part are not one effect. They arise in five physiological domains, by distinct mechanisms, and the literature on each is largely separate from the literature on the others.

Photobiological. The direct action of optical radiation on ocular tissue, including photochemical injury to the retina, and the optical effects of high-luminance sources within the eye. Part V.C.

Neurological. Photosensitive responses including seizure, migraine and photophobia, and the trigeminal and melanopsin pathways that mediate light-induced discomfort. Part V.E.

Hormonal. The neuroendocrine response to light, including the suppression of nocturnal melatonin and the entrainment of circadian timing. Part V.F.

Psychological. Affective and behavioral responses, including those mediated by the circadian pathway and those arising from aversive sensory environments. Part V.G.

Mitochondrial and metabolic. The action of optical radiation on cellular respiration, by absorption in the mitochondrial respiratory chain, with consequences for adenosine triphosphate production and for the functions that depend on it. Part V.B.6.

The Foundation separates them because they are separately established, separately studied, and separately unresolved. A conclusion reached about one does not dispose of the others, and the mechanisms do not stand or fall together. An assessment that treats the adverse health effects of LED light as a single question will understate every one of them, because the evidence bearing on each is thin when considered alone and is not aggregated by a question posed in the singular.

The fifth domain requires a word of its own, because it does not fit the framework within which this subject is ordinarily discussed. The other four concern what light-emitting diode products emit. The fifth concerns, in part, what they do not emit. Sunlight and the incandescent lamp both extend well into the infrared; the light-emitting diode is engineered to the band in which the eye forms images and produces little above 700 nanometers. If long-wavelength radiation performs a physiological function, then a lighting transition that removed it is a subtraction as well as an addition, and no hazard framework built around limiting emission can detect a subtraction. Part V.B.6.

Underlying all four is a fact about the stimulus rather than about any one response. Light is not an incidental feature of the human environment. It is the signal by which the timing of human physiology is set, and the human visual and non-visual photoreceptive systems developed under a particular range of spectra, intensities, source geometries and daily patterns. Artificial sources are properly evaluated against that range, and Part V.B.5 describes it. The Foundation does not draw from this any conclusion that artificial light is harmful. It draws the narrower conclusion that a change in the spectral, spatial and temporal character of the light under which a population lives is a change worth measuring, and that no federal body has measured it.

A note on vocabulary belongs here, because it governs how every study in this Part should be read. The literature uses the terms light pollution, artificial light at night, and ALAN. Those are the field's words for its subject and this comment reproduces them when quoting. They describe the same physical quantity that 21 U.S.C. § 360hh(1)(A) calls electronic product radiation when it is emitted by an electronic product, and that § 360ii(a)(2) calls unnecessary when it serves no purpose for the person exposed to it. Part II.D.3 sets out that correspondence and the limits of it. A study is not outside the subject matter of this subchapter because of the words in its title.

1. Literature selection and search strategy

The Foundation maintains a standing bibliography on the effects of artificial light, published at softlights.org and organized in twelve subject categories: human health, eye hazards, neurology, ecology, the physics of light, flicker, crime and safety, flashing lights, vehicle lights, street lighting, electronic billboards, and other research. It also maintains a shared reference library of research

on artificial light at night. The collection has been assembled over several years and the entries range in date from the 1990s to the present.

The Foundation states at the outset what that collection is and what it is not, because the distinction bears on the weight this Department can give it.

It is a curated bibliography. The majority of its entries are articles in peer-reviewed journals, including journals of general scientific standing and specialist journals in ophthalmology, chronobiology and lighting research. A minority are standards documents, reports of governmental and intergovernmental bodies, and items of press reporting, and these are distinguishable on inspection but are not separately labeled on the page.

It is not a systematic review, and the Foundation does not offer it as one. There is no registered protocol, no pre-specified search string, no documented inclusion and exclusion criteria, no dual independent screening, and no formal assessment of risk of bias. A reader who approached it expecting those things would be entitled to say so.

The Foundation is explicit about this for a practical reason. The most likely way for a body of literature to be set aside is for the party submitting it to overstate what the submission is. The Foundation therefore identifies the limits of its own collection first, and asks the Department to weigh what remains on its merits rather than on the form in which it has been assembled.

The method used for this comment

For the purposes of this Part the Foundation has drawn on that collection subject to the following restrictions, which are stated so that any proposition in Parts V.B through V.K can be traced to a source of known type.

Propositions of fact about physiological or health effects are supported only by peer-reviewed primary research or by peer-reviewed review articles, and the citation identifies which.

Standards documents are cited as statements of what a standard requires or recommends, never as evidence of an effect.

Reports of governmental and intergovernmental bodies are cited as statements of the position of those bodies, with the authorship and sponsorship identified, as at Part V.C.2.f.

Press reporting is not cited in support of any scientific proposition.

Preprints are excluded. A manuscript posted to a preprint server has not been peer reviewed, and this Part relies on peer-reviewed research. Where a preprint has since been published, the published version is cited and the preprint is not counted separately.

Records are deduplicated. The same study may appear under more than one identifier — as a preprint and as a published article, or in a conference abstract and a full paper — and counting such records separately would overstate the weight of the evidence. One instance arose in assembling this appendix and is noted at Appendix C.8.

The first-hand reports described in Part VII are treated separately and are not offered as scientific evidence of causation. Subsection 2 states what they are offered for.

An illustration of the form

One entry is set out here in the form the appendix will use, both to show what the Foundation means by a summary and because the study is among the most directly relevant in the collection.

Citation. Barrett EM, Jeffery G. LED lighting (350–650 nm) undermines human visual performance unless supplemented by wider spectra (400–1500 nm+) like daylight. Scientific Reports 2026 Jan 23;16:3061. doi:10.1038/s41598-026-35389-6. PMID 41577976.

Design. Controlled before-and-after study with an independent control group. Twenty-two adults aged 23 to 65, eleven exposed and eleven control.

Intervention and endpoint. Ordinary LED lighting was supplemented with broad spectrum lighting for two weeks. Color contrast sensitivity was measured on the protan and tritan axes at baseline and at intervals afterward.

Finding, in the authors' words: "Here we supplement LED light with broad spectrum lighting (400–1500 nm+) for 2 weeks and test colour contrast sensitivity. We show significant improvement in this metric that last for 2 months after the supplemental lighting is removed."

Proposed mechanism, in the authors' words: "The 420–450 nm dominant in LEDs suppresses respiration while deep red/infrared (670–900 nm) increases respiration in aging and some diseases including in blood sugar regulation."

What it supports. That a measurable deficit in a visual function, attributable to the spectral composition of ambient lighting, is present in working adults and is reversible by changing the light.

What it does not support. It is a small study. The authors advance the systemic mechanism as a possibility and say so in terms: the effect "likely involves shifting patterns of serum cytokine expression, raising the possibility of wider negative impacts of LEDs on human health." The Foundation reproduces that hedge rather than removing it.

The Foundation offers that entry as an example of why the collection cannot responsibly be set aside as a body. The study was published in a peer-reviewed journal of general scientific standing in January 2026, after the determination of May 24, 2024. It sits within a mechanistic literature that the paper itself cites, on mitochondrial complex activity, adenosine triphosphate production, body weight, lifespan and glucose regulation in animal models, together with a human glucose tolerance result. It concerns a property of light-emitting diode emission that no part of the existing federal framework addresses and that the blue light hazard framework does not reach.

The asymmetry, and why it is part of the request

The Foundation has not conducted a systematic review because it cannot. It has no funding for one, no subscription access to the indexed databases a search would require, and no trained reviewers. It is a small nonprofit corporation.

The Department is differently situated. It engaged an organization to conduct a comprehensive literature search and systematic review of precisely this question, as its response of May 24, 2024 states. The Foundation does not complain of that. It is what a federal agency with the authority and the appropriation should do, and it is what paragraph 360ii(a)(2) contemplates when it directs the Secretary to plan, conduct, coordinate and support research. The Foundation's request is not that the Department should have refrained. It is that the product should be published. Part IX.H.2.

And the Department would not be starting from a scattered literature, because the index already exists and is free

The Foundation has just said that it cannot conduct a systematic review because it lacks the money, the subscription access and the reviewers. It should say in the same place that the first obstacle to such a review, which is finding the literature at all, has already been removed by somebody else.

A curated bibliographic database of research on artificial light at night, known as ALAN_DB, is maintained by DarkSky International together with the Loss of the Night Network and is published as a Zotero group library. Described at Appendix D.9. The organization states on its own website that the library is free for public use and that no login is required. It is the same database that the organization identifies as the main source of the briefing document at Appendix D.9, as the entry there records.

The scale, taken first from the maintainer and then from the library itself. The organization states that the briefing drew on nearly five thousand pieces of scientific literature listed in the database; that in recent years an average of about four hundred and thirty publications have been added each year; and that the contents have grown by roughly twenty-two percent a year on average. Its 2023 edition is described as surveying four hundred and fifty-seven papers published in the single year 2022, against the three hundred and twenty-one references in the 2022 edition that this comment uses. The Foundation then went and looked. On October 16, 2026 the library held 6,754 entries.

The Foundation does the arithmetic rather than leaving it, and marks it as its own. The maintainer's five thousand figure carries no date on the page that gives it, but it is attached to a briefing announced in July 2023. If it was current then, the library has added about seventeen hundred and fifty entries in the three and a quarter years since, which is about five hundred and forty a year. That is the same order as the four hundred and thirty a year the organization reports and somewhat above it. It is not the same order as twenty-two percent a year compounded, which from five thousand in mid-2023 would put the library well over nine thousand today, and the observed figure implies compound growth closer to ten percent. The Foundation therefore reports the twenty-two percent figure as the organization's statement and does not rely on it. Nothing in the argument below turns on the growth rate. It turns on the count, and the count is larger than the figure the organization published.

The Foundation draws one conclusion from those figures and declines to draw a second. The conclusion it draws is about availability. Whatever else may be said about the state of this literature, it is not obscure, not dispersed across inaccessible holdings, and not expensive to locate. A federal agency directed by paragraph 360ii(a)(4) to plan and conduct research into the effects of electronic product radiation, and directed by paragraph 360ii(a)(2) to coordinate and support it, can reach the whole of this field from a browser without paying anything. The conclusion the Foundation declines to draw is that volume equals maturity. A field growing at twenty-two percent a year may be growing because it is unsettled as easily as because it is productive, and the Foundation does not argue that five thousand entries settle anything. What the volume establishes is that the literature is large enough to require evaluation and accessible enough that evaluating it is a matter of deciding to.

The Foundation also states what that count does to its own submission, before anyone else does. Appendix C contains one hundred and fifty-three peer-reviewed articles. Against 6,754 entries that is about two and a quarter percent, or about one entry in forty-four. The Foundation does not claim to have read the field. It claims to have read what it cites, to have said in each entry what the study does and does not establish, and to have recorded the findings that run against its own position, of which Parts V.A.2, V.I and V.J.4 contain many. Those are different claims and the Foundation makes only the second. The right response to the first is not to take the Foundation's word for the field. It is to open the index.

So the request at Part IX.H.2 can be put more precisely than it has been. The Department engaged an organization to conduct a comprehensive literature search and systematic review of this question and has not published the result or named the organization. The Foundation asks that the product be published. It adds here that the Department need not treat the task as one that must be commissioned afresh behind a contract: the population from which any such review would draw is a public web page, and the Department can check the Foundation, check its contractor, and check itself against the same list.

2. Categories of evidence and how each is weighted

Evidence of different kinds supports conclusions of different kinds. The Foundation sets out the categories it relies on and what each can and cannot establish, so that no proposition in this Part is read as resting on more than it does.

Physical and radiometric characterization. Measurements of what a product emits — spectral power distribution, radiance, luminance, modulation. These establish the exposure and nothing about its effect. Part V.B.

Mechanistic and in vitro studies. These establish that a pathway exists and is biologically plausible. They do not establish that it operates at the exposures encountered in ordinary life.

Controlled human exposure studies. These establish effects at the exposures and durations actually administered, in the populations actually studied. They are the strongest evidence available for short-term and acute responses, and they are structurally incapable of addressing exposures measured in years.

Animal studies. These permit exposures, durations and endpoints that cannot be used in humans, including histological examination of the retina. They carry the indirectness that attaches to any inference from another species, and the Foundation states that indirectness wherever it relies on one.

That indirectness has specific grounds in this literature, and the Foundation sets them out here rather than leaving the word to do the work. Thirty-three entries in Appendix C rest wholly or partly on non-human subjects: C.9, whose animal arm accompanies a human analysis, and C.15, C.23, C.26, C.36, C.48, C.49, C.50, C.51, C.125, C.126, C.127, C.128, C.131, C.132, C.133, C.134, C.135, C.136, C.137, C.138, C.140, C.141, C.142, C.144, C.145, C.146, C.147, C.148, C.150, C.151, C.152 and C.153. Appendices C.139 and C.149 are deliberately not among them, neither having observed any organism: the first is a remote-sensing study and the second a radiometric characterization of street lights in which animal visual systems appear only as models. Eighteen animal taxa are represented — laboratory mice, rats, wild spiny mice, an endangered heteromyid kangaroo rat, cattle, a urodele amphibian, the fruit fly, the mosquito, nocturnal moths, dragonflies, the monarch butterfly, two species of intertidal littorinid snail, a coral reef anemonefish, domestic fowl kept as disease sentinels, a seabird, four species of resident and migratory songbirds together with the captive zebra finch, an assemblage of Mediterranean marine fishes and invertebrates, and a flying-insect assemblage identified to order and suborder — and the distance from a human is not the same in each. Appendix C.142 is the only entry that samples a larval stage; every other study of moths in this appendix sampled adults. Two of the thirty-three are not used for their findings at all: Appendix C.131 is not an organism-level study but a satellite observation of urban vegetation across four hundred and twenty-eight cities, and Appendix C.134 is an entry whose findings the Foundation declines and from which it takes only the authors' lighting recommendations and an error in their units. The grounds of indirectness set out below do not apply to either in the same way. Appendices C.136 and C.137 are also different in kind: what the first tests is not an organism but a luminaire, and what the second establishes is a mechanism of flight control rather than an effect on a population; and Appendix C.138 is relied on principally for the limitation in its own exposure variable, its finding being recorded as suggestive only. Appendix C.50 states the grounds in its own entry at length, because the subject there is an insect whose photoreceptive biology is not homologous with a mammal's, and the Foundation does not repeat that here; Appendices C.125, C.128, C.132 and C.135 do the same for the mosquito and for moths, and Appendices C.133, C.141 and C.149 are the three entries in which the investigators resolved the question by modeling a visual system rather than assuming it, the second doing so for three predators at once and for the appearance of the prey to each of them, and the third for five visual systems and four non-visual photoreceptors against nine measured street lights.

For the rodent work, which is most of it, three grounds of indirectness are specific enough to state. The Foundation takes them from a review by investigators who conduct rodent studies of this exposure themselves — Bedrosian and Nelson, in Translational Psychiatry in 2017 — because a limitation carries more weight when stated by those whose own models it qualifies. Randy Nelson is an author of the entries at Appendix C.25 and C.49, as those entries record.

Nocturnality inverts the phase of the exposure. In the authors' words: "Many rodent species are nocturnal, unlike humans, meaning that exposure to light at night occurs during their active and awake phase." Light at night is therefore not the same intervention in a mouse as in a person. In the person it falls in the rest phase and competes with sleep; in the

nocturnal animal it falls in the active phase and does not. Any inference that carries a rodent result across to a human carries that difference with it.

The same fact is also a methodological strength, and the Foundation states it because the point is symmetrical and the comment would be misleading if it gave only the unfavorable half. The standing alternative explanation for the human findings in this literature is that the effects are consequences of disturbed sleep rather than of light. Because a nocturnal animal is not attempting to sleep when the light is on, a result obtained in one cannot be attributed to sleep disruption. The authors put it so: "Indeed some effects of nighttime light are likely attributed to sleep disruption in humans, but studies using nocturnal species show that it is not the only cause." Nocturnal models are accordingly poor analogues of human exposure and good instruments for separating the light pathway from the sleep pathway. The Foundation relies on them for the second purpose and not the first.

Diurnal models exist and have been used to address the phase problem directly. The review records that "Studies in diurnal Nile grass rats have attempted to overcome this difference." When this Part was first drafted the Foundation recorded that no entry in Appendix C used a diurnal model, and that this was a gap in the collection rather than in the field. That gap is now closed, and closed in the strongest form the design admits. The study at Appendix C.126 exposed a diurnal mammal and its nocturnal congener to the same light, in the same enclosures, at the same time, and measured the same endpoints in both. Its principal finding is addressed to exactly the difficulty set out in the paragraph above: the effect tracked the animal's rest phase and not its temporal niche. The Foundation returns to this at Part V.I, and states there both what that does and does not license.

Melatonin is not reliably present in the standard laboratory mouse. The review states: "Although both nocturnal and diurnal species produce melatonin during the dark phase, certain inbred laboratory strains of mice have no detectable pineal melatonin rhythm at all." That bears on any entry whose mechanism is said to run through melatonin suppression, and it bears directly on the animal arm of Appendix C.9, in which melatonin was administered to mice and partially reversed the effect observed. A result in which melatonin matters, obtained in a strain that may have no melatonin rhythm of its own, requires the strain to be identified before the result can be weighed. The Foundation has not established the strain used in every rodent entry and says so.

The Foundation draws two consequences for how this Part should be read. The first is that no proposition in Part V rests on an animal result alone, and where an animal result is the only support for a proposition the entry says so. The second is that the function of the animal evidence in this comment is narrower than its volume suggests. It is relied on to show that a pathway exists, that it responds to the spectral and temporal variables the Foundation asks to have characterized, and that effects are obtainable at exposures that are not injurious. It is not relied on for the magnitude of any effect in a human being, and paragraph 360ii(a)(4) does not require that it be: the provision directs the Secretary to study and evaluate emissions and conditions of exposure, and a demonstration that a pathway responds to a variable is a reason to study it rather than a substitute for having done so.

Observational epidemiology. These establish associations in populations, subject to confounding. Studies of outdoor artificial light at night, in particular, face the difficulty that light exposure covaries with urbanization and with much else.

One limitation attaches to an identifiable subset of that evidence rather than to the whole of it, and the Foundation records it here so that no entry is read as resting on more than it does. Eleven of the fifty-two entries in Appendix C take radiance detected from orbit as their exposure variable, and two further entries are reviews of literatures composed substantially of such studies. The instrument from which that measure derives is sensitive only above approximately 500 nanometers, which is above the emission peak of the products this comment concerns. Part V.J.4 sets the matter out with citation, and the weight the Foundation accords those entries follows from it. They are evidence of an association between outdoor light at night and the stated

outcome. They are not evidence about the spectral content of that light, and the Foundation does not advance them as such. Appendices C.32 and C.38 are the two entries in which exposure was measured at the person rather than from orbit, and Part V.J.4 describes the one study that resolved wavelength.

Case reports and clinical observation. These establish that a presentation has occurred and has been recorded by a clinician. They do not establish frequency or causation.

Consensus standards and assessments by governmental and intergovernmental bodies. These establish what expert bodies have concluded and recommended. They are evidence of the state of expert opinion, not primary evidence of effect, and the Foundation cites them as such.

First-hand reports from members of the public. Part VII. These establish that people report a response, in numbers and with a consistency that can be described. They cannot establish causation, they have no denominator, and they are not offered for either purpose. What they are offered for is stated at Part VII.J.1: they are the only systematic collection of such reports in the United States, because no federal system exists to collect them.

Evidence that does not rest on light at night

One further observation belongs with these categories, because it answers an objection that could otherwise be made to much of this Part. A great deal of the human evidence described below concerns artificial light at night. It would be open to the Department to say that such evidence is about sleep and circadian timing rather than about what a product emits, and that the remedy for it lies in behavior rather than in a performance standard.

Not all of the evidence has that shape. Chang and others, publishing in Ecotoxicology and Environmental Safety in 2024, exposed mice to light-emitting diode light under a maintained twelve-hour light and dark cycle, without alteration of diet, and reported hepatic injury on histological examination — inflammation, hepatocellular ballooning and pyknosis — with the injury more severe in older animals. Appendix C.15.

The Foundation draws attention to the design rather than to the finding. The circadian cycle was not disrupted. The animals were not exposed at night, and they were not deprived of darkness. The variable was the light itself, delivered during the light phase of a normal cycle. Whatever weight the Department gives the result, and Appendix C.15 sets out several reasons for giving it a measured one, the study is not susceptible to the objection that it is really about sleep. It is an experiment in which the exposure was an emission and the outcome was an injury to an organ.

That matters to the statutory question in a way the epidemiology cannot match. Section 360ii(a)(4) directs the Secretary to study and evaluate emissions of, and conditions of exposure to, electronic product radiation. An experiment that varies the emission while holding the conditions of exposure constant is the form that duty contemplates. The Foundation does not suggest that one study in mice establishes anything about human liver health, and says so again at Appendix C.15. It suggests that the design is available, that it has been used, and that it has not been used by this Department.

On confounding by urbanization, and the study that addressed it directly

The second standing objection to this literature is confounding. Outdoor light at night is among the closest available proxies for urbanization, and urbanization brings with it air pollution, traffic, noise, population density, socioeconomic position and differences in access to medical care. An association between outdoor light and disease may be an association between city life and disease. The Foundation has stated that objection against its own entries at Appendices C.5 and C.16 and states it again here.

One study in this appendix addressed the principal component of that objection by measuring it. Wu and others, publishing in Stroke in March 2024, followed 28,302 participants in Ningbo,

China through 127,877 person-years, identifying 1,278 incident cases of cerebrovascular disease confirmed against medical records and death certificates. Outdoor light at night was estimated from satellite imagery, and fine and coarse particulate matter and nitrogen dioxide were estimated separately using land-use regression models. Both were then entered into the same proportional hazards models.

In single-exposure models, each interquartile-range increase carried a hazard ratio of 1.17 (95 percent confidence interval 1.06 to 1.29) for outdoor light at night, 1.25 (1.12 to 1.39) for particulate matter of aerodynamic diameter 2.5 micrometers or less, 1.14 (1.06 to 1.22) for particulate matter of 10 micrometers or less, and 1.21 (1.06 to 1.38) for nitrogen dioxide. In the multiple-exposure models the associations of light at night and of particulate matter with cerebrovascular disease persisted. No interaction between them was observed, and the authors conclude that the two effects may be mutually independent.

The Foundation states the qualifications immediately, and they are real. The association did not persist for ischemic stroke specifically in the multiple-exposure models, and no association with hemorrhagic stroke was observed at any stage. This is one cohort in one Chinese city, and the lighting stock of Ningbo is not that of the United States. Residual confounding by urban factors other than air pollution is not excluded. And the exposure is satellite radiance, so this study is subject to the same spectral blindness as the rest. Appendix C.17 sets all of this out.

What it does establish is narrower and still useful. The most frequently offered alternative explanation for the association between outdoor light at night and disease — that the light is standing in for air pollution — was tested in this cohort by measuring air pollution and adjusting for it, and the association survived. That does not make the finding causal. It removes one specific explanation in one specific population, which is how a confounding objection is properly answered: by measurement rather than by assertion on either side.

A comparison the Foundation offers with care

There is an observation in those figures that the Foundation puts forward cautiously, with its limits stated first. Hazard ratios expressed per interquartile-range increase are not strictly comparable across different exposures, because an interquartile range means a different thing for each; the comparison is within a single cohort in a single city; and the confidence intervals overlap substantially. Nothing in this comment depends on the comparison.

Subject to those limits: in this cohort the hazard ratio for outdoor light at night, 1.17, was of the same order as the hazard ratio for fine particulate matter, 1.25. Fine particulate matter is the subject of a National Ambient Air Quality Standard, a national monitoring network, state implementation plans and decades of federal research. Outdoor light at night is not measured by any federal program at all, as Part V.J establishes. The Foundation does not suggest that the two exposures are equivalent, or that light should be regulated as an air pollutant, which Part II.H.3 explains it cannot be. It observes that an exposure producing associations of a comparable order in a peer-reviewed cohort study has attracted no federal measurement whatever, and that § 360ii(a)(4) directs this Department to supply it.

On the finding that the quality of the evidence was low

The response of May 24, 2024 states that the review the agency commissioned "concluded that the overall quality of evidence in the literature for any health effects was low." The Foundation asks the Department to consider carefully what that sentence does and does not say, because the phrase is a term of art and the conclusion drawn from it in the same letter does not follow.

In the frameworks ordinarily used to rate bodies of evidence, the rating is a statement about confidence in an effect estimate, and it is driven substantially by study design. Randomized controlled trials begin at high confidence and observational studies begin at low, before any examination of the individual studies at all. Ratings are then adjusted for risk of bias, inconsistency, indirectness, imprecision and other factors.

Apply that to this exposure. No one can randomize human beings to decades of exposure to one lighting technology against another. The exposure is ambient, involuntary and lifelong, and the endpoints of interest develop over years. The available evidence will therefore consist of laboratory exposures of short duration, animal models, and observational epidemiology. Under a framework that starts observational evidence at low confidence, the rating of the body of evidence is substantially determined before the first study is read.

This is a recognized difficulty. It is why purpose-built frameworks exist for environmental and occupational health evidence, developed precisely because instruments designed to evaluate clinical interventions systematically understate evidence about ambient exposures. The Foundation does not know which framework the review applied, because the protocol has not been published and the organization has not been named.

Three consequences follow, and the Foundation puts them as propositions rather than as argument.

A finding that the quality of evidence is low is a finding about the state of the evidence. It is not a finding that the exposure is safe, and it is not a finding of no effect. Insufficient evidence of harm and evidence of no harm are different findings, and only the first was made.

A review framed around the question whether exposure has been shown to elicit adverse health effects can return the answer not shown for any exposure that has not been adequately studied. It cannot return the answer safe. The question posed determines the range of available answers.

A finding that the evidence on a question is of low quality is the classic occasion for research, not the classic occasion for closing a file. Paragraph 360ii(a)(2) directs the Secretary to plan, conduct, coordinate and support research, and paragraph 360ii(a)(4) directs the Secretary to study and evaluate emissions and conditions of exposure. A low-quality evidence base is the condition those paragraphs address.

The Foundation accordingly does not dispute the review's rating. It may well be right. The Foundation disputes the inference drawn from it in the same letter, which is that the products have a long history of safety and that performance standards have historically not been considered necessary. A body of low-quality evidence will not support a conclusion of safety in either direction. Part I.C.

A further feature of this literature, which goes not to the confidence of the evidence but to its form

The preceding passage concerns how a body of evidence is graded. This one concerns the shape of the experiments in it, and the Foundation puts it last among the observations in this subsection because it is the one that bears most directly on what the Department could lawfully prescribe.

In October 2023 the Royal Society published a theme issue on light pollution in complex ecological systems. Its guest editors introduced the collection with an assessment of the field they had just assembled, and the Foundation reproduces the substance of it because an assessment of that kind is more useful from the people who solicited the papers than from a commenter. Described at Appendix D.7.

Their observation is this. Light intensity is among the most important and most widely studied properties of artificial light at night. But the majority of studies of it, they write, rest on binary comparisons — the presence or absence of light — or include only a limited number of intensity levels, and they name only two exceptions in the literature they surveyed. They attribute this to the practical difficulty of running experiments at many levels, particularly at the level of a community, and they are careful to say that such studies have provided a solid foundation for recognizing that light pollution matters.

They then state the two consequences, and the Foundation adopts both. A study with too few levels risks misinterpreting the true impact of light, and it limits the ability to predict. Their own illustration makes the first concrete in a way worth setting out: an experiment comparing two conditions may find nothing where a real effect exists, if the two conditions happen to sit on a flat part of the curve; and an experiment comparing two conditions may miss that the relationship saturates, and so overstate what a further increase in light would do. Two papers in the same issue show the shapes at issue are real: one reports a nonlinear relationship between irradiance and the survival of barnacles, and another a saturating relationship in which more than half of the measured change in invertebrate movement had already occurred at illuminances below that of a full moon.

Why the Foundation puts this in a comment about a performance standard

Because a performance standard is a number. Section 360kk authorizes the Secretary to prescribe performance standards for an electronic product to control the emission of electronic product radiation, and such a standard prescribes a limit on a characteristic of the emission. A limit is a point chosen on a curve. To choose it, the Department needs the curve: the relationship between how much is emitted and what follows.

A comparison between light and no light does not produce a curve. It produces the proposition that something happens at some unstated level. That proposition is enough to justify research, and it is enough to defeat a claim that nothing happens. It is not enough to yield a number, and no quantity of such studies will become a number by accumulation.

The Foundation therefore asks the Department to recognize a distinction that the response of May 24, 2024 does not draw. The obstacle between this literature and a performance standard is not principally that effects are unproven. It is that the literature is the wrong shape to yield a limit, and the people who edit the field say so. That is a diagnosis with a remedy attached, and the remedy is the one paragraph 360ii(a)(2) and paragraph 360ii(a)(4) describe: research planned, conducted, coordinated and supported, and emissions and conditions of exposure studied and evaluated. What is needed is not another demonstration that light at night has effects. It is a characterization of the relationship between the quantity emitted and the effect produced, across a range of levels wide enough to show the shape. Part IX.C makes that request and this is its evidentiary basis.

One finding in the same issue bears on where that range must begin, and the Foundation flags it because the intuition it corrects is a natural one. More than half of the change those investigators measured occurred below the illuminance of a full moon. A dose-response study that begins at street lighting levels and works upward would therefore miss most of the relationship. If the Department commissions such work, the range must extend down to and below natural nocturnal light. Appendix C.128 measured the ambient night at its field sites at a median of 0.0168 lux, and Part V.I records why that figure is not the natural level but a measure of how far above it field work is conducted; a moonless natural sky is conventionally placed one to two orders of magnitude lower.

And one attempt has been made to assemble the thresholds, which the Foundation reports with its provenance stated first

Seymoure and seven colleagues have published what appears to be the only compilation of the illuminance levels at which effects have been reported, arranged across species. Described at Appendix C.147. The Foundation has read the 2019 preprint of that work under its earlier title and has not read the published article, which appeared in 2025 under a different title and which a National Park Service summary indicates contains at least two findings the preprint does not. Everything in this paragraph is therefore provisional and is offered to show that the exercise has been attempted, not to supply numbers the Department could rely on.

As the preprint has it, a systematic review found effects of light at night reported in 117 species from 23 orders across 8 classes, covering foraging, movement, activity patterns, vigilance, mating and reproduction, population and community measures, predation and mortality, physiology and development, and vocal behavior. Sorted by the illuminance at which the effect was reported: 77

species between one tenth of a lux and three lux; 25 species between one hundredth and one tenth of a lux; 18 species between one thousandth and one hundredth; and 28 species below one thousandth of a lux, a level below that of a moonless natural sky, with five of those being cases of elevated mortality in prey species.

Two things follow for this subsection and the Foundation keeps them apart from the numbers. The first is that the shape of the distribution is the opposite of what a reader would expect: the bin with the fewest species is not the dimmest one. Effects are reported across four orders of magnitude of illuminance, and the authors say the studies are not evenly distributed across light levels, which is a statement about where the research has been done and not about where the effects are. The second is that if any part of the lowest bin survives peer review, it describes effects occurring below the ambient level at which the field studies collected in this appendix set their dark controls, which is the gap Part V.I now identifies. The Foundation asks the Department to obtain the published article and its supplementary data, which is where the species-by-species thresholds are, and notes that this is the nearest thing in the record to the compilation paragraph 360ii(a)(4) would require.

There is in fact an earlier and better compilation, and it settles the question of where a natural night is

Gaston K.J., Bennie J., Davies T.W. and Hopkins J., The ecological impacts of nighttime light pollution: a mechanistic appraisal, Biological Reviews, volume 88 (2013), pages 912 to 927. Described at Appendix D.7. The Foundation states the authorship first: Gaston and Bennie are authors of Appendix C.94 and Appendix C.128 and of the satellite instrument paper relied on at Part V.J.4, Davies is an author of the marine review at Appendix D.7 and of Appendix C.141, and the fourth author was then at Natural England, a government body. This comment therefore leans on one research group in several places and says so wherever it does. The review is also thirteen years old and the Foundation uses it for two tables rather than for its account of the literature.

The first table, which discharges a question this comment had left open

Part V.I records that the Foundation had to withdraw a characterization of two field measurements as agreeing measurements of natural darkness. This review supplies a reference table of illuminance, compiled from the British Standards Institute, a standard reference work on ecological consequences of artificial light, and a third source. In lux:

> Full sunlight, 103,000. A partly sunny day, 50,000. A cloudy day, 1,000 to 10,000.
>
> An operating table, 18,000. A bright office, 400 to 600. Most homes, 100 to 300.
>
> Main road street lighting at average street level, 15. A lighted parking lot, 10. A residential side street, 5.
>
> A full moon under clear conditions, 0.1 to 0.3. A quarter moon, 0.01 to 0.03. A clear starry night, 0.001. An overcast night sky, 0.00003 to 0.0001.
>
> Urban skyglow, 0.15.

Three things follow and the Foundation separates them. First, the correction made at Part V.I is confirmed: a clear starry night is a thousandth of a lux, so the 0.0168 lux measured at the English field sites is roughly seventeen times a natural unlit sky and the 0.03 lux measured in the lagoon is the illuminance of a quarter moon. Neither is natural darkness and the comment no longer says they are. Second, the span this comment is concerned with covers about four orders of magnitude between an overcast natural night and a lit residential street, and about ten orders of magnitude from an overcast night to full sunlight, which is the range the authors give for the natural day and night cycle. A performance standard operates somewhere in that span and nothing in the American regulatory record identifies where.

Third, and this is the figure the Foundation asks the Department to hold in mind through the rest of this Part: urban skyglow is given as 0.15 lux, and a full moon under clear conditions as 0.1 to 0.3 lux. On these figures the diffuse background of a lit city is of the same order as moonlight, which is to say that in such a place the moon has in effect been switched on permanently. The Foundation offers

that as the scale of the alteration and not as a biological claim, and notes that the figure is a single representative value in a reference table rather than a measurement with a stated location, instrument or method, which is why the comment states it as the review gives it and relies on it for order of magnitude only.

The second table, which is the compilation itself

The review also tabulates, in its own words, examples of the levels at which nighttime lighting has been observed to have biological effects: a species, a setting, an effect, an illuminance and a source, ordered by increasing intensity. Twenty-odd rows spanning from millionths of a lux to a thousand lux. It is a better object than the compilation described above because every row names the study behind it. Selected rows, in ascending order of illuminance: prey detection in a common toad at 0.00028 lux; altered circadian rhythm in a Syrian hamster at 0.01 lux; shifted activity peaks in the fruit fly at 0.03 lux; increased rates of tumor growth and metabolism in the brown rat at 0.2 lux and increased rate of tumor growth in the brown rat at 0.21 lux; higher prey intake in five species of wader in a field experiment at 0.74 lux; earlier singing in the American robin at a mean of 1.26 lux in field observations, range 0.05 to 3.06; suppressed immune response in the Siberian hamster at 5 lux; altered timing of nocturnal migration in Atlantic salmon at 14 lux measured at the stream surface; reduced feeding and disturbed flight in pond bats below 30 lux; reduced activity and delayed onset of commuting in the lesser horseshoe bat at 51.67 lux; and disruption of circadian rhythm in a field mouse at 1,000 lux delivered as a fifteen-minute pulse.

And the footnote to that table, which the Foundation treats as the most important thing in the review

The authors append two cautions to their own table and the Foundation quotes both. “Note that: (i) in many cases these represent levels of experimental treatments, and precisely where thresholds might lie remains unknown; and (ii) although widely used, lux measurement places emphasis on brightness at wavelengths perceived by human vision.”

The first limb is the proposition this subsection has been arguing. A table of twenty effect levels is not a table of twenty thresholds; it is a table of the intensities investigators happened to use, and the authors say so. The lowest figure at which an effect has been observed is not the lowest figure at which an effect occurs, and no one has looked below most of these numbers. That is the gap paragraph 360ii(a)(4) directs the Secretary to fill, stated by the field about itself in 2013, and the abstract states it again among the review’s three principal conclusions: that major research gaps exist, particularly in “identification of intensity thresholds, and the spatial extent of impacts in the vicinity of artificial lights.”

The second limb belongs with the attestations collected at Part V.J.4 and is the earliest of them. In 2013, in a table caption in Biological Reviews, the investigators on whom several parts of this comment depend recorded that the unit in which the entire table is expressed is weighted to human vision. Thirteen years later the literature still reports in that unit, as the review at Part V.J.4 demonstrates by counting. The Foundation has not added this instance to the tally kept there, because the tally is of papers whose own exposure variable was affected and this is a review tabulating other people’s work; but the date is the point, and it is recorded here.

Two rows the Foundation flags and does not yet use

The two brown rat rows are increased tumor growth at 0.2 and 0.21 lux, cited to work of 1997 and 2006. Those figures sit within the full-moon range and above the urban skyglow figure in the same review’s other table. The Foundation does not advance that juxtaposition as an argument and sets out why. Both rows describe constant light rather than light at night, the table says so; both are laboratory rodent tumor models, whose relation to human carcinogenesis is the subject of Part V.F and is not assumed here; and the Foundation has read neither paper. They are recorded because if they hold they are the lowest illuminance in this comment at which a disease endpoint has been reported in a mammal, and because the Department should know that the figure exists in a review of this standing. Obtaining those two papers is an acquisition of the first rank.

And one experiment demonstrates the footnote's first limb better than any argument could, because it is the same investigators and the same species

The table above lists lesser horseshoe bats at 51.67 lux, for reduced activity and delayed commuting, citing work of 2009. The Foundation has obtained both that paper and the one that followed it, and they are very nearly a matched pair. Stone E.L., Jones G. and Harris S., Street lighting disturbs commuting bats, Current Biology, volume 19 (2009), pages 1123 to 1127, described at Appendix C.153; and Stone E.L., Jones G. and Harris S., Conserving energy at a cost to biodiversity? Impacts of LED lighting on bats, Global Change Biology, volume 18 (2012), pages 2458 to 2465, described at Appendix C.152. The same three authors, the same species, the same region of Britain, field seasons in consecutive summers, the same seven- and six-night regime of control nights, generator-noise nights and lit nights, luminaires from the same manufacturer obtained under guidance from the same professional body, and exposure measured in both with the same model of illuminance meter. Two things differ. The earlier study used high-pressure sodium and the later one used white diodes; and the earlier study illuminated at one level while the later one illuminated at three — a mean of 3.6 lux, a mean of 6.6 lux and a mean of 49.8 lux.

Activity of the lesser horseshoe bat and of Myotis species was significantly reduced at every intensity, including the lowest, and for Myotis the low and medium treatments did not differ from each other. The authors then state the consequence in terms this subsection has been arguing for:

> "reducing light intensity has often been advocated as a potential mitigation strategy for lighting schemes affecting bats; this assumes that there is a critical light threshold below which there are no negative effects on bat activity. However, for these species, we have shown that light levels would have to be lower than at least 3.6 lux before a potential threshold is found."

Now set that against the earlier study. The 2009 experiment illuminated hedgerows to a mean of 53.09 lux and compared lit nights with unlit nights. One level against darkness. It found a large effect, no habituation over four consecutive lit nights, and the onset of activity at the hedge delayed from a mean of 29.9 minutes after sunset to a mean of 78.6 minutes. What it could not do, and did not claim to do, is locate a threshold, because an experiment with one lit level cannot. It is a binary design of exactly the kind this subsection has been describing, and it is the source of the number in the table.

So the sequence is this. The same investigators studied the same animal twice. The first time they tested one intensity against darkness and found an effect at about 53 lux, and that figure entered a reference table as a level at which lighting has been observed to have biological effects. The second time they tested three intensities and found an effect at the lowest, 3.6 lux, about a fifteenth of the first figure, and reported that they had not reached a level at which the effect disappeared. The table entry was never a threshold. It was the one number the first experiment happened to use. That is what the review's own footnote says about every row in it, and this is the row where the Foundation can show it rather than assert it.

The Foundation states the limit of the comparison in the same breath. Two variables changed between the experiments, not one: the intensity and the lamp. A white diode and a high-pressure sodium lamp are not the same stimulus, and the Foundation does not claim that the 3.6 lux result is the 53 lux result with the dial turned down. What the comparison establishes is narrower and sufficient: that the figure tabulated for this species was a treatment level and not a floor, and that when the same group looked lower they found the effect still there. It is also worth recording that the authors of the later study, who had used both lamp types, considered them comparable in the one spectral respect they addressed, writing that although the diodes emit white light they are comparable with high-pressure sodium in spectral content because they emit very little ultraviolet. That statement is about the ultraviolet alone; the two sources differ most in the blue, and neither paper publishes a measured spectrum of either lamp. Part V.J.4 takes that up.

Three features of the design deserve notice because they are rare in this appendix. The lights were driven by a petrol generator, so the authors added a treatment in which the lamps were installed and the generator ran all night with the lamps switched off; control and noise nights did not differ, which separates the effect of the light from the effect of the apparatus. The three intensities were randomized in sequence across nights to control for order. And activity on the unlit side of the hedge did not change, which means the animals did not relocate to the dark side: the activity was lost rather than displaced. Observation confirmed the avoidance directly, with 44 percent of lesser horseshoe bats turning back or flying over the hedge rather than passing the lights.

One further comparison between the two studies is the best thing in either of them, and it belongs to the authors and not to the Foundation. In the 2009 experiment the unlit side of the hedge was not dark: the high-pressure sodium units spilled across it, and the authors measured a mean of 4.17 lux there on lit nights against a mean of 0.03 lux at the same places on unlit nights. Few bats used it. The authors offered an explanation in 2009 which they were in no position to test, writing that even these relatively low light levels may make established routes unsuitable for commuting. Three years later, having built an experiment that could test it, the same group reported a significant reduction in the activity of the same species at 3.6 lux. Their 2009 conjecture about a spillover of 4.17 lux was confirmed by their own 2012 experiment at a level below it. The Foundation asks the Department to notice what that sequence means for a standard: the light that mattered was not the light the experiment was about. It was the light that leaked off the far side of a hedge, at a level that would not register as lighting to anyone specifying the installation.

Two qualifications, one of which the Foundation volunteers against itself. The effect was confined to the slow-flying species: no effect was detected on three faster-flying taxa, and the comment does not say that all bats avoid light, because this study says they do not. And the authors themselves doubt that their own finding points to a workable remedy, writing that achieving light levels that low may not be practical because public perception of safety and the practicality of dimming often preclude it. The Foundation records that because it is the honest position: an experiment that fails to find a threshold above 3.6 lux does not thereby establish that 3.6 lux is achievable on a public road, and Part IX asks for a standard the Secretary can write rather than one nobody could meet.

The limits of what the Foundation takes from this

Three. The document is an editorial introduction and reports no data of its own; the Foundation uses it for the editors' assessment of their own field and not as evidence of anything. Their assessment concerns studies of light intensity, with community-level work identified as the most constrained; whether the human literature has the same shape is a separate question this comment has not answered, although the exposure characterizations audited at Part V.J.4 point the same way. And the Foundation has not audited its own Appendix C against the editors' claim. It notes that the designs described there are predominantly two-level, that Appendices C.128, C.132 and C.136 are among the exceptions, each using three or more levels, and that the audit is recorded as a task rather than asserted as a result.

3. What is established, what is emerging, and what is unresolved

The Foundation sorts the subject matter of this Part into three classes. The purpose of doing so is to make clear that it is not asking the Department to accept the whole of the literature, and to identify which propositions it does ask the Department to accept.

a. Established

The following are not in serious scientific dispute, and the Foundation relies on them as settled.

> Light is the principal stimulus that entrains the human circadian system, acting through a retinal pathway distinct from the one that mediates image formation. Part V.F.

Photochemical injury to the retina from short-wavelength optical radiation is a real mechanism, distinct from thermal injury. It is the basis of an international standard and of an exposure limit. Part V.C.2.

Discomfort glare is a real and common response to lighting, and is the most frequent immediate complaint about it. Part V.C.4.

Temporal light modulation produces visual artifacts and physiological effects, and is present in many LED products. Part V.D.

Light-emitting diodes differ from the thermal sources they replaced in spectral power distribution, in the luminance and apparent size of the emitting surface, and in temporal structure. Part V.B.

b. Emerging or contested

On the following the literature is active, the findings are mixed, and the Foundation does not ask the Department to resolve them in its favor. It asks only that they be recognized as open.

Whether exposure to light-emitting diode products at the levels encountered in ordinary life contributes to retinal injury in humans. The intergovernmental assessment described at Part V.C.2.f reports that independent groups have found retinal damage below the current exposure limit and that there is no consensus on revising it.

Whether long-term exposure is associated with age-related macular degeneration. The same assessment states that it is not yet possible to conclude anything on this question.

The magnitude of circadian effects at the exposure levels produced by domestic and roadway lighting, as distinct from the laboratory.

The proportion of the population that experiences severe effects from temporal light modulation.

c. Unresolved because unstudied

The third class is the one this comment is principally about. These are not questions on which the evidence conflicts. They are questions on which there is substantially no evidence, because the studies have not been done.

Cumulative exposure across years to the emission of these products, against an exposure limit constructed for episodes of under three hours. Part V.C.2.c.

Real-world exposure from many emitters at once, against a literature in which sources are characterized singly. Part V.J.3.

Radiometric characterization of the products actually in service in the United States, as opposed to products selected for study. Part V.J.1.

Effects on the populations identified at Part VII as disproportionately affected, including people with photosensitive conditions, migraine, and sensory processing differences.

Whether any of the mitigation techniques described at Part II.G.3 reduces human exposure, and by how much.

The Foundation asks the Department to note the character of the third list. Every item on it is a question that 21 U.S.C. § 360ii(a)(4) directs the Secretary to study and evaluate. The absence of evidence on these questions is not a reason to defer the inquiry. It is the subject of the statutory duty.

What the leading advocacy organization in this field concedes about the same evidence

The Foundation adds one source to this sorting and adds it for a reason that has nothing to do with its authority. In May 2022 the International Dark-Sky Association published a briefing titled Artificial Light at Night: State of the Science 2022, compiled from a curated database of the research literature and, the document states, externally reviewed by subject experts. It is described at Appendix D.9. It is an advocacy organization's publication. It carries no named authors, it reports no measurement of its own, and the Foundation does not offer it as evidence of anything. It is cited for a small number of sentences, each of which concedes a limitation that the organization publishing it had every incentive not to concede.

On the health literature, which is the concession that matters most and which runs against this comment

The document's summary of its own human health section reads:

> "These conclusions are largely drawn from controlled studies of exposures to indoor lighting, suggesting caution in interpreting the influence of outdoor lighting on health."

And in the text of that section:

> "It is not possible now to directly connect outdoor light at night exposure to the incidence of disease in individual people."
>
> "whether outdoor light pollution influences human health and wellbeing awaits further research."

The Foundation adopts all three without qualification and asks the Department to read them against the request this comment actually makes. This comment does not assert that outdoor light at night causes disease in any person, and Part V.A.2 and the entries at Appendices C.5 and C.7 are written to prevent that assertion being read into it. It asserts that the question is open, that resolving it is work paragraph 360ii(a)(2) and paragraph (a)(4) assign to the Secretary, and that the Department should not treat the absence of a demonstrated outdoor effect as a demonstration that there is none. The organization whose purpose is the reduction of outdoor lighting says the same thing about the same literature, in a document written to persuade.

On the exposure variable, from a fifth direction

The same document states the proposition of Part V.J.4 twice. On the instrument:

> "the best available satellite cameras are not sensitive to some colors of light. In particular, they do not see the blue light emitted by white LED lighting. This means that key light pollution indicators are probably underestimated."

And on the use made of that instrument in the health literature:

> "critics point out the reliance on the use of satellite data to predict disease-related ALAN exposure. This may make the results of some studies less reliable because satellite measurements are only crude estimates of the actual doses of ALAN from outdoor sources that most people receive."

The Foundation does not add this to the count of attestations kept at Part V.J.4. That count is of peer-reviewed papers in which investigators disclosed the limitation of an instrument they had themselves used, and this document is neither peer-reviewed nor a report of original work. It is recorded because of the company the statement now keeps. The same proposition has been stated by the authors of the instrument paper, by a continental mapping study, by the most comprehensive cancer meta-analysis in this field, by a review of marine ecology, by nine research groups about their own data, and now by the organization most committed to the subject — which adds one thing the others do not, in saying that the need for new dedicated orbital instruments to answer these questions is urgent, while existing Earth-observing missions are scheduled to end.

On lighting and safety, and on the absence of a dose-response relationship

Two further sentences are recorded here and taken up at Part V.M. The document's summary of its public safety section states that there are cases in which the careful application of outdoor lighting may improve nighttime safety "but there is no general benefit supported by scientific evidence." In the text it goes further, and in a direction that costs the organization something:

> "many of the claims about outdoor lighting and its impact on crime and traffic safety – for better or worse – may be fundamentally wrong."

And on the quantity:

> "There is no clear known 'dose-response' relationship that may predict appropriate lighting levels."

That last sentence is the proposition of Part V.A.2 in a line. The field cannot say how much light is required, which is why a literature composed of comparisons between lit and unlit conditions cannot yield a number, and why no quantity of such comparisons becomes a number by accumulation. The document adds that international lighting standards often do not establish benchmarks for the amount of light drivers and pedestrians need on the basis of scientific evidence, and that decision makers substitute their intuition when guidance is lacking.

What the Foundation does not take from this document, which is nearly all of it

Every affirmative factual claim in it. The document reports no measurement and its statements of fact are summaries of three hundred and twenty-one cited sources, written for a general audience. Where this comment needs such a fact it takes it from the source, and Appendix D.9 lists the sources in it worth obtaining for that purpose. The Foundation also records a relationship rather than leaving it to be found: two of the five authors of the mapping study at Appendix C.139 disclosed in that paper that they serve as uncompensated members of the board of directors of this organization. That disclosure was theirs and the Foundation repeats it here only so that the two citations are not read as independent of each other.

The principle on which this document is used is the ordinary one. A statement by a party against its own interest carries weight that the same statement from a neutral source would not, because the incentive runs the other way. The Foundation has applied that principle to itself throughout this Part, and it applies it here. Nothing in this subsection rests on the document agreeing with the Foundation. It rests on the document conceding, where it would have preferred not to, that the outdoor health question is unresolved and that the instrument used to study it cannot see the emission at issue.

B. Physical Characteristics of LED Emission, and Their Departure from the Sources Under Which Human Vision Developed

Three emission characteristics, and the form a standard would have to take

This Part is organized around three characteristics of what a light-emitting diode product emits, and the organization is not the Foundation's invention. It follows from the statute. Section 360kk(a)(1) authorizes the Secretary to prescribe performance standards for electronic products to control the emission of electronic product radiation, and a performance standard of that kind must specify an emission characteristic: it must say what a product may emit, in what quantity, measured how. A standard cannot be written about a technology in the abstract. So the question this comment puts to the Department – what limits should exist – resolves into three questions, one for each characteristic by which optical radiation can be described.

The three are the spatial distribution of the emission, its spectral distribution, and its temporal structure. Subsection 8 below treats the first, subsections 1 and 3 the second, and subsection 7 the third. For each the Foundation states what the evidence in Part V.C and Appendix C reports, and then what federal limit applies. The second answer is the same in all three cases.

Spatial distribution. A light-emitting diode delivers its output from a small, flat, high-radiance surface, so that for a given quantity of light the emitting area is smaller and its radiance higher than in any source that preceded it. Appendix C.64 records a documented macular injury to a thirteen-year-old from a marketed handheld light-emitting diode device. No federal instrument limits the radiance or the luminance of the emitting surface of any visible-light product.

Spectral distribution. Appendix C.70 reports that the biological response to two light-emitting diode lamps of the same manufacturer and part number, differing only in spectral distribution, differed at matched illuminance; and that two lamps of identical correlated color temperature, differing in the structure of their spectra, also differed. No federal instrument limits the spectral distribution of a visible-light product, and none requires that it be disclosed to a purchaser, to a procuring municipality or to this Department.

Temporal structure. The modulation produced by a switching driver is periodic, often approximates a square wave, and occurs at frequencies set by the convenience of the circuit. Subsection 7 below, Part V.D and Part V.J.3 treat it. No federal instrument limits modulation depth or modulation frequency for general illumination.

The three are independent of one another, and that independence is the reason they must be addressed separately. A product may be unobjectionable in its spectrum and present a hazard in its radiance, or be acceptable in both and modulate in a way that matters to a person with photosensitive epilepsy. A standard that addressed one and not the others would leave the others unregulated, and a finding of safety directed at one is not a finding about the others. The Foundation notes that this triad is a division of emission characteristics and should not be confused with the three axes of product classification discussed at Part V.C.2.k, which concern which products a regime reaches rather than what they may emit. The two work together: classification establishes the class, and an emission characteristic supplies the limit.

The division also has a basis in the photobiology and not only in the statute, which the Foundation notes because it answers the objection that the three characteristics are an administrative convenience. The review at Appendix C.72 sets out the three mechanisms by which optical radiation between 400 and 1,400 nanometers injures tissue. Photomechanical damage arises from very high irradiance over very short exposures and, in the review's words, is not determined by the wavelength of light. Photothermal damage is also governed by irradiance thresholds, over somewhat longer exposures. Photochemical damage is the wavelength-dependent mechanism, and it is the one the blue-light hazard framework addresses. So two of the three recognized injury mechanisms turn on how much radiant power is delivered to a point on the retina, which is governed by the spatial characteristic treated at subsection 8, and all three turn on duration. The emission characteristics are the terms in which the injury mechanisms are themselves described.

That division is not peculiar to the review cited. Appendix C.80 records an independent review of retinal light injury published in 2010 by the Department of Ophthalmology and Visual Sciences of the University of Wisconsin, in the journal of the Royal College of Ophthalmologists, which is organized on the same three mechanisms and gives photomechanical injury in substantially identical terms: irradiances of the order of megawatts to terawatts per square centimeter over nanoseconds to picoseconds, producing microcavitation bubbles lethal to the pigment epithelium. The Foundation relies on the American review for the framework in preference to the other, for the reason given in that entry.

The Foundation's request is the same for each of the three, and it is stated at Part I.C.7 and Part IX.B.4. It does not ask the Department to find that these products are unsafe. It asks the Department to read the literature collected in Appendix C and to determine, for each of the three characteristics, the level at which a limit should be set. That is a determination the statute commits to the Secretary, and in the sixty years since the Radiation Control for Health and Safety Act it has not been made for any of the three.

1. Spectral power distribution of phosphor-converted white LEDs and the short-wavelength peak

The characteristic treated in this subsection is the one the agency's own determination put in issue. A phosphor-converted white light-emitting diode does not generate white light. It generates blue light, at a narrow peak near 450 to 460 nanometers, and converts part of that emission to longer wavelengths by passing it through a phosphor. What leaves the lamp is the sum of two things: the unconverted blue peak and the broad phosphor emission. The spectral distribution of the product is therefore not a property of the light the device makes but of the ratio between what the phosphor converts and what it does not.

The consequence the Foundation asks the Department to consider first

That ratio is not fixed for the life of the product. Phosphors degrade. As they do, a smaller proportion of the blue emission is converted and a larger proportion leaves the lamp unconverted. The study at Appendix C.77, published in this Department's own journal, states the point directly, and cites a 2009 publication of the Department of Energy for the lumen maintenance figure:

> "Although it is robust in the beginning, a PC LED progressively releases more short-wavelengths (blue light) when LED lumen depreciation occurs because of phosphor degradation. The quality of the light deteriorates after the lights pass the 70% lumen maintenance level."

If that is correct, and the Foundation has found no contrary authority, then the emission characteristic this comment asks the Department to address drifts over the service life of the product, in the direction of more short-wavelength content. Three consequences follow and each is a consequence for a standard rather than for a person.

A measurement at manufacture does not describe the product in service. Part V.C.2.k sets out that the risk group classification is performed once, at a reference distance, on a sample. Nothing in the framework requires that it be repeated, and a classification assigned to a new lamp is not a statement about the same lamp after several thousand hours.

A performance standard under 21 U.S.C. § 360kk would have to specify the point in the product life at which the limit applies. For the four classes in 21 C.F.R. part 1040 the emission being limited does not drift in this way, so the question has not previously had to be answered. For this technology it does, and the Foundation does not know of an answer in any existing instrument.

The direction of the drift is adverse. A lamp that ages toward dimmer and warmer would present a diminishing question. A lamp that ages toward a larger proportion of unconverted blue presents an increasing one, and it does so invisibly, because the quantity that changes is the one no instrument available to a purchaser reports.

The Foundation states the limits of what it is asserting. It does not quantify the drift, and the sentence quoted above does not quantify it either; it gives a threshold in lumen maintenance rather than a change in spectral composition. Whether the shift in the blue fraction over a product life is large enough to matter for any of the effects in Part V.C is unknown to the Foundation, and it is a question that measurement would answer. It is precisely the kind of question 21 U.S.C. § 360ii(a)(4) directs the Secretary to study, and the Foundation asks for it at Part IX.C.

2. Point-source geometry, peak luminance, and non-uniform emission

The characteristic treated in this subsection is geometric rather than spectral, and the Foundation gives it a subsection of its own because it governs how every other quantity in this Part reaches the eye. A light-emitting diode delivers its output from a small, flat, high-radiance surface. The sources it replaced delivered comparable output from a larger and dimmer one. That difference is not a matter of degree in the way a difference in wattage is. It determines the quantity in which the

exposure must be expressed, and it defeats the most common intuition about how optical exposure varies with distance.

a. The quantity that determines exposure at the retina

Radiance is the optical power leaving a surface per unit area of that surface and per unit solid angle, in watts per square meter per steradian. It is the quantity in which the retinal hazards are expressed in the international guidance described at Part V.C.2, and the reason is the following relation. For a source of radiance L that the eye resolves, the irradiance delivered to the retinal image is

$$E(\text{retina}) = (\pi / 4) \times \tau \times L \times (d / f)^2$$

where L is the radiance of the source, d is the diameter of the pupil, f is the posterior focal length of the eye, and τ is the transmittance of the ocular media at the wavelength in question. Taking the conventional values used in the exposure guidance — a focal length of 17 millimeters and a transmittance of 0.9 in the visible band — the relation reduces to a single coefficient. A dark-adapted pupil of 7 millimeters gives an E(retina) of approximately 0.12 times the radiance of the source. A light-adapted pupil of 3 millimeters gives approximately 0.022 times. The ratio between the two is the square of the ratio of the pupil diameters, or a factor of 5.4.

That relation is not the Foundation's construction and it is worth saying whose it is, because the whole of this subsection proceeds from it. It is equation 2 of the governing exposure guidelines, which state that "Retinal irradiance E r (W m-2) is related to source radiance, L s (W m-2 sr-1), ("brightness"), the transmittance of the ocular media, τ (rel.), the pupil diameter, d p (mm), and inversely related to the effective focal length of the eye, according to the Gullstrand eye (Gullstrand 1909) f = 17 mm". The focal length of 17 millimeters used above is therefore the guidelines' own value, attributed by them to a schematic eye published in 1909, and the two pupil diameters used above are the two the guidelines assume. The guidelines attribute the relation itself to Sliney and Wolbarsht and to Henderson and Schulmeister.

The Foundation draws attention to what is absent from that relation. The distance to the source does not appear in it. That is not an omission, and the reason it is not is the refracting optics of the eye.

Two things happen as a source recedes, and they are equal and opposite. The optical power passing through the pupil falls as the inverse square of the distance, without exception: the pupil is an aperture of fixed area and it intercepts a diminishing fraction of what the source emits. At the same time the retinal image of the source grows smaller, also as the inverse square of the distance. The eye therefore delivers a diminishing power onto a diminishing area, and the quotient of the two — which is the irradiance at the retina — does not change. The cancellation in the relation above is not an algebraic coincidence. It is what a lens does.

The magnitude of the concentration is worth stating, because it is not a modest effect. The ratio of the area of the pupil to the area of the retinal image is the optical gain of the eye. For a source of diameter D at distance d, that gain is the transmittance multiplied by the square of the quantity (d multiplied by the pupil diameter, divided by D multiplied by the focal length). The Foundation sets out the result for the same apertures used in the table at paragraph c, at a dark-adapted pupil of 7 millimeters.

Source and viewing distance	Angular subtense	Optical gain of the eye
1 millimeter aperture at 0.67 meter	1.5 milliradians	approximately 67,800
25 millimeters at 5 meters	5.0 milliradians	approximately 6,100
25 millimeters at 16.7 meters	1.5 milliradians	approximately 67,800
150 millimeters at 10 meters	15.0 milliradians	approximately 680

150 millimeters at 50 meters	3.0 milliradians	approximately 17,000
150 millimeters at 100 meters	1.5 milliradians	approximately 67,800
300 millimeters at 100 meters	3.0 milliradians	approximately 17,000

That gain is not a constant of the eye. It rises as the square of the distance to the source, which is precisely the factor by which the collected power falls, and the two cancel exactly. It rises until the retinal image reaches the smallest size the eye can form, and then it can rise no further. At a dark-adapted pupil of 7 millimeters that ceiling is approximately 67,800; at a light-adapted pupil of 3 millimeters it is approximately 12,500. Those two pupil diameters are not the Foundation’s choice. They are the two the governing guidelines assume, which state that in deriving the retinal thermal limits “two different pupil diameters were assumed, 7 mm for the dark-adapted eye and approximately 3 mm for bright light conditions.”

The physical meaning of the minimum angular subtense discussed at paragraph c below is now apparent, and it is worth stating plainly because the quantity is otherwise opaque. It is the angle at which the eye exhausts its capacity to concentrate. Within it, gain rises with distance and offsets the inverse square exactly. Beyond it, gain is fixed while the power entering the eye continues to fall, and retinal irradiance falls with distance at last. The inverse square law does not fail and then resume. It governs the power entering the eye throughout. What changes at the minimum angular subtense is whether the eye is still able to compensate for it.

The same result can be stated formally, as the conservation of radiance along a ray bundle in a lossless medium. The Foundation gives the mechanical account first because the formal one, while correct and more general, explains nothing about why the result holds.

That formal statement can now be attributed rather than asserted, and with it two further relations this subsection and Part V.B.8 depend on. The conference paper described at Appendix D.6, by an officer of the two standards bodies whose instruments Part V.C.2 examines, sets out the same physics as settled radiometry. On why radiance is the governing quantity, that it is “a measure of the irradiance level in the image plane of a system that images the source (such as the human eye)”. On its photometric counterpart, that “In the field of lighting, radiance is referred to as brightness (more correctly, luminance) when it is weighted with the luminous efficiency function”. On the conservation itself, that the product of area and solid angle is constant in a lossless system and that “This quantity A × Ω is referred to as etendue or throughput.”

And on the result this subsection argues at length, the same author gives the mechanical account the Foundation gave above, with an illustration the Foundation did not have. The irradiance from the sun falls as the inverse square of the distance to it while the solid angle it subtends falls in exactly the same proportion, so that “the sun has the same brightness from all planets when one looks into the sun, but the size of the sun changes. However, the ‘lighting level’ (irradiance) of the surface of the planet changes with distance.” That is the distinction at paragraph b above between the quantity an illuminance meter reads and the quantity the eye poses, stated for two planets instead of two tissues. The same paper gives the retinal relation in the form this subsection uses, that retinal irradiance is the radiance multiplied by the solid angle subtended by the pupil and reduced by transmission losses; and it gives the Lambertian relation on which the arithmetic at Part V.B.8 rests, that the radiance of a Lambertian emitter is its exitance divided by pi steradians.

The arithmetic admits of a check against a familiar case, and the Foundation offers one so that the Department need not take the method on trust. The solar disc subtends approximately 9.3 milliradians. At a pupil constricted to 2 millimeters the gain is therefore approximately 144, and a solar irradiance at the cornea of the order of 1,000 watts per square meter delivers of the order of 100,000 watts per square meter to the retina. That is the order of magnitude the ophthalmic literature reports for solar retinal irradiance. The agreement is offered as verification of the method, not as a finding.

A note on terminology is required, because the comment uses the word lens elsewhere in a different sense. The refraction is performed principally by the cornea, which supplies roughly two-thirds of the refractive power of the eye, and secondarily by the crystalline lens. The Foundation accordingly refers to the refracting optics of the eye rather than to its lens, and does so deliberately. Part II.F.4 relies on the aphakic hazard weighting used by the scientists of the Center for Devices and Radiological Health in their 2010 characterization, and in that weighting the absence of the crystalline lens signifies the removal of a short-wavelength filter rather than the removal of focus. An eye without a crystalline lens still forms an image and still concentrates, and it concentrates a greater proportion of the short wavelengths with which this Part is concerned. An eye without a cornea would form no image at all. The two senses of the word must not be conflated.

b. The consequence, and the error it corrects

The consequence is that within the range described at paragraph c below, the irradiance delivered to the retinal image of a source does not diminish as the observer moves away from it. The source grows smaller without growing dimmer.

The clearest statement of that consequence is a comparison between two tissues of the same person, facing the same source, at the same moment.

Skin has no optical element in front of it. A patch of skin is a bare detector of fixed area. The irradiance upon it falls as the inverse square of the distance to the source, exactly as intuition holds and exactly as a meter reads.

The retina has the cornea and the crystalline lens in front of it, and is not a bare detector. It receives the same diminishing power through an aperture of fixed area, compressed onto an image that diminishes in step with it. The irradiance upon it does not fall.

Those two surfaces belong to one person and face one source at one distance, and they are subject to different physics, because one of them sits behind a refracting system and the other does not. It follows that any characterization of exposure resting on a quantity measured at the body surface, or by any flat detector, understates ocular exposure, and understates it by the gain set out at paragraph a, which across the ranges at issue is of the order of a thousand to fifty thousand.

The Foundation states this because the contrary proposition is asserted routinely, and because it is asserted in response to complaints about the products at issue. The assertion takes the form that the inverse square law governs, so that a person standing twice as far from a light receives a quarter of the exposure. The underlying physics is sound and the conclusion does not follow, because the two statements are about different quantities that share a name.

Irradiance at a flat surface held at the observer’s position does fall as the inverse square of the distance. This is the quantity an illuminance meter reads, and it is the quantity cited.

Irradiance at the retinal image of a resolved source does not. The total power entering the eye falls as the inverse square, exactly as the meter indicates, and the area of retina it is delivered to falls by the same factor.

Both quantities are irradiance and both are measured in watts per square meter. The meter reading is a correct answer to a question other than the one the eye poses. The everyday observation that establishes the point is that a painted wall does not darken as a person walks away from it, and a photograph of a lamp taken at ten meters and at one hundred meters records the same brightness over fewer pixels. A camera and an eye are the same kind of instrument in this respect.

What does fall with distance is the extent of retina exposed, not the intensity of the exposure upon it. For a photochemical mechanism of the kind described at Part V.C.1, which is driven by irradiance and duration rather than by total power delivered to the eye, that distinction is the

material one. Retreating from the source reduces the area at risk. It does not reduce the dose rate within that area.

c. Where the regime changes, in numbers

The relation above holds while the eye resolves the source. It ceases to hold when the source subtends so small an angle that its retinal image can shrink no further, because diffraction, aberration and eye movement set a floor on image size. Below that angle the image area is fixed while the power entering the eye continues to fall, and retinal irradiance does then fall as the inverse square of the distance. The exposure guidance encodes that floor as a minimum angular subtense, 1.5 milliradians for the retinal thermal hazard, and it encodes an upper bound of 100 milliradians beyond which radiance is averaged over a fixed field. For the retinal photochemical hazard it provides an alternative criterion expressed in irradiance for sources subtending less than approximately 11 milliradians.

The retinal image diameter corresponding to an angular subtense is that angle multiplied by the focal length of the eye. At 17 millimeters, 1.5 milliradians corresponds to an image approximately 25 micrometers across, 11 milliradians to approximately 187 micrometers, and 100 milliradians to approximately 1.7 millimeters.

The distance at which a source of a given physical size subtends a given angle is the size divided by the angle. The Foundation sets out the result for a range of emitting apertures, because the numbers are the substance of the point and because they are arithmetic that the Department can check.

Diameter of emitting aperture	100 milliradians at	11 milliradians at	1.5 milliradians at
1 millimeter (a bare high-brightness die)	0.01 meter	0.09 meter	0.67 meter
10 millimeters	0.1 meter	0.9 meter	6.7 meters
25 millimeters	0.25 meter	2.3 meters	16.7 meters
50 millimeters	0.5 meter	4.5 meters	33.3 meters
150 millimeters	1.5 meters	13.6 meters	100 meters
300 millimeters	3.0 meters	27.3 meters	200 meters

The Foundation asks the Department to read the final column. It is the distance beyond which the inverse square law begins to govern retinal exposure, and within which it does not.

For a single bare die of a millimeter across, that distance is approximately 0.67 meter, and at any ordinary viewing distance the inverse square law does govern. The Foundation states that because it is the case against its own general proposition and the proposition should not be stated more broadly than it holds.

For an emitting aperture of 25 millimeters, which is the order of magnitude of a single module in a vehicle warning lamp assembly, the resolved regime extends to approximately 16.7 meters, or 55 feet. For an aperture of 150 millimeters, the resolved regime extends to approximately 100 meters, or 328 feet. An observer at the far side of a parking lot and an observer at the near side receive, at the retinal image, the same irradiance from such a source. For a luminaire aperture of 300 millimeters the figure is approximately 200 meters.

Those distances exceed the distances at which members of the public encounter the product classes described at Part VI. The practical consequence is that for most of the products at issue, across most of the range at which people are exposed to them, distance is not a material variable in retinal exposure at all.

d. What follows, and what does not

The Foundation states the limits of the foregoing before stating its use, because the proposition is a statement about a quantity and not about a magnitude.

It does not establish that any product is hazardous. It establishes what must be measured in order to find out, and in what units. The magnitude question is addressed at Part V.J, where the Foundation states that the measurements have not been made.

It does not establish that all light-emitting diode products present comparable exposure. They do not, and the reason is the one this subsection identifies. Radiance for a fixed luminous output is inversely proportional to the area of the emitting aperture, so products differ in retinal exposure by orders of magnitude according to how widely they spread their emission. A high-output luminaire behind a large diffusing aperture and a bare-die module of the same luminous output are not comparable exposures. The difference between them is in radiance and in position within the visual field. It is not in distance.

It does not hold below the minimum angular subtense, where the inverse square law governs, nor in air carrying appreciable fog, rain, smoke or dust, where attenuation is not negligible. It assumes an eye focused at or near the plane of the source; an eye accommodated elsewhere spreads the image over a larger retinal area and the irradiance falls accordingly.

It concerns a source that the eye resolves, and it is not a statement about scattered light. Skyglow is radiation emitted upward, scattered by the atmosphere and returned to the ground as a diffuse luminance spread across the whole sky. The relation governing that field is the one described at Part V.J, in which brightness at a location falls with distance from the emitting city as a power of that distance. A resolved emitter within the field of view and a diffuse luminance distributed across the sky are different physical situations. The Foundation relies on the first here and on the second there, and there is no inconsistency between them.

It is one of three distinct mechanisms by which darkness aggravates a given emission, and the Foundation keeps them separate rather than running them together. The pupil term in the relation at paragraph a above is this one: a dark-adapted pupil raises retinal irradiance by a factor of approximately 5.4 over a light-adapted pupil, from the same source, at the same distance. The second is the background luminance term in the discomfort glare metric, treated at Part V.C.4. The third is circadian phase, treated at Part V.F. They are different mechanisms with different remedies and the comment does not merge them.

e. The regulatory consequence

Two consequences follow for the form of any standard, and the Foundation puts them as propositions.

First, a limit expressed in illuminance, in luminous intensity, or in a required separation distance does not constrain retinal exposure within the resolved regime. The photometric standards for warning lamps described at Part VI.D are expressed in candelas, which is luminous intensity. Lighting ordinances and siting conditions are commonly expressed as setbacks, mounting heights and illuminance at a property line. None of those quantities constrains radiance, and a product may satisfy every one of them while delivering an unchanged irradiance to the retinal image of anyone who looks at it. The Foundation does not contend that those conventions are without purpose. It contends that they do not address this hazard, and that an agency relying on them is not regulating the quantity that reaches the retina.

Second, the remedy is a radiance limit, and the means of complying with one are established. Because radiance is luminous output divided by the product of emitting area and solid angle, the radiance of a product can be reduced at unchanged luminous output by enlarging the aperture from which it emits — through a diffusing optic, a larger lens, or a greater number of emitters

operated at lower drive current. Doubling the linear dimension of the emitting aperture reduces radiance by a factor of four. Products embodying each of those techniques are in commerce today. Section 360kk(a)(2) directs that a performance standard be technically achievable and that it take into account the reasonableness and practicability of its application. A radiance limit satisfies that direction, because the engineering by which it would be met is neither novel nor costly, and because it is already practiced by some manufacturers in the same product classes.

The Foundation accordingly asks the Department to note that the quantity in which the hazard is expressed, the quantity in which the existing conventions are expressed, and the quantity in which a remedy would have to be expressed are three different quantities, and that only the first and third coincide.

A third consequence bears on the scope of this inquiry rather than on any product, and the Foundation states it here because this subsection is where the ground for it is laid. The Department's notice concerns electromagnetic radiation across the spectrum. For every band within it other than the optical, the human body presents no organ that concentrates the incident field. Radiofrequency, microwave and extremely low frequency radiation are absorbed by tissue in proportion to the field present at that tissue, and the dose quantities in which they are assessed are constructed accordingly. Optical radiation is the exception, and the exception is anatomical rather than physical. The human eye is a refracting instrument that concentrates incident optical radiation onto a layer of non-regenerating neural tissue by a factor that reaches approximately fifty thousand, and it is the only such instrument in the body.

That is why optical radiation cannot be assessed with the dose concepts or the instruments used for the remainder of the spectrum, and it is why the Foundation asks the Department to treat it as a distinct subject within this inquiry rather than as one band among several. It is also the answer to the objection that visible light is ubiquitous, ancient and self-evidently tolerated. What the eye evolved to tolerate is the radiance of the sources described at Part V.B.5, concentrated by the same factor. A source of far higher radiance presented to the same instrument is not a familiar exposure, whatever the illuminance in the room.

A fourth consequence: the quantity is specifiable, and in one industry it is specified

The consequences stated above identify a mismatch between the quantity in which retinal exposure arises and the quantities in which the governing conventions are written. An objection is available at this point and the Foundation meets it here, because the objection is practical rather than scientific. It is that a criterion expressed in source luminance would be difficult to specify, difficult to measure, and difficult to certify against. The answer is that it is none of the three, and the demonstration is an industry that already does it. The Foundation sets out what four product classes report.

Displays. Source luminance, in candelas per square meter, is the headline specification and the basis of certification. The Video Electronics Standards Association' display certification scheme states three separate luminance requirements for each performance tier, measured under three named test procedures: a ten percent center patch, a full-screen flash, and a full-screen long-duration test. A product certified at the 1,400 tier must reach 1,400 candelas per square meter on the center patch and 900 on sustained full-screen output. The quantity is specified, the test geometry and duration are specified, and products are certified against them.

General illumination. Luminous flux, in lumens, together with correlated color temperature. Flux is the total light emitted and is indifferent to the area it departs from. Two products of identical lumen rating may differ by orders of magnitude in source luminance, as Part V.B.8 shows from a manufacturer's own figures.

Roadway and area lighting. The luminance of the road surface, in candelas per square meter, and not the luminance of the luminaire. The distinction is not the Foundation's. A

manufacturer states it, in the document described at Appendix D.3 and Part V.C.4.f, as the complaint that the metrics in use "do not consider true luminaire luminance." What is regulated is the illuminated pavement. What enters the eye is the luminaire.

Warning lamps, including the beacons described at Part VI.C. Luminous intensity, in candelas. Intensity is flux per unit solid angle and is likewise indifferent to the area of the emitter. A reduction in emitting area at constant intensity raises source luminance without altering the reported figure or affecting compliance.

Three of the four report quantities from which source luminance cannot be recovered, and the three are the product classes a member of the public encounters without choosing to. The fourth reports source luminance directly, measures it under published test procedures that specify both the area of the measurement patch and its duration, and certifies products against the result. It is the one class whose purchasers acquire the product in order to look at it.

The Foundation is careful about what that comparison establishes and about what it does not. The display criteria are minimum levels for certification, not maximum permitted emission, and the scheme is a performance mark rather than a safety standard; the Foundation does not present it as one and does not suggest the Department adopt its numbers. The comparison goes to feasibility and to nothing else. Whatever reason there may be for the absence of any source-luminance criterion from the conventions governing the products at issue, it is not that the quantity cannot be specified, cannot be measured repeatably, or cannot be certified against. It is specified, measured to a published procedure, and certified against, in the one product class whose users look at it deliberately. The Foundation asks the Department to weigh that against the position recorded at Part V.C.4.f, where a manufacturer states that the metrics applied to its own outdoor products do not reach luminaire luminance at all.

3. Correlated color temperature and its limits as a descriptor

Correlated color temperature is the descriptor in which the spectral character of a lamp is almost always reported. It appears on the package, in the lighting standards, in the specifications by which municipalities procure street lighting, in the Foundation's own petition to the National Highway Traffic Safety Administration described at Part IV.C.5, and in the recommendation the International Commission on Non-Ionizing Radiation Protection offers for mitigating circadian disruption. It is therefore worth being exact about what the quantity is, because this comment relies on the proposition that it does not describe what a product emits.

a. What the quantity is, and the information it discards

Correlated color temperature is the temperature of the blackbody radiator whose perceived hue most nearly matches that of the source. It is arrived at by a chain of reductions. The spectral power distribution, which is a function of wavelength and carries the whole of the information about what the source emits, is integrated against three color-matching functions to give three numbers; those are reduced to a two-dimensional chromaticity coordinate; and that coordinate is reduced to the single temperature of the nearest point on the blackbody locus. Information is discarded at each step, and what survives is a statement about appearance to a standard observer.

The consequence is that correlated color temperature cannot distinguish sources that look alike and differ in composition. Two lamps of identical correlated color temperature may differ substantially in short-wavelength output, as Part I.G records and as the Foundation states at Part IV.C.5. A blackbody at 2,700 kelvin emits a continuous spectrum. A phosphor-converted white light-emitting diode reported at 2,700 kelvin does not: it emits a narrow peak in the blue and a broad phosphor emission, with the proportions chosen so that the mixture matches the blackbody in hue. The match is in appearance. It is not in spectral content, and nothing in the quantity requires it to be.

b. The published characterization, and where the descriptor fails worst

The Foundation does not rest that proposition on its own analysis. Galadí-Enríquez, of the Centro Astronómico Hispano-Alemán at the Calar Alto Observatory, published in the Journal of Quantitative Spectroscopy and Radiative Transfer in February 2018 a quantitative treatment of exactly this question. The paper opens:

> "Correlated color temperature (CCT) is a semi-quantitative system that roughly describes the spectra of lamps. This parameter gives the temperature (measured in kelvins) of the black body that would show the hue more similar to that of the light emitted by the lamp. Modern lamps for indoor and outdoor lighting display many spectral energy distributions, most of them extremely different to those of black bodies, what makes CCT to be far from a perfect descriptor from the physical point of view."

The paper then computes a spectral index for a set of lamps of many kinds and plots it against correlated color temperature. The author's statement of the result is the sentence this subsection exists to make, and the Foundation asks the Department to note the range it identifies:

> "CCT would be a bad descriptor for the evaluation of the content of blue light, specially in the interval of the most frequent CCTs, from 2000 to 4000 K. All lamps analyzed are redder than the black bodies with the same CCT."

Two thousand to four thousand kelvin is the interval in which domestic lamps, interior commercial lighting and modern roadway lighting are specified. The descriptor is reported as performing worst over precisely the range in which it is used. And the second sentence states a systematic bias rather than scatter: every lamp examined contained less short-wavelength energy than the blackbody of the same nominal temperature, so the descriptor does not merely fail to resolve blue content but misstates it in a consistent direction.

c. The guidance offers its remedy in this descriptor

That bears directly on the assessments treated at Part V.K. The 2020 statement of the International Commission on Non-Ionizing Radiation Protection addresses circadian disruption and offers a remedy expressed in correlated color temperature:

> "Traditional incandescent lamps have a CCT of approximately 2,700 K. There have been recommendations and efforts to lower the CCT of "white" LEDs to below 3,000 K. These efforts should serve to lessen concerns about circadian rhythm disruption from "white" LEDs."

The Foundation sets the two passages side by side and draws the consequence narrowly. A recommendation to reduce correlated color temperature below 3,000 kelvin is a recommendation expressed in a descriptor that the published characterization reports to be a bad predictor of blue content between 2,000 and 4,000 kelvin, which is the interval the recommendation operates in. Two lamps may both satisfy the recommendation and differ in the emission the recommendation is directed at reducing. The Foundation does not say the recommendation is wrong in its aim, which it is not. It says the recommendation is not capable of being verified in the quantity in which it is stated, and that this is a defect of the quantity rather than of the aim.

d. The quantities that do describe spectral content

Four quantities are available, and the Foundation sets them out together because they weight different things and the comment relies on keeping them distinct. Nothing below should be read as suggesting that one may be substituted for another.

- The spectral power distribution itself, measured by spectroradiometry. Part V.J.1. It carries all of the information and any weighted quantity can be computed from it afterwards. It is the only one of the four that presupposes no choice of biological endpoint.
- Melanopic equivalent daylight illuminance, standardized by the International Commission on Illumination as CIE S 026:2018 and described at Part V.F and Part V.J.4. Weighted by the melanopsin sensitivity function, which peaks near 490 nanometers. This is the quantity

apt to the circadian question, and it is the quantity the 2020 statement's recommendation is not expressed in.

Blue-light-hazard-weighted radiance, weighted by the function described at Part V.C.2.a, which peaks at 445 nanometers. This is the quantity apt to acute retinal photochemical injury and to nothing else. Part V.K.6 addresses the consequences of treating it as a general measure of hazard.

The spectral index system of the 2018 paper described above, of which the index relevant here is written $L_{500} - V$: the energy emitted below 500 nanometers compared with the photopically weighted output, expressed as 2.5 times the base-ten logarithm of the ratio. A larger value means less blue per lumen. The system is self-normalized and unit-independent, so no reference source is required.

The Foundation is careful about the last of those and states its limits before its uses. A step at 500 nanometers is not a biological weighting. It is neither the melanopsin function nor the blue-light hazard function, and it does not approximate either. The index was developed by an astronomer, for the characterization of lamp spectra in connection with artificial light at night, and the author describes it as a quantitative description of what a lamp emits rather than as a measure of effect. The Foundation offers it for what the author offers it for: as an objective, computable descriptor of blue content that correlated color temperature is not. The author's own summary of the comparison is that the system is "quantitative, providing the numerical and physical meaning that CCT lacks."

Nine street lights measured, five visual systems modeled, and the finding that the descriptor problem is worse than this subsection has said

Everything above concerns whether correlated color temperature describes what a lamp emits. One study goes further and asks whether the category of lamp does. Seymoure B.M., Linares C. and White J., Connecting spectral radiometry of anthropogenic light sources to the visual ecology of organisms, Journal of Zoology, 2019, doi 10.1111/jzo.12656. Described at Appendix C.149. Working with the municipal utility of Fort Collins, Colorado, the authors measured the radiance of nine street lights actually in service, at a distance of twenty-five meters, with a sensitive spectroradiometer, recording energy flux in watts per square meter per second per nanometer and converting to photon flux. The nine were five high-pressure sodium lamps at 70, 100, 150, 250 and 400 watts, two mercury vapor lamps at 175 and 250 watts, a 1,000-watt metal halide and a 73-watt light-emitting diode. They then computed, for five visual systems and for four non-visual photoreceptors, how many photons each photoreceptor would catch under each lamp, and whether the lamps would be told apart.

Two findings bear on this subsection and the Foundation takes the more important one first.

The first is that a human sees a different city at night from the one a bird or an insect sees, and that the difference is not of degree. In the authors' words: "humans see a much different nocturnal urban environment than other animals as humans see most lights as the same color, yet birds and insects are likely seeing a myriad of differently colored lights in their environment." The modeled chromatic contrasts were above the discrimination threshold for most lamp comparisons in the avian and insect visual systems and below it for many of the same comparisons in the two mammalian ones. The lamps that a human eye cannot tell apart are not the same lamps, and three of the five modeled receiver systems can tell them apart.

The second finding is narrower and, for a Department writing a performance standard, more awkward. Lamps of the same type at different powers do not have the same spectrum. The authors state that this corroborates an earlier measurement study and that it contradicts what they call current doctrine, that similar light sources have the same spectral composition regardless of power. They add that previous research in this field has assumed that light sources within a type are the same color, and they name three papers that did so, two of which this comment has recorded as acquisitions. If that holds, a standard written by lamp technology — sodium, halide, diode — does

not control the emission, because the same technology at a different wattage emits differently. A standard written on the spectrum does control it. That is the conclusion this subsection reached from the spectral-index literature and it is reached here from measurement of hardware in the street.

The Foundation records two things in the same study that do not run its way, because a subsection built on this paper cannot omit them. The diode measured here was not the most short-wavelength-rich of the nine; by the hue metric the authors use, the metal halide had the greatest short-wavelength composition and the diode and the sodium lamps the greatest long-wavelength composition. And only the 1,000-watt metal halide was significantly brighter than the others, the authors observing that subtle differences in brightness are probably irrelevant to an eye that adapts. What they say against the diode is different and more precise than the usual claim, and the Foundation adopts their formulation rather than the louder one: the diode was the least chromatic of the nine, which is to say the most broadband, and was therefore "most likely to stimulate photoreceptors regardless of visual system." A source that spreads its energy across the spectrum reaches every receptor, and that is a different objection from an excess of blue.

One limitation the authors state and the Foundation repeats: these were lamps in service, so fixture height, cleanliness and bulb age could introduce differences their method did not control. And no organism was observed in this work. Every statement about perception is the output of a model of a visual system, resting on published photoreceptor sensitivities and cone ratios and on three assumptions the authors list about how color discrimination works. Part V.A.3 records this as one of three entries in which a visual system was modeled rather than assumed, and the Foundation relies on it for what the lamps emit rather than for what any animal does.

And a field experiment that varied correlated color temperature under radiometric control, which is the test this subsection has been reasoning toward

The argument of this subsection is that correlated color temperature does not determine what a lamp emits. The question it does not answer is whether varying that number changes a biological outcome. One experiment put exactly that question and the Foundation sets out its design before its result, because the design is the reason the result is worth having. Pawson S.M. and Bader M.K.-F., LED lighting increases the ecological impact of light pollution irrespective of color temperature, Ecological Applications, volume 24, number 7 (2014), pages 1561 to 1568. Described at Appendix C.151.

Six white diodes of six different correlated color temperatures were operated in the field in New Zealand, in three blocks, with flying invertebrates collected in traps. The critical feature is how the lamps were equalized. Each diode's drive current was adjusted through a programmable driver until all six produced the same radiant power, 12 milliwatts plus or minus 1, measured by collimating the emission onto a thermopile sensor and averaging over ten-second intervals with a laboratory power meter. Emission spectra were measured for each. That is radiometric matching, and it is the opposite of the photometric matching at Appendix C.148, where two lamps were equalized at a stated illuminance in lux and the cooler lamp therefore delivered more energy by construction. Here the energy was held constant and only its distribution across wavelength was allowed to vary.

Twelve thousand eight hundred and sixty invertebrates were caught. The lamps attracted significantly more flying invertebrates than unlit control traps. And, in the authors' words, irrespective of taxon the color temperature had no significant effect on invertebrate attraction.

The Foundation states carefully what that does and does not show, and the limits are as important as the finding. It does not show that spectrum is irrelevant; it shows that this descriptor, varied across its commercial range at constant radiant power, did not move this endpoint. It does not show anything about human beings. And the endpoint is attraction measured in light traps, which is the quantity Appendix C.142 establishes is not a good proxy for ecological impact and which Appendix C.135 establishes captures only a fraction of the animals affected. A reader could fairly say that the study asked whether a poor descriptor moves a poor proxy.

What survives that is still the thing this subsection needs. If correlated color temperature described the biologically operative content of a lamp's emission, then six lamps differing in it at identical radiant power should have differed in their effect on organisms whose photoreceptors are known to be sensitive to the wavelengths in question. They did not. That is a result about the descriptor, obtained under the only matching condition that could isolate it, and it is the empirical counterpart of the spectral analysis set out above. Taken with the measured correlation of 0.62 between correlated color temperature and a composite wildlife index recorded earlier in this subsection, and with the field comparison of two lamps of identical rating that differed by a fifth in insect attraction, the Foundation submits that the descriptor has now failed three different tests put to it by three different groups.

Two further results in the same paper run in directions a reader should know about. The effect of the lamps was strongly taxon-dependent: marked in flies and in moths and butterflies, and absent in thrips, in bees, wasps and ants, and in beetles. And in a separate comparison at an industrial site, traps at a white diode luminaire caught 48 percent more flying invertebrates than traps at a high-pressure sodium luminaire. The Foundation does not use that second figure in support of anything, for a reason given at the appendix entry: those were two real installations rather than two matched sources, and the paper does not state that their outputs were equalized, so the comparison is between lighting installations and not between spectra at equal power.

Two lamps of the same correlated color temperature, tuned differently, tested in the field, and the author who reports it is the one who calls the descriptor a reasonable rule of thumb

The proposition at the head of this subsection is that correlated color temperature does not determine what a lamp emits. The Australian guidelines at Appendix D.1 demonstrate it with two spectra of identical rating and different blue content. One source reports the biological counterpart, and the Foundation sets out both what it says and what the same author says against this subsection in the same four pages. Longcore T., Hazard or Hope? LEDs and Wildlife, LED professional Review, issue 70, 2018. Described at Appendix D.1. It is a signed essay in a trade magazine of the lighting industry, addressed to lighting professionals, and it is not research.

The experiment it reports is not its own and is described at second hand. Spectral response curves for bees and moths were used to choose between configurations of two prototype tunable lamps rated at 2,700 kelvin and one at 3,000 kelvin, built from red, green and blue diodes, in a manner predicted to reduce insect attraction. Those custom configurations were then compared in a field study against an off-the-shelf lamp of 2,700 kelvin and a fluorescent lamp of the same rating. The result reported is that the tuned lamp attracted twenty to twenty-one percent fewer insects than a similar lamp not designed with that objective, the effect being large for moths.

Two lamps carrying the same number on the package differed by a fifth in a measured biological response. That is the proposition of this subsection established on an organism rather than on a spectrum, and the Foundation states its limits in the same breath: the figure is reported at second hand in a trade essay, the primary study has not been obtained, the subject is insect attraction and not any human endpoint, and a twenty percent reduction is a reduction and not a remedy. What it establishes is narrow and sufficient. A procurement specification, an ordinance or a performance standard written in correlated color temperature cannot distinguish the better of those two lamps from the worse, because it is the same number for both.

And what the same author says that tells against this subsection

The Foundation would not cite an essay for one proposition and suppress its contrary one. The same four pages state that correlated color temperature "is not a perfect predictor of effects on wildlife, but it is a reasonable rule of thumb that lower CCT will be less disruptive to wildlife," and, later, that "As a rule of thumb, CCT can be used as an indicator of wildlife effects, but this may not hold true across all applications." The essay reports modeled results in which lower correlated color temperatures had lower predicted effects on average and for every species group examined.

The Foundation accepts that and says what follows from it, which is less than it appears. A descriptor may correlate with an effect on average across a sample of lamps and still fail to distinguish two particular lamps, and the same essay demonstrates both facts about the same quantity. The comment has never asserted that correlated color temperature is unrelated to blue content; it asserts that it does not determine it, that two compliant lamps may differ in the emission a limit is meant to control, and that a performance standard must prescribe an emission characteristic rather than a rule of thumb. An author who recommends the quantity for rough guidance and in the same essay reports a field experiment distinguishing two lamps that share it has stated the Foundation's case and his own without contradiction, because they are answers to different questions.

Three further things in the essay the Foundation records rather than uses. Its concluding recommendation is a numerical one and it is lower than any American instrument this comment has found: that with amber and filtered products on the market, color temperatures of 2,200 kelvin and below are, in the essay's words, "feasible and desirable to minimize adverse impacts." Its examples of where a simple spectral rule fails are two, that migrating birds cannot orient under red light so solid red lamps are to be avoided on communication towers, and that green light has support for minimizing attraction of nocturnal migrant birds; which makes this the third source in the comment, with the Australian guidelines and the note at Appendix D.6, to say that one spectral rule will not serve every taxon. And its statement of what is missing is a statement of what paragraph 360ii(a)(5) directs: that the relationship between light intensity and spectral responses "is largely unknown and needs research across nearly all wildlife groups," and that "taxonomic-specific metrics of both radiance and irradiance are needed."

e. Numerical limits on lamp spectra already exist in law

The objection most readily made to Part IX.H is that no one knows how to write a spectral limit, and that the Foundation is asking for something that cannot be drafted. The 2018 paper answers it. Table 3 of that paper sets out existing regulations whose requirements the author expresses in this formalism, and they are in three jurisdictions on two continents:

Andalusia, Spain, by regulation of 2010, article 13.a. In general, L_{525} – bolometric greater than 0.753. In protected areas, L_{440} – bolometric greater than 2.060 for non-LED sources and L_{500} – bolometric greater than 2.060 for light-emitting diodes. The author translates the last of those into plain terms: it requires that the total emission below 500 nanometers be less than fifteen percent of the total. That instrument has since been replaced, and the regulation now in force is set out below; the Foundation reports the 2010 provision because it is what the paper analyzes, and does not rely on it as current law.

The Canary Islands, Spain, by the 2017 revision of the Instituto de Astrofísica de Canarias specifications, section G.8. An "amber LED" requires L_{500} – bolometric greater than 4.560; a "warm LED" requires L_{500} – V of at least 1.505; a "super-warm LED" at least 2.060.

Antofagasta, Atacama and Coquimbo, Chile, by decree of 2013, article 7, which imposes three conditions simultaneously, each expressible as a ratio between emission in a defined wavelength interval and emission in another.

The Foundation asks the Department to note the form of those provisions rather than their numbers. Each states a limit on the proportion of a source's emission falling in a defined band. Each is verifiable from a measurement laboratories already perform. None is expressed in correlated color temperature. Section 360kk requires that a performance standard prescribe an emission characteristic, and these are emission characteristics prescribed.

One calibration in the paper is worth stating because it bears on the comparison this Part makes throughout. For the three lamps the author uses as examples, the index L_{500} – V takes the values 4.491 for a phosphor-converted amber light-emitting diode, 1.522 for a classical incandescent bulb and 0.833 for a discharge metal halide lamp; the corresponding fractions of below-500-

nanometer energy relative to photopic output are 0.016, 0.246 and 0.464. The warm threshold of the Canary Islands specification is 1.505. The incandescent lamp, at 1.522, therefore just satisfies it. The author states the point and its qualification: “Not surprisingly, the PC amber LED overruns both criteria, but also the incandescent lamp would fit in the ‘warm’ box (although these IAC definitions are intended only for LEDs).” The Foundation does not represent the threshold as having been set by reference to the incandescent lamp. It notes that a threshold arrived at independently falls within two percent of the lamp that light-emitting diode products replaced, which is the comparison Part V.B.5 and Part V.B.6 draw on other grounds.

The Andalusian instrument as it now stands, verified against the regulation rather than the paper

The drafting of this comment required the three instruments above to be checked against their own texts and not against the paper’s summary of them, and to be checked for whether they remain in force. That check has been performed for the first of the three, and it changed the answer. The Andalusian regulation of 2010 has been superseded. The instrument in force is Decreto 37/2025, de 11 de febrero, por el que se aprueba el Reglamento de protección frente a la contaminación lumínica en Andalucía, published in the Boletín Oficial de la Junta de Andalucía, number 31 of 2025. It is binding regional law, not a technical annex and not a recommendation. Described at Appendix D.2.

The replacement is more useful to this comment than what it replaced, for three reasons.

First: the instrument regulates a named spectral index, and defines it

The decree does not express its spectral requirement in the paper’s notation. It adopts an index by name, the índice espectral G, defines it in article 3.c, and caps its value at 10.00 for all results above that figure. The definition published by the environmental authority of the autonomous community is this. G is minus two and one half times the base-ten logarithm of a ratio: in the numerator, the lamp’s emission summed without weighting from 380 to 500 nanometers; in the denominator, its emission from 380 to 780 nanometers weighted by the photopic luminous efficiency function. A larger value of G means less blue radiation per unit of visible light. The quantity is self-normalizing, so the absolute units of the measured spectrum are immaterial and no reference lamp is required. The authority gives its reasons for the two boundaries: 500 nanometers because it is the threshold commonly used in studies of the effects of light at night, and 380 nanometers because it is a practical lower limit of the spectrometers used by certification laboratories.

That is the same construction as the index described at paragraph d of this subsection, and the same caution applies to it. A step at 500 nanometers is not a biological weighting function. It is neither the melanopsin function nor the blue-light hazard function, and the Foundation does not present it as either. What it is, and all the Foundation offers it for, is a computable description of how much of a lamp’s output lies in the short-wavelength region, obtainable from a measurement that laboratories already make.

Second: the limits are stated as plain numbers, by zone

The environmental authority publishes the minimum value of G required according to the lighting zone in which an outdoor installation is located: not less than 2.00 in zones E1 and E2, and not less than 1.50 in zones E3 and E4. Article 4.1.m permits municipalities to establish exceptions to the annex value in E4 zones, which the Foundation records because a limit with a local exception is a weaker instrument than one without.

The authority also publishes computed values of G for particular products, and these are what make the limits legible. A high-pressure sodium lamp, whose correlated color temperature it gives as approximately 1,880 kelvin, computes to 2.342. A light-emitting diode product labeled 2,500 kelvin computes to 2.044. A light-emitting diode product labeled 3,500 kelvin computes to 1.109. The authority states expressly that correlated color temperature does not determine G, and that the figures given are the labels of those particular products rather than general values for a color temperature.

Three things follow from those three numbers, and the Foundation states them as statements about three specific products in one official document and not as general claims about lamp classes. The diode product labeled 3,500 kelvin satisfies neither limit; on this index it would not be permitted in any lighting zone in Andalusia. The diode product labeled 2,500 kelvin clears the strictest limit by 0.044. And the high-pressure sodium lamp, which is the lamp the conversions described at Part V.M and Part VI.D replaced, outperforms both diode products on the quantity the decree regulates.

The Foundation draws the narrow consequence and not a broad one. It does not submit that sodium lighting should be restored, which is not its position and does not follow. It submits that where a jurisdiction has put a number on short-wavelength content, the conversion of a public lighting estate turns out to be a question that can be asked and answered quantitatively, and that the answer is not supplied by the nominal color temperature printed on the product. That is the proposition this subsection exists to establish, and an instrument in force establishes it better than a paper does.

Third: the instrument distinguishes a warm lamp from a narrow-band lamp, by wavelength and bandwidth

For the protected surroundings of astronomical observatories the requirement is not a color temperature and not merely a higher index. The authority's technical description states that amber sources in those zones must have G not less than 3.5, an effective wavelength between 585 and 605 nanometers, and a spectral width not exceeding 25 nanometers.

The Foundation places that beside a distinction it drew at Part V.I and regards as important. A lamp of low correlated color temperature is not a narrow-band lamp. Warm white light is broad-spectrum light with a reduced blue fraction and it retains blue content. A narrow-band amber source is a different thing: its emission is confined to a stated interval of wavelengths with a stated maximum width. The distinction is not the Foundation's invention and it is not merely a scientific nicety. A regulator has written it as law, in nanometers, with a bandwidth limit, because the two kinds of lamp are not interchangeable for the purpose the rule serves.

What else the same instrument regulates, which bears on Part IX

The Foundation records the remainder of the decree because Part IX asks this Department to characterize four things — spectrum, quantity, direction and duration — and the objection it expects is that no instrument does all four. One does.

- Duration. Article 9.1.a defines the night period as the hours between eleven at night and six in the morning, which article 9.2 permits a municipality to extend or to begin up to one hour later with justification. Article 9.3.b requires installations to remain switched off during those hours except those necessary for an activity or for safety. Article 12.3 requires ornamental lighting to be off during the night period, article 12.4 permitting temporary exceptions until two in the morning.
- Quantity. Article 9.3.d requires installations of one hundred kilolumens or more that must remain lit during the night period to reduce their luminous flux by at least fifty percent.
- Direction. Article 12.2 refers the maximum installed upward hemispherical flux to the annex and provides that in no case may the values of the basic national rules be exceeded. Article 11.2 requires that sign and poster lighting be achieved with devices directing the flux downward. And the first transitional provision requires that existing luminaires inclined above the horizontal with any installed upward flux be reaimed within two years, where doing so does not require replacing components.
- Zoning. Article 17.2 provides that as a general rule no E3 or E4 zone may be established in the adjacent zones of influence of the reference points, which are the observatories.

The Foundation states the limits of this material plainly. Decreto 37/2025 is the law of an autonomous community of Spain. It binds no one in the United States, it was not adopted on a public health rationale that the Foundation has verified, and nothing in it is evidence of a health

effect. The Foundation does not ask the Department to adopt it, to follow it, or to treat it as persuasive authority. It is offered for one purpose, which is the purpose paragraph e of this subsection was written to serve: to answer the objection that a numerical limit on the emission characteristics of a lamp cannot be drafted, cannot be measured and cannot be enforced. It has been drafted, it is measured by a formula the authority publishes together with a calculation tool, and it is in force.

An independent proposal of the same kind, published seven years earlier

The objection answered in the preceding paragraphs is answered a second time, by a different research group, in a different journal, in a different formalism, seven years before the paper described above. The Foundation sets it out because two independent proposals are harder to dismiss as idiosyncratic than one, and because the form this one takes is already in use by this agency.

Falchi, Cinzano, Elvidge, Keith and Haim published in the Journal of Environmental Management in 2011 an analysis of outdoor lamp spectra assessed against three response functions: the photopic, the scotopic, and the band in which light suppresses melatonin. Appendix C.57. They proposed two numerical criteria, and the criteria are plain ratios rather than logarithmic indices.

A limit on the fraction of a lamp’s output falling in a protected band. The authors define the band as 440 to 540 nanometers and propose that a lamp not be installed outdoors if its emission in that band exceeds 15 percent of its photopic energy flux, measured in watts. They write the quantity as R subscript P and the limit as R subscript P less than 0.15.

A limit on the ratio of scotopic to photopic output, measured in lumens, which they write as R subscript sp and set at less than 0.66. The authors confine this second criterion to settings where accurate color perception is essential.

The values they compute for common sources place the technologies in an order that bears on this comment. On the scotopic-to-photopic ratio, low-pressure sodium stands at 0.20 and high-pressure sodium at 0.55, while a white light-emitting diode described as natural white stands at 3.5. On the protected-band fraction, low-pressure sodium stands at 0.0027 and the white diode at 0.87. The spread between the first and the last is three orders of magnitude on the second measure.

Why the form of that proposal matters to this Department

The Foundation asks the Department to notice what kind of requirement R subscript P is. It is a limit on the ratio of a source’s emission in one defined wavelength interval to its emission measured another way. It is not a limit on total output, not a limit on correlated color temperature, and not a limit expressed in any photometric unit alone.

That is the form of a requirement this agency has already prescribed. Part II.C records that 21 C.F.R. § 1040.20, the performance standard for sunlamp products, does not merely cap intensity: it limits the ratio of the irradiance a product produces in one ultraviolet wavelength interval to the irradiance it produces in another. A band-ratio limit on the spectral composition of a light-emitting product is therefore not a novel instrument that this Department would have to invent. It is an instrument this Department has used, in this part, for a light-emitting product, since 1985.

The Foundation draws the conclusion narrowly. It does not assert that the numerical values proposed in 2011 are the right values, and the passage immediately below records one proposal in that paper the Foundation does not adopt. What the paper establishes for present purposes is that the quantity is computable from measurements laboratories already make, that independent researchers have proposed specific numerical values for it, and that the formal structure of such a limit already exists in title 21. The objection that a spectral limit cannot be drafted is answered three times over: by two independent research proposals and by the agency’s own sunlamp standard.

A proposal in that paper the Foundation does not adopt

Candor requires the Foundation to report that the same authors proposed, as their primary rule, something considerably more restrictive than the band-ratio limit described above: a total ban on the outdoor emission of light at wavelengths shorter than 540 nanometers, benchmarked to the emission of high-pressure sodium in that range. A requirement in that form would effectively exclude white light from outdoor use.

The Foundation does not adopt that proposal and does not ask the Department to adopt it. It reports it for two reasons. The first is that a comment which cited the paper for its band-ratio criterion while omitting its principal recommendation would be presenting the source selectively. The second is that the distance between the two proposals is itself informative: researchers working on this question in 2011 regarded a measure of that severity as warranted, and the Foundation's own request – that the Department study and evaluate, and then prescribe a standard on the evidence – is a great deal more modest than what the published literature has proposed.

f. The instrument was proposed for labelling in 2018 and was not adopted

Part II.H.13 records that the label is the only disclosure of emission characteristics most purchasers ever see, and that the quantities it reports are the quantities this comment identifies as insufficient. In February 2018 the author of the paper described above submitted to a European consultation a proposal that an index measuring the weighted content of blue light be stated on lamp labels alongside the energy class, the wattage, the luminous output and the correlated color temperature. In the same month, a lighting academic writing in Nature recommended that light sources be defined by their spectral characteristics in nanometers rather than only by correlated color temperature in kelvin.

Neither recommendation was adopted in any labelling requirement applicable in the United States. Eight years later the quantities on the label are lumens, watts and correlated color temperature. The Foundation states that as a fact about the record and not as an allegation against anyone: a method of reporting blue content was published in a peer-reviewed journal, proposed for labelling, implemented in three jurisdictions abroad, and is absent from every federal requirement.

The author's own expectation, written in 2017, measures the outcome: the index "has some chances to become a kind of standard to classify lamps according to their amount of blue emission." It did not become one.

g. The Foundation's own petition, explained rather than defended

An inconsistency in the Foundation's record is apparent at this point and the Foundation identifies it before it is identified for it. On May 15, 2024 the Foundation petitioned the National Highway Traffic Safety Administration to limit the correlated color temperature of vehicle headlamps, as Part IV.C.5 records. This subsection argues that correlated color temperature does not describe what a source emits. The Foundation therefore petitioned for a limit in a quantity it says is inapt.

The explanation is not a defense of the petition's drafting. Correlated color temperature is the only descriptor of spectral character that appears in the federal motor vehicle safety standard, on the package, or in the procurement specifications of any purchaser the Foundation could address. A petitioner asking for a limit must ask in a quantity the agency recognizes, and there was no other. That is itself a consequence of the absence this comment describes, and the Foundation would rather state it than have it found. If the Department prescribes a limit on the spectral content of any product, the Foundation asks that it not be prescribed in correlated color temperature, and it does not ask that its own petition be treated as a model for the form of such a limit.

h. What follows for a performance standard

Section 360kk(a)(2) directs that a performance standard be technically achievable and that the Secretary take into account the reasonableness and practicability of its application. The 2018 paper addresses that directly, and the Foundation quotes it because the sentence is about implementation rather than about science:

> "The spectral index system is extremely easy to implement from the spectral data that are routinely measured at laboratories. Thus, including this kind of computations in the standard protocols for the certification of lamps will be really straightforward, and will enrich the technical description of lighting devices."

The measurement is already being performed. Spectral power distributions are measured as a matter of routine in the laboratories that certify lamps, because the photometric and colorimetric quantities reported on the package are themselves computed from them. What is absent is not the measurement and not the method of expressing it. What is absent is any requirement that the result be computed, reported or limited. Among the author's own statements of the system's purpose is that it is "potentially useful for industrial certification, legal regulation and biophysical studies."

A second demonstration that the computation is practicable, from a different direction, and a warning about which quantity it is written in

Everything above establishes that a spectral limit can be expressed and that three jurisdictions have expressed one. It does not establish which quantity predicts biological effect best, and that is a separate question which somebody has attempted to answer empirically. Longcore T., On the Use of Summary Metrics of Light Spectral Characteristics to Assess Effects of Artificial Light at Night on Wildlife, posted 13 May 2020 on FIRES, the forum of the Illuminating Engineering Society. Described at Appendix D.6. The Foundation states what the document is before what it says: a short signed note on a standards body's own forum, carrying the forum's printed disclaimer that views expressed there do not necessarily reflect those of the Society, not peer reviewed, and written by an investigator whose other work this comment relies on in several places.

What was done. The author took the database of lamp spectra built for his 2018 paper, twenty-five light sources, added some further sources, and tested four candidate summary descriptors against measured or modeled wildlife responses. The four were correlated color temperature; the melanopic response of the source relative to a standard daylight illuminant; the ratio of melanopic to photopic light; and the percentage of visible light emitted below 530 nanometers. The responses were a composite index and its four components, being insects, juvenile salmon, a seabird and an average of sea turtle responses. The ultraviolet range was considered only down to 350 nanometers.

The result bearing on this subsection is a number, and it is the only number the note states in its text. The correlation between correlated color temperature and the composite wildlife index is 0.62, which the author describes as "adequate but not outstanding." Everything else in this subsection establishes that correlated color temperature fails to describe spectral content as a matter of physics. This is the first quantification the Foundation has of how much it fails by when tested against biology, and the Foundation states its weight accurately: twenty-five sources, in a note that is not peer reviewed, with the remaining coefficients presented in a figure whose values do not appear in the text and which the Foundation therefore cannot report.

The second result is structural and matters more than the first. No single descriptor won. The melanopic response and the melanopic to photopic ratio predicted the composite best; correlated color temperature was better for insects; the melanopic to photopic ratio was better for the seabird. A descriptor that is best overall and worse than a descriptor it replaces for one of the four components is not a quantity on which a single national limit can be written for all of them. That tells in favor of the form the three foreign instruments use and that this subsection has preferred throughout — a stated limit on the proportion of emission falling in a defined wavelength band — and against a single biologically weighted scalar.

And the warning, which the Foundation states against its own convenience because a standard that can be evaded is worse than no standard

The note identifies a specific way in which a limit written in the wrong quantity could be satisfied while making matters worse. Of the two descriptors that performed best overall, the author writes: “Neither the M/P value nor the melanopic response can be used to evaluate effects on insects, however, because any light source that avoids the peak of the melanopic response by using shorter wavelengths (e.g., a violet LED pump) will be extremely attractive to insects.” The mechanism is given earlier in the same note: the insect action spectra indicate high response at short wavelengths, where the melanopic response is approaching zero.

The Foundation sets out why that is directed at its own request and not only at somebody else’s. Melanopic equivalent daylight illuminance is the quantity this comment identifies at paragraph d above as apt to the circadian question, it is standardized, and it is the obvious candidate for a limit addressed to the effect Part V.F describes. A performance standard expressed in that quantity alone could be met by a manufacturer moving the pump diode from blue into the violet, which would reduce the melanopic figure while increasing emission in the band to which the comment’s own spectral material says many organisms are most sensitive, and while increasing the ultraviolet content that paragraph d records the index system as reaching. The Foundation does not know whether such a product is commercially practical and does not assert that anyone would build one. It states the mechanism because section 360kk requires a standard to prescribe an emission characteristic, and the choice of which characteristic is the whole of the drafting problem.

The index this subsection prefers is not defeated by that move, and that is a reason for preferring it that the Foundation did not have before reading this note. An index expressed as the energy emitted below five hundred nanometers relative to the photopically weighted output rises when the pump is moved into the violet, because violet emission lies below five hundred nanometers. A melanopic weighting falls. The two quantities move in opposite directions under the same change to the product, and only one of them moves in the direction that describes what the lamp is actually emitting. The Foundation asks the Department to note that this is an argument for a band-ratio form and not an argument against limiting melanopic output, which may be the right limit for the circadian endpoint considered on its own; it is an argument against using one weighted scalar as the whole of a spectral standard.

On practicability the note adds a second item to the one quoted above. The author records that he and his colleagues published the code so that designers can supply their own spectral power distributions and obtain the assessment with a web browser and a server, and gives the public repository. Taken with the 2018 paper’s statement that the computation is straightforward from spectral data routinely measured in certifying laboratories, there are now two independent statements, by two authors in two disciplines, that the arithmetic of a spectral descriptor is not the obstacle.

Two statements in the note qualify the whole approach, and the Foundation adopts both rather than quoting around them. The first: “Adjusting spectrum is not a panacea,” followed by the other tools the author directs be considered, which are to light only when needed, only as brightly as needed, directed where needed, and reduced or switched off when possible. Those are the quantity, geometry and duration this comment asks to have characterized alongside spectrum, named by the investigator whose subject is spectrum. The second is the sentence the note opens with, that from the position of wildlife the best artificial light at night is no artificial light at night, which the author immediately qualifies by recognizing that this is not feasible while maintaining safety and achieving other goals. The Foundation asks for neither darkness nor the abolition of any product, and records the qualification because it is the same one this comment makes.

One thing the Foundation must say against the note, and it concerns the component that carries most of its weight. The insect responses in this database derive from modeling of insect flight to light, which is to say from attraction. The moth experiment described at Appendix C.128 and at Part V.I states, on its own evidence, that the attractiveness of a light is not a good proxy for its other

effects, and found that a composite source engineered to match a broad-spectrum source produced the largest suppression of activity of any treatment tested. That experiment is of 2026 and this note is of 2020, and it did not address the metric question this note asks. The Foundation does not treat the note as refuted on a point its author was not writing about. It declines to present the ranking of descriptors as settled, and relies on the note for the three things that do not depend on the ranking: the measured inadequacy of correlated color temperature, the evasion mechanism, and the practicability of the computation.

A biological demonstration of the same defect

Everything in this subsection to this point establishes by spectral analysis that correlated color temperature does not determine blue content. One study supplies the biological counterpart, and it is reported here for a proposition about spectra and not about product types. The Foundation records the funding before the findings because the funding bears on how much of the study can be used. The work was conducted at the Institute of Vision Research of Yonsei University College of Medicine and is recorded at Appendix C.70. It was supported in part by LG Display Co., Ltd., which manufactures organic light-emitting diode panels and supplied the organic panel used as a test article, and the authors conclude that a change from light-emitting diode to organic light-emitting diode lighting may be warranted. The Foundation does not adopt that conclusion, does not ask the Department to prefer any technology, and does not treat the study as a comparison of product types. What follows is the part of it that concerns spectra.

The design used three lamps. A white light-emitting diode at 5,700 kelvin; an organic light-emitting diode panel at 4,000 kelvin; and a third lamp, a warmer light-emitting diode at 4,000 kelvin, included for the express purpose of matching the correlated color temperature of the organic panel. Exposures were set by illuminance, not by irradiance or by blue content. The biological measures were reactive oxygen species production and interleukin-8 expression in four human ocular cell lines, and in albino mice the thickness of the photoreceptor layer and the electroretinogram.

Two comparisons are available in the data, and together they identify the variable. The first holds the technology constant. The white lamp and the warmer lamp were the same manufacturer’s same part number, differing in correlated color temperature. In conjunctival epithelial cells, reactive oxygen species rose to approximately eighteen times the unexposed level under the lamp at 5,700 kelvin and approximately eleven times under the lamp at 4,000 kelvin. One product line, one emitting technology, two spectral distributions, and a difference of roughly forty percent in the measured response.

The second holds the correlated color temperature constant. At 4,000 kelvin, the light-emitting diode lamp raised reactive oxygen species to approximately eleven times the unexposed level while the organic panel produced no statistically significant increase at all. The Foundation states the qualification: that separation appears on the oxidative stress marker and not on the inflammatory one, interleukin-8 having been significantly raised only by the lamp at 5,700 kelvin. The matched-descriptor comparison therefore rests on one of the two markers.

The authors explain the difference by reference to how each technology makes white light, and the explanation is checkable independently of their conclusion. A phosphor-converted light-emitting diode produces two peaks in its spectrum, one narrow peak in the blue and one broad phosphor emission in the yellow. The organic panel produces three, in the red, the green and the blue. A source that must reach a given correlated color temperature using two peaks requires proportionally more energy in the blue peak than a source that reaches the same correlated color temperature using three. The descriptor is satisfied either way. The short-wavelength content is not the same, and the biological response was not the same.

So the proposition stated at subsection a is not only true as a matter of spectral composition. It is true as a matter of measured biological response. Two sources that a purchaser would find described by the same number on the package, and that a procurement specification written in

that number could not distinguish, differed in the quantity that bears on the effects described at Part V.C. That is the defect this subsection identifies, demonstrated on a biological endpoint rather than inferred from a spectrum.

Read together the two comparisons establish the proposition this subsection needs, and it is narrower and more useful than a statement about either technology. The variable that moved the biological response was the spectral power distribution. It moved when the technology was held constant and the spectrum changed, and it moved when the correlated color temperature was held constant and the spectrum changed. Neither the name of the emitting technology nor the correlated color temperature predicted the response. The spectrum did.

That has a consequence for every descriptor presently in use, and the Foundation sets them out in order of how much they discard. Lumens integrate the spectrum against the photopic response and return one number, discarding the distribution entirely. Correlated color temperature reduces the distribution to the hue of a blackbody and discards the peak structure that produced it. The name of the emitting technology discards more still, because it identifies a method of manufacture rather than any emission characteristic: the two lamps in the first comparison above were both light-emitting diodes, from the same part number, and differed in the quantity that bears on the effects described at Part V.C. A purchaser, a procurement officer and a federal standard written in any of those three descriptors would be unable to distinguish sources that this study distinguishes.

One refinement follows, and it bears on the Foundation's own record. Within a single family of phosphor-converted lamps, correlated color temperature is produced by the ratio of the blue emission to the phosphor emission, so within such a family it does track blue content, and the first comparison above shows the response falling as the correlated color temperature falls. Across technologies that generate white by different means it does not track blue content, and the second comparison shows that. So the descriptor is a usable proxy within a technology and an unreliable one across technologies. Part IV.C.5 records the Foundation's petition to the National Highway Traffic Safety Administration to limit the correlated color temperature of vehicle headlamps, and this subsection records the Foundation's acknowledgment that the descriptor is defective. The two are reconciled on the distinction just drawn: headlamps are, at present, overwhelmingly one emitting technology, and within one technology the descriptor carries information. A general federal characterization of products in commerce cannot rely on it, because it must span technologies.

A second consequence bears on what this comment asks for, and the Foundation states it rather than leaving the agency to find it. Part V.C.2.k asks the Food and Drug Administration to establish product classes for light-emitting diode products, which is a classification on the emitting technology axis. If the biological variable is the spectral power distribution, a class defined by emitting technology does not by itself identify a hazard. The answer is that the two do different work, and the agency's own regulation already does both: a class establishes which products are subject to a regime, and an emission limit establishes what any product within it may emit. Part V.C.2.k sets out how 21 C.F.R. part 1040 classifies on four different bases within a single part, and Part V.B.3 above identifies the form such a limit would take, namely a constraint on the ratio of emission in a defined wavelength interval, which is the form 21 C.F.R. § 1040.20 has used for a light-emitting product since 1985. The Foundation asks for a class defined by technology and application and a limit expressed in spectral terms. Neither alone is sufficient.

A third consequence is the one that matters most in this forum, and the Foundation states it plainly. No federal instrument imposes any limit on the spectral distribution of a visible-light emitter, and none requires that the distribution be disclosed. The determination of May 24, 2024 nonetheless rests in part on a finding that light-emitting diode products have a long history of safety with respect to the visible wavelengths being emitted. The study described above reports that the biological response to two such products differed according to their spectral distribution, at matched illuminance and at matched correlated color temperature. The Foundation does not read that study as establishing harm in ordinary use and does not advance it for that purpose. It

advances it for this: a finding of safety framed in terms of emitted wavelengths was made with respect to a quantity for which the agency has set no limit, prescribed no measurement, and required no disclosure. Part I.C.7 sets out what follows, and Part IX.B.4 asks the Department to identify the level at which it regards such emissions as ceasing to be safe.

The Foundation states the limits of the demonstration. The animals were albino mice, which the authors themselves identify as more susceptible than pigmented animals; the illuminances were 1,000 and 2,000 lux delivered for twelve hours a day across eight weeks to caged animals that could not look away, and 10,000 lux to the cell preparations; and the clean matched-descriptor comparison was made on a cellular marker of oxidative stress rather than on vision. Appendix C.70 sets out those limits and one further problem with the animal data in full. None of them touches the point taken here, which is a point about the descriptor and not about the magnitude of any hazard.

A second demonstration, and the illuminances run the wrong way

The study just described compared two sources at matched illuminance. A second study, recorded at Appendix C.74, compared two sources at illuminances that were not matched, and the result is the stronger of the two because the mismatch runs against the finding. Investigators at Gifu Pharmaceutical University exposed pigmented mice to blue light-emitting diode illumination at 1,100 lux and, separately, to white fluorescent illumination at 12,000 lux, for comparable durations of one to three days. The blue diode exposure at 1,100 lux damaged the retinal pigment epithelium and the photoreceptors. The white fluorescent exposure at 12,000 lux did not produce severe retinal damage.

The same paper sets its result against three earlier studies of pigmented animals under fluorescent light, and the Foundation reproduces the comparison because the pattern is what matters rather than any single figure.

Source	Illuminance	Exposure and animal	Reported outcome
White fluorescent	1,200 to 1,600 lux	24 hours, pigmented mice	No retinal damage
White fluorescent	10,000 lux	6 consecutive days, 12 hours light and 12 dark, pigmented rats	No severe retinal damage
White fluorescent	12,000 lux	1 to 3 days, pigmented mice	No severe retinal damage
Blue light-emitting diode	1,100 lux	1 or 3 days, pigmented mice	Damage to the retinal pigment epithelium and photoreceptors; outer nuclear layer thinning; macrophage accumulation and pseudodrusen-like material

A source delivering roughly a tenth of the photometric quantity produced injury that sources delivering ten times as much did not. Illuminance is the quantity in which lighting is specified, procured, labeled and regulated where it is regulated at all, and in this comparison it does not merely fail to predict the outcome; it predicts the outcome backwards. The Foundation asks the Department to notice that the same authors had reported the same relationship the previous year in albino animals, finding that blue diode light of lower intensity than the fluorescent light induced retinal damage. The 2018 study was undertaken to establish whether the finding held in pigmented animals, and it did.

The limits of the comparison are stated at Appendix C.74 and the principal one belongs here as well. The peak wavelength of the diode source is not reported in the text available to the Foundation, so the blue content cannot be quantified and the two arms cannot be compared in

radiometric terms. What can be said is what the Foundation says: the two sources were measured in the same photometric unit, that unit was an order of magnitude higher for the source that did no severe damage, and the difference between them is a difference of spectral distribution. The exposures in both arms are far above ordinary domestic levels and no threshold is established by either.

A third demonstration, which runs the comparison both ways

The two studies just described each hold one quantity constant. A third, recorded at Appendix C.79, holds each of the two candidate quantities constant in turn, which settles the question between them. Investigators at Gifu Pharmaceutical University exposed cone photoreceptor-derived cells to blue, white and green light-emitting diode light in two separate sets of conditions: first at a single matched radiometric irradiance of 0.38 milliwatts per square centimeter, and then at a single matched illuminance of 2,500 lux. Their conclusion, in the abstract, is that the damage was wavelength-dependent and not energy-dependent.

The incidental arithmetic of their first condition is the clearest statement of this subsection's point that the Foundation has found. At one and the same radiometric irradiance of 0.38 milliwatts per square centimeter, the authors record the corresponding illuminances as 450 lux for the blue source at 464 nanometers, 1,600 lux for the white source, and 2,500 lux for the green source at 522 nanometers.

Three sources delivering identical radiant power to the same cells differed in measured illuminance by a factor of five and a half. The reason is the one given at Part V.J.1: illuminance is radiant power weighted by the photopic response, which is near its maximum at 522 nanometers and small at 464. Nothing is wrong with either quantity. They are measures of different things, and a specification written in one of them does not constrain the other. A procurement specification, an energy conservation standard, a lamp package and the reference conditions of the photobiological standard are written in photometric quantities. The damage in this experiment followed the wavelength.

The Foundation states the limitation, which is substantial. This is a monolayer of a transformed murine cell line in a plate, illuminated from below for twenty-four hours, and Appendix C.79 sets out why that is not a retina. The proposition the comment takes from it is not about any human and not about any dose. It is that at constant radiant power the biological effect varied with wavelength, and that the photometric quantity in which lighting is specified varied by five and a half times across sources of constant radiant power. The first is a finding about cells. The second is arithmetic, and it holds wherever the two units are used interchangeably.

The Foundation accordingly asks the Department, at Part IX.C, to include in the characterization it requests the spectral power distribution of representative products in commerce, and not the correlated color temperature alone. The distinction is not a refinement. A characterization expressed in correlated color temperature would reproduce the defect this subsection describes, and would not support any limit the Department might afterwards wish to prescribe.

f. Whether the discarded quantity matters, and an industry statement that nobody had asked

The subsections above establish that the descriptor in which these sources are reported discards the shape of the spectrum, and that two sources of identical descriptor may differ substantially in composition. A question follows which the comment has not yet put: does the discarded shape make a difference that a person can perceive? If it does not, the descriptor loses information of no consequence. If it does, the descriptor conceals something that matters, and the concealment has been in place across the whole of the transition described at Part IV.G.

The Foundation found the question asked, and answered with an absence, in a place it did not expect. In a paper delivered at a symposium of the National Academy of Engineering in 2009 and published in the proceedings volume the following year, an industry technologist in solid-state

lighting set out the spectral consequence of blue-pumped phosphor conversion: the emission is smooth and follows the blackbody curve closely, unlike the sharply peaked spectrum of the fluorescent lamp it replaced. He then wrote this.

> "One might assume that this provides a more natural appearing light, compared to the high-intensity peaks of the FL spectrum, but as of this writing the author is aware of no studies of the effects of smooth vs. spiked spectra on human perception."

The Foundation is careful about the document and about the claim. The document is described at Appendix D.6, and it is a symposium paper by one engineer published under the imprint of the National Academies Press; it is not a consensus report of the National Academies and the Foundation does not present it as one. The claim is a statement of what its author was aware of in 2009, not proof that no such study existed. What makes it worth having is who made it. A specialist developing the technology, writing for an audience of engineers, recorded that the perceptual consequence of the spectral change his industry was bringing about had not been studied. That is a statement against the interest of the party making it, since it is that party which would be asked to wait for an answer.

Seventeen years have passed. The Foundation states what it can and cannot say about the interval. It has not found, among the literature collected for this comment, any study comparing perceptual or visual-performance outcomes between a spectrally smooth source and a spectrally peaked one at matched chromaticity. That is a statement about this comment's own collection and not about the literature, the collection was not assembled to answer this question, and the Foundation does not assert that the gap persists. It asks instead that the question be put, because it is precisely the kind of question paragraph 360ii(a)(4) directs the Secretary to study: an identified absence, recorded by the industry itself, about the biological consequence of a characteristic of electronic product radiation that no federal requirement addresses and that the governing descriptor does not report.

The Foundation adds one observation about the shape of the interval, because it bears on the request rather than on the science. The same chapter carried a projection of what the technology would achieve by 2018, attributed to a report commissioned by the Department of Energy in 2009. The efficiency of these products was therefore the subject of federally commissioned forecasting in the same years in which, on this author's account, their perceptual consequences were unstudied. The Foundation does not offer that as criticism of the Department of Energy, whose remit is energy. It offers it as the answer to a question the Department may fairly ask of this comment, which is why a characteristic of a product in universal use should still be unexamined in 2026. It was not that the technology went unstudied. It was that what was studied was its efficiency.

4. Radiofrequency emissions from LED drivers and control circuits

A light-emitting diode is driven by a switching converter, and a switching converter produces electrical emissions as well as the temporal modulation Part V.D treats. Those emissions take two forms: energy conducted back onto the supply wiring, and energy radiated from the product and from the wiring attached to it. Part VI.L.4 sets out the product class and the regulatory position, and Part VII.B.7 sets out the accounts at Appendix A describing interference attributed to these products.

The Foundation includes the characteristic in this Part for one reason and confines itself to it. Both emissions are electronic product radiation within § 360hh(1)(A), as Part II.B.5 establishes, and both arise from the operation of an electronic circuit in the same product. The Foundation asserts no health effect of conducted or radiated electrical emissions, relies on no study about them, and does not ask the Department to find anything about them. What it records is that the statutory definition reaches both and that the program has addressed neither.

5. The sources under which human visual and circadian physiology developed

Human photoreception developed under a small number of sources. Daylight is the dominant one: a continuous spectrum, broadly blackbody in character, varying in intensity and in spectral balance through the day, and present for roughly half of each cycle. Moonlight is reflected daylight at very low intensity. Fire, available for a substantial part of the species' history, is a low color temperature blackbody source, dominated by long wavelengths, flickering irregularly and at low frequency.

Those sources share features that are easy to overlook because they were universal. All are continuous across the spectrum, without narrow peaks or gaps. All carry substantial long-wavelength and infrared content. None is a small, flat, high-radiance emitter: the sun subtends a fraction of a degree and the sky is diffuse. And none is modulated periodically at high frequency.

6. Long-wavelength and infrared content

Sunlight extends from the ultraviolet to beyond 2000 nanometers. The incandescent lamp, which illuminated American buildings for a century and which federal policy displaced, had a comparable reach: the spectrum of a 60-watt incandescent bulb runs past 1700 nanometers and continues beyond the range of ordinary instruments. The light-emitting diode does not. Its output is engineered to the band in which the human eye forms images, running from approximately 350 to 720 nanometers with a peak near 450 and negligible emission above 700.

That is a deliberate design choice and a sound one in its own terms. Radiation outside the visual band produces no illumination and consumes power, so a lamp optimized for lumens per watt will not emit it. Part IV.G.4.

The question this Part raises is therefore not only what light-emitting diode products add to the human environment. It is what they removed from it, and whether the removal matters. The Foundation asks the Department to attend to this question with particular care, because it is invisible to every existing regulatory instrument. A performance standard limits what a source emits. An exposure limit caps a dose. Neither can register an absence. If long-wavelength radiation performs a physiological function, no hazard framework in existence would detect its disappearance.

There is now direct human evidence that it does. Barrett and Jeffery, publishing in Scientific Reports in January 2026, studied twenty-two adults working in a London building lit entirely by ceiling-mounted LEDs delivering 1000 lux at the desk, in a space whose glazing carried an infrared-blocking film. Infrared photography of the interior returned black images. Eleven subjects had incandescent desk lamps added to their benches for two weeks; eleven comparable subjects in a similar LED-lit space did not.

Color contrast detection thresholds improved in every exposed subject on both the protan and tritan axes, at p less than 0.001. At the end of the two-week exposure the reduction was 28 percent on the protan axis and 24 percent on the tritan, in all eleven exposed subjects. The concurrent control group showed no significant change on either axis. The incandescent lamps were then removed and the subjects returned to LED lighting alone. At the second follow-up the reduction was 24 and 21 percent in ten subjects, and at the third it was 25 and 26 percent in six.

The Foundation asks the Department to note four features of that result, each of which bears on its weight.

The deficit was produced by ordinary ambient workplace lighting, not by an experimental exposure. The subjects had worked under that lighting for more than two years before the study began.

It was reversed by restoring a part of the spectrum that the lighting transition removed. The intervention added nothing novel; it added the lamp that preceded the LED.

The effect was present in every exposed subject and absent in the concurrent controls, and it was still present at the final follow-up. The Foundation states the qualification in the same breath as the finding, because the qualification is material: the final follow-up retained six of the eleven exposed subjects. Persistence is supported by the data, on a sample that had lost nearly half its members by the time it was measured, and the Foundation does not rest weight on it that it will not bear. Appendix C.1.

> The study ran from October to December in London, as daylight hours fell from approximately 10.4 to 7.5. Natural light exposure was decreasing across the study period while measured performance improved. That trend runs against the finding rather than producing it.

The authors attribute the effect to mitochondrial function, on the basis of a body of work they cite: short-wavelength light in the 420 to 450 nanometer range reduces mitochondrial complex activity and adenosine triphosphate production in animal models, while deep red and near-infrared light in the 670 to 900 nanometer range increases it. The Foundation does not ask the Department to accept that mechanism. It asks the Department to note that a measurable functional difference attributable to the spectral composition of ambient lighting has been demonstrated in working adults, and that no federal body has examined it. Appendix C.1 sets out the study in full, including its limitations.

One enzyme, two absorption bands, and the connection between the two halves of this Part

The mechanism referred to in the preceding paragraphs can now be stated with a molecule attached to it, and doing so connects this subsection to the blue-light material at Part V.C. The review at Appendix C.72 identifies the enzyme. Complex IV of the mitochondrial electron transport chain, also called cytochrome oxidase or cytochrome c oxidase, carries heme groups and has an absorption peak at approximately 420 nanometers in its oxidized form and approximately 440 nanometers in its reduced form.

That is the same enzyme, and the same absorption, that the near-infrared literature relies on. Cytochrome c oxidase is the accepted chromophore for the stimulatory effects of deep red and near-infrared light reported in the 670 to 900 nanometer range. So the two bodies of work this comment has treated separately – the blue-light hazard literature at Part V.C and the long-wavelength literature in this subsection – converge on one molecule with absorption in two spectral regions and effects in opposite directions. Light near 420 to 440 nanometers is reported to inhibit the enzyme; light near 670 to 900 nanometers is reported to stimulate it.

The Foundation states what that does and does not do for this comment. It does not establish either effect, and the Foundation continues not to ask the Department to accept the mechanism. What it does is remove the objection that the two claims are unrelated and must be assessed in isolation. A single enzyme with a blue absorption band and a red one supplies a coherent reason why the removal of long-wavelength content and the addition of short-wavelength content, which the transition to light-emitting diode illumination accomplished together, might act on the same target in the same direction. Three independent observations now bear on it: the review at Appendix C.72, which reports that at least two of the four respiratory complexes are implicated in blue-light injury and that blue light at 404 nanometers irreversibly inhibited the enzyme in the rat retina; the measurement at Appendix C.69, which found Complex II and succinate dehydrogenase activity reduced by 460 nanometer light in an intact animal; and the review at Appendix C.71, which gives direct action on ganglion cell mitochondria as the first of three injury routes.

One finding reported in that review bears directly on what a limit would have to measure, and the Foundation sets it out separately because it recurs throughout this comment. The review records that cytochrome oxidase activity was significantly altered across the layers of the rat retina over time while no visible morphological change was observed by ophthalmoscopy or by light microscopy. A measurable change in the activity of a respiratory enzyme, in the absence of any lesion an examiner could see, is precisely the kind of effect that an exposure limit calibrated to

threshold lesion formation is not constructed to detect. Part V.C.1.g develops that point and Part V.C.2.f gives the dose figures on which the limit rests.

Section 360ii(a)(4) directs the Secretary to study and evaluate emissions of, and conditions of exposure to, electronic product radiation. The Foundation submits that the spectral content of the light under which the American population now works and lives, including what that light no longer contains, falls within those words.

A second study bears on the same characteristic, and it bears on it experimentally. Roddick and others published in the Journal of Environmental Psychology in December 2024 a preregistered, double-blind, within-subjects experiment on the effects of near-infrared radiation in ambient lighting. One hundred fifty-one participants each spent about forty-five minutes under each of two lighting conditions in a single session. Both conditions were white light-emitting diode lighting at a nominal 3500 K and at matched illuminance, 741 and 748 lux. What differed between them lay entirely above 700 nm: irradiance in that band was 0.12 watts per square meter in one condition, which the authors describe as typical of modern office lighting, and 14.11 watts per square meter in the other.

The Foundation asks the Department to attend to what was held constant. Melanopic irradiance was 0.532 watts per square meter in the condition without near-infrared and 0.539 in the condition with it. The rhodopic and the three cone-opic irradiances differed by comparably small amounts. Every quantity by which American lighting is specified, purchased, regulated and studied was, for practical purposes, the same in the two conditions. A photometer could not have told them apart. Neither could a melanopic measurement, which is the most spectrally informed instrument in general use. The two conditions differed by a factor of more than one hundred in a band that no such instrument reports.

Under those conditions the authors observed differences. Resting high-frequency heart rate variability, a measure of parasympathetic cardiac activity, was higher under the lighting containing near-infrared, and remained so after adjustment for covariates. The cardiovascular response to cognitive demand was larger under that lighting for four of the five tasks administered. Ratings of pleasure differed between conditions in a manner that depended on the order of exposure. Appendix C.13 gives the estimates.

The Foundation states the rest of the result as the authors found it, because the comment is not advanced by selective reporting. Of five cognitive tasks, lighting condition predicted performance on one, visual search, and in the direction opposite to the authors' hypothesis: performance was worse under near-infrared. There was no effect on perception, short-term memory, working memory or executive function, and none on self-reported alertness. Asked which lighting they had preferred, a majority in both order groups chose the condition without near-infrared. The authors describe their findings as preliminary, and the Foundation adopts that word.

That mixed result is the point, and it is worth being plain about why. A finding that near-infrared is good for people would support a conclusion. A finding that it produces measurable physiological and affective effects, in directions that are not all the same, that depend on the order of exposure, and whose long-term consequences the investigators describe as unknown, supports something different and, for present purposes, more useful. It supports the proposition that there is a question here, that the question is answerable by experiment, and that it has not been answered. That is the condition to which § 360ii(a)(4) speaks. The Secretary is directed to study and evaluate emissions and the conditions of exposure; the Secretary is not directed to study only those emissions whose effects are already known.

The authors state the policy consequence themselves, and the Foundation quotes rather than characterizes it:

> "the move away from the natural balance of visible and near-infrared radiation found outdoors —the condition under which humans evolved—may not be optimal for well-being, even if it is better for delivering more light output for less energy."

Two further features of the study are relevant independently of what it found. The authors include researchers at the National Research Council of Canada and at Pacific Northwest National Laboratory. And the work was funded by the Department of Energy. Part IV.G.4 sets out why that matters.

A third study carries the same characteristic beyond the eye. Powner and Jeffery, publishing in the Journal of Biophotonics in 2024, randomized thirty healthy adults to a single fifteen-minute exposure of the upper back to 670-nanometer light, or to an identical sham in which the array was not switched on, and then administered a standard oral glucose tolerance test. Against the sham group, the exposed group showed a 7.3 percent reduction in total circulating glucose measured as area under the curve ($p = 0.0061$), a 27.7 percent reduction in the rise in glucose following the challenge ($p = 0.0002$), and a 12.1 percent reduction in peak glucose concentration, from 10.8 to 9.5 millimoles per liter ($p = 0.0102$). The sham group showed no change against its own baseline on any measure. Appendix C.19.

The Foundation states the inferential limit of that result before stating its use, because the limit is severe. This was a therapeutic exposure, not an ambient one: 40 milliwatts per square centimeter delivered to roughly four percent of the body surface, which is nothing like living under a lamp. The study does not show that lighting lacking long wavelengths impairs glucose regulation, and the Foundation does not advance that proposition. The subjects were healthy and not diabetic, and the authors state expressly that their results cast no light on diabetes.

What it establishes is a premise, and the premise is what Part V.B needs. Light in the long-wavelength band that light-emitting diode sources largely omit is biologically active in human beings at the systemic level, on a timescale of minutes, with effects measurable in blood chemistry rather than in reported experience. Taken with the contrast-sensitivity finding at Appendix C.1 and the cardiovascular and affective findings at Appendix C.13, the spectral content of ambient light is shown to be a physiologically consequential variable and not a matter of appearance or preference. Whether its absence from the built environment does harm is a different question, and an open one. It is open in the direction of requiring study.

The authors draw the connection to lighting themselves, in the discussion, and the Foundation quotes rather than characterizes it:

> LED lighting is fundamentally blue dominant — However, LEDs fundamentally lack longer wavelengths. They peak strongly around 450 nm, but have little content beyond 620 nm. Hence, lengthy exposure to them in the absence of sunlight may have significant long-term consequences for human health including dysregulation of blood sugars. This problem remains to be fully appreciated but is likely to be a potential public health issue.

The Foundation asks the Department to weigh that sentence as what it is. It is not a finding, and the Foundation does not present it as one. It is the judgment of investigators working in this field, published in a peer-reviewed journal, that the spectral composition of the lighting Americans now live under is likely to be a public health question that has not yet been appreciated. Paragraph 360ii(a)(3) directs the Secretary to maintain liaison with and receive information from organizations on present and future potential electronic product radiation. The word potential is in the statute. A published judgment that a problem is likely and not yet appreciated is precisely information about potential electronic product radiation, and the statute directs that it be received.

A fourth study, by substantially the same investigators, addresses the step the third one left open. The Foundation sets it out because of what it measured, and then states plainly the inference it does not support.

Jeffery, Fosbury, Barrett, Hogg, Rodriguez Carmona and Powner published in Scientific Reports in July 2025 a study in two parts. Appendix C.60. The first part is a measurement: they placed a spectrometer behind the human thorax in direct midday sunlight and recorded what came through. The transmitted spectrum peaked at approximately 800 to 875 nanometers, with very little energy below 600 nanometers, and the average transmitted irradiance at 850 nanometers was approximately 5.6 microwatts per square centimeter. They also report that layered clothing attenuated but did not block the band, describing the garments as roughly a hundred times more transparent at 850 nanometers than in the visible.

That is a direct measurement of a quantity this comment has previously had to argue for. The human body is substantially transparent in the near infrared and substantially opaque in the visible, so sunlight deposits long-wavelength radiation inside the body and does not deposit short-wavelength radiation there. Part V.C.2.h argues that the photobiological safety framework is ocular while the evidence is not; this is the transmission spectrum that makes the extraocular route physically available, measured in people rather than inferred.

The second part is an exposure experiment. Subjects received fifteen minutes of 850 nanometer light to the bare upper back at approximately 9 milliwatts per square centimeter, in a dark room, and color contrast detection thresholds were measured twenty-four hours later. Thresholds fell – that is, performance improved – by approximately 9 percent on the protan axis and 16 percent on the tritan axis. In a separate group whose heads were wrapped in foil so that the eyes were shielded, the tritan improvement persisted at approximately 7 percent and reached significance, while the protan change did not.

The head-shielded result is the one the Foundation asks the Department to weigh. A measured improvement in a visual function, produced by light delivered to the back of a person whose eyes were covered, is direct human experimental evidence that optical radiation acts on the body by a route that does not pass through the eye. Appendix C.56 reports the same proposition from receptor work in mice. This reports it from a human psychophysical outcome.

Now the limit, which the Foundation states against its own interest because the paper does not state it in these terms and a reviewer would otherwise supply it.

The two parts of this study are not joined. The transmission measurement establishes that sunlight delivers approximately 5.6 microwatts per square centimeter at 850 nanometers through the thorax. The exposure experiment demonstrated an effect at approximately 9 milliwatts per square centimeter. Those differ by a factor of roughly 1,600. The study therefore shows that the band penetrates the body at ambient levels, and separately that the band produces a measurable effect at laboratory levels, and it does not show that the irradiance sunlight actually delivers through the body is sufficient to produce the effect. The Foundation does not assert that it is.

What the four studies establish together is accordingly narrower than any one of them read alone, and the Foundation states it in the form it is prepared to defend. Light in the long-wavelength band is biologically active in human beings; it acts at least partly by a route that does not require the eye; the band penetrates the body and is present within it under natural illumination; the measured performance deficit associated with lighting that omits the band is reversible by restoring it; and light-emitting diode sources omit it almost entirely. Whether the quantity of that radiation removed from the American indoor environment is enough to matter is precisely the question nobody has answered, and it is the question § 360ii(a)(4) assigns to the Secretary.

Daylight and incandescent sources carry substantial energy beyond 700 nanometers. Phosphor-converted white LEDs carry almost none. This is not incidental to their design: efficacy is measured in lumens per watt, and radiation outside the visual response contributes nothing to the numerator. The efficiency standards described at Part IV.G selected for sources that emit as little as possible outside the visible band.

7. Temporal characteristics

Daylight does not flicker. Fire flickers irregularly, at low frequency, and with a continuously varying waveform. The modulation produced by a switching LED driver is periodic, frequently approximates a square wave, and occurs at frequencies determined by the convenience of the circuit rather than by anything in the visual system. There is no natural antecedent for a light source that extinguishes and re-illuminates hundreds or thousands of times a second.

8. Spatial characteristics

An LED emits from a small flat surface at high radiance. For a given quantity of light delivered, the source is smaller and brighter than any artificial source that preceded it and than any natural source except the solar disc itself. The aversion responses that protect the eye from looking at the sun are not reliably triggered by a source of the same radiance and far smaller angular size, which is why a person will look directly at an oncoming headlamp.

The first of those propositions can now be supported from a manufacturer’s own published figures rather than asserted, and the Foundation does so because a claim of that kind is worth more when the party with the strongest interest in understating it supplies the numbers. Appendix D.3 describes a white paper published by a component maker in February 2023 on what it calls high-luminance directional lighting. In a worked comparison it states that a single emitter of 1.2 square millimeters produces a luminous flux of 500 lumens.

Those two figures fix the luminance of the emitting surface, and the Foundation sets out the arithmetic so that it can be checked. For a Lambertian emitter the luminance is the flux divided by the product of the emitting area and pi steradians. Five hundred lumens from 1.2 square millimeters is therefore of the order of 1.3 × 10 to the eighth candelas per square meter, about 133 million. That is a lower bound rather than an estimate, because the whole object of the document is to describe emitters that radiate into a narrower angle than a Lambertian source, and a narrower emission at the same flux and area implies a higher luminance.

The comparison that matters is with the sun. The luminance of the solar disc is of the order of 1.6 × 10 to the ninth candelas per square meter. A component on a shelf, 1.2 square millimeters in area, therefore emits at a luminance within about a factor of twelve of the brightest object in the sky, and does so at an angular size thousands of times smaller. The Foundation states the limits of that comparison at once. It is a comparison of source luminance and not of retinal dose, which depends on the angular subtense as Part V.B.2 sets out. And the figure is well below the luminance at which the photobiological framework places a source in its highest risk group, which Part V.C.2 records as approximately 4 × 10 to the ninth candelas per square meter at 6,000 kelvin. Nothing here suggests that this component would be classified as hazardous under the existing scheme. The point is the one this subsection is making: the emitting surface of a light-emitting diode is in a luminance regime that no previous artificial source occupied, and the regulatory framework contains no limit on that quantity at all.

The geometry that produces the pattern, derived

The two propositions with which this subsection opens are geometric, and the geometry has been derived in closed form. Khan, publishing in the IEEE Photonics Journal in 2019 and described at Appendix C.86, obtained an analytic solution for the near-field luminous intensity distribution of a finite flat light-emitting diode and showed that it reduces to the Lambertian form used in the arithmetic above. The paper is a derivation rather than a health study and the Foundation relies on it as such. Three results from it bear on this subsection.

The first concerns directivity, and it meets an objection the Foundation encounters. The objection is that a light-emitting diode is a lamp like any other and that its apparent intensity is an artifact of the optic fitted in front of it. The author addresses the point directly: “Fig. 17 also shows the directivity of the beam generated by a finite, flat LED and such a behavior is never observed from a point radiant source that generates intensity distribution omni-directionally over the full solid

angle range spanning from 0 to 4π steradians." The beam is therefore a consequence of the shape of the emitter, present before any lens or reflector is fitted, and absent from any source that approximates a point. The author reports further that the transverse confinement is circular where the emitting surface is square and elliptical where its two dimensions differ, which is the mechanism behind the difference between the square and the round emitter recorded at Appendix D.3.

The second concerns the peak, and it is the proposition this subsection exists to establish. In the author's derivation the peak of the surface distribution scales with the product of the emitting area, the number of radiative electron-hole pairs within that area, and the luminance each pair contributes. She states the consequence in her own word: "the peak of the parabola shown in Fig. 11 would become enormous when L avg for the LED is very high due to very high inherent quantum efficiency, high light extraction efficiency form the LED chip, and driven by a large current. The peak of the parabola would also become very large when the size of the LED chip is very large." The spelling form appears in the original. The Foundation asks the Department to read that expression for what it contains: the area of the emitting surface, the number of radiative pairs within it, the luminance each contributes, and the drive current. It asks the Department to note also that not one of those four quantities is reported on a component data sheet, required by any standard this comment examines, or recoverable from the lumen rating by which the product is sold. The quantity that governs the peak is unreported, and the quantity that is reported does not constrain it.

The third is a comparison with the source the newer product replaced, and it is the cleanest statement of this subsection's thesis the Foundation has found in the technical literature. The author photographed a G12 corn lamp carrying seventy surface-mount modules, operating at 10 watts and producing 1,080 lumens, and observed the characteristic pattern from each flat face. She then states: "such patterns are never observed for fluorescent G12 lamp counterparts because their emitting surfaces are not flat." A lamp of the same fitting and comparable output does not produce the pattern. The difference is attributed to a single property of the newer source, which is that the surface it emits from is flat. That is the whole of the distinction this subsection draws, stated in a photonics journal and tested against a measured lamp.

The Foundation states the limit of all three results. The paper verified the angular shape of the distribution against measured data. It did not verify the magnitudes, and the author says so expressly, recording that the measured magnitudes are not tied to the analytic solution and that the dependence of the peak on emitter size remains to be measured. Nothing above establishes the luminance of any product. What it establishes is why the luminance of this class of product is high, what it varies with, and that none of what it varies with is presently reported.

The reported number, and what it does not determine

The derivation above concerns a flat emitting surface. A manufacturer of these components has published an account of its own chip architectures that confirms the derivation for one of them, limits it for the other, and then states what the number on the data sheet is worth. The Foundation takes all three, including the limitation, because a limitation the Foundation states itself cannot later be put to it. The document is described at Appendix D.3.

The confirmation first. Of the two ways these chips are built, the surface emitter carries a reflector beneath the light-emitting layer, and the manufacturer describes the result in the terms of the derivation above: "The result is what is known as a surface emitter that emits light only in the front half-space of the LED with a lambertian emission curve. The maximum possible emission angle here is 90 degrees." The distribution Khan derives from the geometry of a flat emitter is therefore also the distribution this manufacturer designs for, and says it achieves.

The limitation next. The other architecture is the volume emitter, in which light leaves the chip in all directions and the phosphor must surround it rather than lie as a thin layer across its face. With chip heights of 100 to 150 micrometers, the manufacturer reports, "emission surfaces of 200

μm and more are easily generated, emitting white light over a wide range of angles," with the consequence of "significant intensity at angles greater than 90 degrees." That is not a flat emitting surface and it does not produce a Lambertian distribution. The Foundation therefore confines the derivation at Appendix C.86, and the propositions it supports in this subsection, to devices that emit from a flat surface, and records that a substantial part of this product class does not.

Then the reported number. The quantity a data sheet gives for the spatial distribution of emission is the half width, defined as the angle at which luminous intensity has fallen to half its maximum. The manufacturer states what that figure is and is not, and the Foundation quotes the sentence in full because it comes from the party that prints the figure: "This information is not sufficient, however, as the basis for selecting an LED because the half width specifies only a single point along the LED emission curve, and the luminous intensity distribution is not an accurate measure of the brightness of the LED in a luminaire."

The article then demonstrates it twice. Of two devices both specified at a half width of 120 degrees, one Lambertian and one not, "Both curves are almost identical at low angles but at more than 60° there are significant differences – despite the same value for the half width"; the non-Lambertian device emits about ten percent of its output beyond 90 degrees and delivers about ten percent less cumulative flux within a 60-degree cone. And of a named product in the manufacturer's own range, the Oslon Square: "the half width corresponds to that of many LEDs and is 120°. Within the half width the luminous intensity is greater than that of a lambertian emitter, and smaller outside the half width."

The Foundation asks the Department to read the second of those together with the first. Products sharing a reported half width differ in where their light goes. Where they differ, the device engineered to concentrate its output delivers more intensity on axis than the shared figure implies, and the manufacturer presents that as the product's advantage. So the single number that is reported does not determine the distribution, and for the devices designed for concentration it errs in the direction of understating what arrives on axis. That is the same failure as the one recorded at Part VI for two indicator components of identical size differing by about fifty times in the solid angle into which they emit, and it is the reporting counterpart of the quantity problem set out at Part V.B.2.

The same emission described from the application side, and where the point-source assumption fails

The propositions above are drawn from a derivation and from a component manufacturer. They are also stated, in nearly the same terms, by optical engineers designing luminaires for the roadway. Babadi and others, publishing in the IEEE Photonics Journal in 2017 and described at Appendix C.88, explain why a street lighting luminaire requires a lens or reflector at all: "In spite of the advantages of LEDs, it is impractical in many cases to use them in street light luminaires directly without a suitable secondary optic due to their lambertian radiation pattern. Normally, the LED produces high light intensity at the centre and low light intensity at the edge of its circular illumination footprint." The spelling is the authors'. The distribution is Lambertian and the intensity is concentrated at the center, which is what the derivation predicts and what the manufacturer says it designs for.

The same authors state where the approximation that underlies most optical design fails. Their method assumes a point source, and they record the condition on that assumption: "Using an extended light source reduces uniformity on the target plane. To keep uniformity the size of the light source and the optic have to be taken into account. An extended light source acts as an approximate point light source when the size of the optic is five times larger than the light source."

The Foundation now has three statements of that threshold from three sources, and sets them beside one another because the agreement is the point. The derivation at Appendix C.86 establishes that Lambert's law holds exactly only for an infinitesimal emitter and that a finite one must be treated as finite. The metrology reference work at Appendix D.5 gives a photometric

distance of five to fifteen times the extent of the source, below which a measurement does not record luminous intensity as defined. And these authors give five times the source size as the condition on the optic. The three are expressed in different terms, two about measurement distance and one about optic size, and the Foundation does not treat them as the same quantity. What they share is that each identifies a regime in which these emitters cannot be treated as points, and each places the products at issue inside it.

The authoritative treatment, which corrects the threshold above and supplies the mechanism

The three statements set out above are each from a source addressing something else. The question has a literature of its own, and the standard reference in it is described at Appendix C.89: Moreno and Sun, publishing in Optics Express in 2008 and cited several hundred times since. They open on the difficulty itself, writing that "LEDs are far more difficult to model than the conventional sources", which is worsened because "there is a wide variety of LED radiation patterns." Three things in that paper bear on this subsection and the first of them corrects it.

The correction concerns the threshold. The rule that a source may be treated as a point beyond about five times its largest dimension is a general rule of radiometry, and these authors state that it does not carry over to this technology: "this rule of thumb is not so easily applied to LEDs because of the radiance complexity and wave effects." A separate regime, which they call the mid field, had to be defined for these sources. And they give the measured consequence: "Using the radiometric definition, a high-power LED with a 1mm2 chip should have a 5-mm near field, but in practice up to 20-mm mid fields are found." Their own laboratory places the onset of the stable far-field pattern at about 20 millimeters from the tip for some power devices, and longer for multi-chip ones. So for this technology the distance within which the device cannot be treated as a point is up to four times what the general rule predicts. The factor of four is the Foundation's arithmetic on the authors' two figures.

The Foundation states what that does and does not do to the paragraph above. It does not make the three thresholds agree, and they remain three different quantities: the smallest retinal image the eye can form, the distance at which a measurement records intensity as defined, and the distance at which the normalized angular pattern stops changing. This is a fourth, and it is the last of those three. What it establishes is that the general rule from which two of the others are drawn was examined for this technology by the specialists in it and found to under-predict. Every threshold in this subsection should therefore be read as a lower bound.

The second matter is the mechanism, and it settles a question this subsection left open. The Lambertian form belongs to the emitting region and not to the product: "From the radiometric point of view, the emitting region is a Lambertian light source", and the pattern of each chip face will "generally be Lambertian" subject to microstructures and waveguide effects within the chip. The pattern of the finished device is then that pattern as modified by the reflecting cup and the encapsulating lens, and the authors give the direction of the modification: "In most cases, the lens angularly narrows the radiation pattern (due to the chip and the mirror), though sometimes it enlarges the pattern." That is the explanation the Foundation preferred, over coherence, for the measured departures recorded above, and it is now attributable rather than inferred. The literature calls a distribution of that kind an imperfect Lambertian.

The third matter is the one the Foundation asks the Department to weigh most heavily, because it is a recommendation rather than a finding and because of its date. Having set out that manufacturers characterize the angular distribution by the half angle, and having noted the one further published attribute, the authors write this.

> "However, additional parameters are needed to render the shape of the radiation pattern. Therefore, we propose that the manufacturer should include a simple formula (like those reported here) with its coefficients in their technical data sheets."

That is the request this comment makes at Part IX.F, published in a peer-reviewed optics journal in 2008 by the authors of the standard treatment of the subject, and addressed to the manufacturers directly. The Foundation does not assert that nothing has changed since. What it states now is narrower. The proposition that the published half angle is insufficient to describe what a light-emitting diode emits is not the Foundation's contention. It is the settled view of the specialist literature, it has been in print for eighteen years, it was accompanied by a concrete and simple remedy, and the data sheets of the products described at Part VI still report the half angle.

Three incidental findings in the same paper bear on how much weight any published distribution will carry, and the Foundation records them here because they qualify its own use of manufacturer data throughout this Part. Of the single device in their set best described as Lambertian, the authors report that a simple cosine fit carries a 5.1 percent root mean square error, which exceeds the five percent threshold they set themselves. Several manufacturers publish not a curve but an envelope, an upper and a lower bound, and the authors attribute the spread to "manufacturing errors related to the emission, reflection and transmission of the optical flux." And to fit one manufacturer's published data the authors had to rotate the whole distribution by 2.55 degrees, which they attribute to "a misalignment of the optical axis of the LEDs tested by the manufacturer." A published angular distribution is accordingly a nominal figure for a population of parts, not a property of the part in hand.

What the distribution is when it is measured, rather than derived or designed

The derivation at Appendix C.86 gives a Lambertian for a finite flat emitter. The manufacturer at Appendix D.3 states that its surface-emitting architecture is built to produce one and that its volume-emitting architecture does not. Neither is a measurement of a finished device, and the Foundation now sets out what two national metrology institutes found when they measured four of them.

The work is described at Appendix D.6. The Institute of Optics of the Spanish National Research Council built a goniophotometer for the purpose and measured four light-emitting diode transfer standards of 7 millimeter package diameter, one red, one green, one blue and one white, at the reference distance of the averaged-intensity geometry, with a stated relative uncertainty of 0.2 percent. The same four devices were measured at the Physikalisch-Technische Bundesanstalt, the German federal metrology institute, on a comparable instrument. Each measured distribution was then fitted to a cosine raised to a power, the exponent being unity for a true Lambertian emitter.

Not one of the four devices is Lambertian, and the two institutes agree closely about how far each departs.

LED transfer standard	g, CSIC	g, PTB	Anisotropy, CSIC	Anisotropy, PTB
F107, blue	3.64	3.54	0.052	0.047
F108, red	1.38	1.31	0.069	0.065
F126, green	1.86	1.76	0.016	0.015
F132, polar white	1.62	1.62	0.014	0.015
A Lambertian emitter	1	1	not applicable	not applicable

Two things follow and the Foundation separates them. The first is a qualification of its own argument. The Lambertian form is the correct description of a bare flat emitter, as the derivation shows and as a manufacturer confirms for one chip architecture, and it is the form in which a component manufacturer presented the figures from which this subsection computes a peak luminance. It is not the measured form of a packaged device with an integral lens, which is what reaches a product. The Foundation accordingly confines the Lambertian relation to the bare emitter and does not represent it as describing a finished lamp.

The second is the direction of the error, and it runs against the products rather than against this comment. An exponent above unity describes a narrower distribution than Lambertian, which is to say output concentrated more tightly about the axis. For a given total luminous flux the on-axis intensity of such a source exceeds that of a Lambertian source by a factor of one plus the exponent, divided by two: on the measured values that is 1.19 for the red device, 1.31 for the white, 1.43 for the green and 2.32 for the blue. The integration is the Foundation's and is not stated by the authors. Where this comment assumes a Lambertian distribution in order to compute a peak, as it does above, the assumption is therefore conservative, and for a device of this kind the true on-axis figure is higher than the figure stated.

The Foundation states what it does not take from this, because the available inference is tempting and the sample will not support it. Four devices from one supplier, chosen for metrological stability rather than for representativeness, do not establish that blue emitters are generally more concentrated than red ones. What they establish is narrower and sufficient: that the angular distribution of a real device is a measured property which varies from device to device, that it is not recoverable from the Lambertian assumption, and that two national metrology institutes had to build instruments and compare them against one another to determine it at all. The authors state the reason the work was necessary, and it is the proposition this Part advances: "New methods of measurement are required, because these sources have different emission characteristics than traditional lighting sources."

What the measurement community reports instead, and the reason it gave for reporting it

Everything above concerns what a light-emitting diode emits. The remaining question is what is reported about it, and for that the Foundation turns to the people whose profession is measurement. The document described at Appendix D.6 is a lecture given in April 2002 at the Institute for National Measurement Standards of the National Research Council of Canada, which is the national metrology institute of that country. The Foundation states its form plainly: it is teaching material from a measurement course, not a research paper, and it is relied on for what a metrologist told a room of practitioners about the limits of their instruments. Four things in it bear on this subsection, and the fourth is a concession the Foundation did not expect to find.

The first is the point of principle, and it is stated of this technology by name. Having introduced the point source as the diagram by which intensity is defined, the author writes that "point sources have several inherent implicit properties which can mislead us when we apply our ideas of intensity to other sources such as LEDs which do not possess these properties." The lecture then names the properties. The intensity of a point source is the same in all directions; it is the same at all distances; and, third, "it means that the intensity measurements we make do not depend on the particular size (or shape) of the input aperture of our detector." For a source that is not a point, each of the three fails, and the Foundation draws attention to the third because it is the one least often noticed. Where it fails, the reported figure is a property of the instrument as much as of the device.

The second is what the lecture says these devices actually look like, and it is more useful to this comment than the Lambertian description would have been. Of real parts the author writes that "the intensity is quite nonuniform in the angular variation, and is often not even symmetric with respect to any angle in this planar view." The cause is given as the package: "The problem can be worse for LEDs since the packaging introduces many components which act as reflectors and concentrators of the light which is emitted from the small source itself." That is the mechanism described at the preceding heading, stated at a national metrology institute six years before it was modeled. The Foundation also records what this lecture does not say, since the question is live in this subsection. The author introduces the Lambertian source as a second idealization alongside the point source, each with its own equation, and then applies neither of them to a light-emitting diode. A lecture devoted to measuring these devices declines to classify them as either.

The third is that the measurement is forced into the regime where the quantity is still changing. "The small size and low output of typical LEDs demands that we place our detectors at small distances from the LED. This will aggravate most of the problems indicated above." And the reason the proximity matters: "These considerations show that even at constant solid angle Ω the intensity output of extended sources will change with distance from the source." So the practitioner must measure close, and close is where the number depends on how close.

The fourth is the concession, and the Foundation quotes it in full because the whole of it matters.

> "If all these conditions can be specified exactly, it is possible to present an accurate representation of the intensity (distribution) of the LED. However, this is too demanding of experimental accuracy, and too much of a burden for efficient comparison of LEDs during the manufacturing process, or comparison of LEDs between manufacturers, or selection of LEDs for any specific purpose."

An accurate representation of the distribution was achievable. It was set aside as too demanding and too burdensome, and the lecture names the three purposes for which it was too burdensome: comparison during manufacture, comparison between manufacturers, and selection of a part for an application. The Foundation makes a narrow point about that list. Not one of the three is the protection of health, and there is no reason it should have been, because the people making the trade-off were designing a tool for industry and said so. The Foundation does not contend that the judgment was wrong for the purposes stated. It contends that a quantity selected for ease of commercial comparison, by a committee that was not asked about exposure, is the quantity on which the emission of these products is now reported, and that the Department should know on what basis it was chosen before relying on it.

What was adopted instead is named for what it is. Because an intensity measurement of such a source is, in the author's words, "an average which is dependant on the measurement configuration used", the quantity is called the Averaged LED Intensity, and the configuration is fixed by definition rather than derived. The reference point is the front tip of the device and the reference axis is its mechanical axis. The detector aperture is a circular area of 100 square millimeters. Condition A places that aperture 316 millimeters from the tip, giving a solid angle of 0.001 steradian; condition B places it at 100 millimeters, giving 0.01 steradian. Two conditions means that one device has two values of the quantity, each correct under its own condition, and the subscript carries which. The Foundation asks the Department to notice that the standard's own name for the figure concedes the point this subsection has been establishing: what is reported is an average over a stipulated geometry, not the intensity of the source.

One further fact about that quantity bears on how this comment is read. In April 2002 it did not yet exist as a standard. The lecture states that the Commission "is working on a standard which proposes (it is not yet accepted) two defined geometrical configurations for measuring the luminous intensity of LEDs", and the figure in which the two conditions appear is captioned as proposed. Three technical committees are named as then at work: one revising the governing report, one preparing a joint standard on intensity measurement, and one on the optical properties of clusters and arrays. What became of each is a question of fact the Foundation has not yet answered. The Foundation notes only that the measurement convention on which reported intensity now rests was, a quarter century ago, an acknowledged compromise still awaiting acceptance.

9. The progression of artificial sources, stated accurately

The Foundation does not contend that LEDs are the first artificial source to depart from natural spectra. Gas and incandescent lighting were blackbody sources, rich in long wavelengths and close in character to fire. Fluorescent lighting introduced a discontinuous line spectrum, very little infrared, and periodic modulation at twice the supply frequency. LED lighting carries each of those departures further: a narrower and more pronounced short-wavelength peak, still less long-

wavelength content, higher source radiance in a smaller emitter, and modulation that is periodic, square in waveform, and at frequencies with no precedent.

10. What follows from this, and what does not

The Foundation does not argue that a natural stimulus is for that reason safe or that an artificial one is for that reason harmful. The argument is narrower and is about knowledge rather than about virtue. The response characteristics of the visual, circadian and nervous systems were shaped by the stimuli under which those systems developed. Where a stimulus falls outside that range in spectrum, in geometry, and in temporal structure at once, evolutionary history supplies no basis for predicting the response, and the response must therefore be determined empirically.

It has not been. That is the gap this comment identifies, and it is the gap 21 U.S.C. § 360ii(a)(4) directs the Secretary to close by studying and evaluating emissions of, and conditions of exposure to, electronic product radiation.

C. Optical Radiation and the Human Eye

1. Retinal phototoxicity and photochemical injury

This subsection concerns acute photochemical injury to the retina: what it is, how it is recognized, and what is known to cause it. It is distinct from the chronic and cumulative questions at subsection 2, and the Foundation keeps them apart because conflating them is the fastest way to lose both.

a. The injury, and how it is recognized

Photochemical retinal injury is damage produced by the absorption of light rather than by heating. The energy is absorbed preferentially by the pigment of the retinal pigment epithelium, the damage extends to the outer segments of the photoreceptors, and the clinical signature is a disruption of the outer retinal layers visible on optical coherence tomography, accompanied by reduced visual acuity and by a scotoma at the point of fixation.

The classically recognized causes are three: staring at the sun, which produces solar maculopathy and is the reason eclipse viewing requires filters; viewing a welding arc without protection, which produces the same picture; and laser exposure. The Foundation sets those out because they are the comparison class, and because each of them is the subject of a regulatory instrument.

The injury described above is the gross end of a range. Below it sits a cell-biological literature which characterizes the pathways by which short-wavelength light damages photoreceptors, and the Foundation introduces it here because one feature of that literature bears on the question this comment puts, while its findings do not.

One such pathway is stress of the endoplasmic reticulum, the organelle in which proteins are folded. Blue light is reported to cause the aggregation of short-wavelength opsin, a photoreceptor protein; misfolded protein accumulates; the cell mounts the unfolded protein response; and if that response fails to restore function, it terminates in programmed cell death. Appendix C.65 sets out a study tracing that sequence in a photoreceptor cell line under blue light-emitting diode illumination at 470 nanometers.

The Foundation notes a convergence rather than a conclusion. Appendix C.61 reports blue light at 447 nanometers damaging proteins inside their own structure by an entirely different route, worked out by different methods in a different field. Two literatures that do not cite each other arrive at protein integrity as the thing short-wavelength light disturbs. The Foundation has no basis for saying the two mechanisms are related and does not say so.

The feature of this literature that bears on the statutory question is not any of its findings. It is the role blue light-emitting diode illumination plays within it. In this branch of research, blue diode light is the standard insult: it is the means by which photoreceptor damage is reliably produced in

order that candidate protective compounds can be tested against it. The study at Appendix C.65 is an instance. Its subject is a plant extract. The blue diode exposure is the assay.

The Foundation draws from that the narrowest inference it can. Among researchers who use it as a tool, the capacity of blue light-emitting diode illumination to damage photoreceptor cells at laboratory doses is not in dispute; it is relied upon. That is not evidence that the products described at Part VI damage anyone's retina, and this comment does not offer it as such: the laboratory doses are prolonged and continuous in a way no eye experiences, and a cell line in a dish lacks the pigment epithelium, the circulation and the repair machinery of a retina. It is evidence about what is taken as settled by the people who work on it, and about where the open question actually lies, which is not whether this radiation can damage retinal cells but at what exposure it begins to. Paragraph 360ii(a)(4) directs the Secretary to study and evaluate emissions and conditions of exposure, and that is the form the unanswered question takes.

b. A documented human injury from a consumer light-emitting diode device

In July 2023 ophthalmologists at the West China Hospital of Sichuan University published in Heliyon what they describe as the first case report of human retinal damage from a handheld light-emitting diode lighting device. Appendix C.64.

The patient was a thirteen-year-old girl. A classmate directed a handheld light-emitting diode light at her right eye several times, at very short distance, in flash mode. The device was bought online. It was a product for outdoor lighting, built from thirty chip-on-board emitters rated together at 5 watts and 100 lumens per watt at 500 milliamperes.

Three days after the exposure her best corrected visual acuity in the affected eye was 6/20. Optical coherence tomography showed a hyperreflective area in the external retinal layers corresponding to disruption of the ellipsoid zone and of the photoreceptor outer segments. She was treated at five days with a single retrobulbar injection of triamcinolone acetonide. Acuity recovered to 16/20 at nineteen days and to 20/20 at thirty-three days, and the restoration of the outer retinal layers was documented by imaging through three months.

c. What the Foundation does not draw from it, stated before what it does

The authors of that report make a statement that forecloses the broadest use of their own case, and the Foundation adopts it rather than working around it. They write that no evidence of direct adverse health effects from light-emitting diodes has been found in conditions of normal use, and that it is misuse which may cause damage to the eye, particularly in children.

The Foundation therefore does not offer this case as evidence that ordinary light-emitting diode illumination injures the retina. It does not, on this record. Nor is a single case report evidence of risk at the population level; Part V.A sets out how this comment weights evidence, and a case report sits at the bottom of that ordering. What a case report establishes is that a thing happened once, in a documented way, to an identified person.

d. What it does establish, which is a fact about the regulatory system

The authors observe that the imaging findings in their patient were particularly similar to those seen in solar maculopathy, in welding arc maculopathy, and in maculopathy following exposure to the plasma flash of a femtosecond laser, and they suggest that these may share the same phototoxic cause.

The Foundation asks the Department to set that observation beside the contents of its own regulations.

Laser products are the subject of a performance standard at 21 C.F.R. § 1040.10, with a classification scheme, accessible emission limits, labeling requirements and reporting obligations, and specific purpose laser products are further addressed at § 1040.11, which for some applications restricts which classes may lawfully be used at all. Part V.C.2.k.

Sunlamp products are the subject of a performance standard at § 1040.20, which limits irradiance, limits the ratio of irradiance between two ultraviolet bands, and prescribes labeling, timers and a recommended exposure schedule. Part II.C.2.

Exposure to welding arcs is addressed in the occupational setting through eye protection requirements administered by another department. Part II.H.10.

A handheld lighting device assembling thirty emitters at five watts, purchasable online by a schoolchild, is the subject of no performance standard within this Department's authority. It has no classification, no emission limit, no mandatory labeling as to optical hazard, and no reporting obligation. Part II.C.

The Foundation does not contend that a handheld lamp and a laser present hazards of the same magnitude, and it does not ask the Department to treat them alike. The contention is narrower and is about the structure rather than the severity. Where an injury of the same clinical description is produced by four different sources, the agency reaches three of them and not the fourth, and it does so not because it determined that the fourth is safe but because of where the definitional boundary described at Part II.C happens to fall. The Final Response of May 24, 2024 states that light-emitting diode products have a long history of safety with respect to the visible wavelengths being emitted. A documented macular injury in a child from a marketed diode product does not refute a history of safety, and the Foundation does not say it does. It does establish that the question of what such products may emit has an answer in at least one direction, and that no federal instrument asks it.

e. The aversion response, in the circumstances of an actual injury

One feature of the case bears directly on the assumption examined at Part V.C.2.k. The protective premise of the moderate risk group in the photobiological framework is that a person will look away from a bright source within a quarter of a second. In this case the light was directed at the patient's eye by another person, without warning, repeatedly, and in flash mode.

Those are precisely the conditions in which an aversion response cannot operate as the framework assumes. A person cannot avert from a source before it appears, and a source that re-presents returns to the retina each time the eye returns to it. The Foundation does not assert that this device would have fallen into any particular risk group, because no one classified it and the voluntary system described at Part V.C.2.k would not have required anyone to. The point is about the assumption rather than about this product.

f. The person injured was a child

The patient was thirteen years old and the device was bought online by another child. Part V.C.2.g sets out the measured age dependence of ocular transmission: the retina of a child under nine receives about 65 percent of incident light at 460 to 480 nanometers against about 40 percent in an adult aged 60 to 70. Part VI.E describes the settings in which children are exposed to lighting they did not choose, and Part IX.L asks that populations differently exposed to an identical emission be addressed expressly. The Foundation notes that the one documented human case it has located of retinal injury from a consumer diode product involved a child, and asks that the coincidence be treated as a reason for inquiry rather than as evidence of anything.

g. The endpoint is a lesion in one tissue, and the retina contains others

The structure the weighting function describes

The blue-light weighting function B(λ) discussed in Part V.C.2.a is an action spectrum. An action spectrum is not a general statement about what light does to an eye. It is a measured statement about the relative efficiency of each wavelength at producing one particular effect, in one particular tissue, assessed by one particular endpoint. The effect B(λ) describes is photochemical lesion formation in the outer retina – the retinal pigment epithelium and the photoreceptors – and the endpoint by which that lesion was recognized in the threshold experiments that generated

the function was a visible or histologically detectable lesion at or above threshold. Part V.C.2.f sets out the dose figures and the regulatory margin drawn from them.

Two consequences follow, and neither is controversial as a matter of photobiology. First, the function carries no information about wavelengths that do not produce that lesion; Part V.B.6 and Appendix C.63 address the red end on exactly that ground. Second, and the subject of this subsection, the function carries no information about other tissues, other molecular targets, or other endpoints – including other tissues inside the same retina.

A study of a different retinal tissue

Appendix C.66 records a 2023 study from Taipei Medical University that examined the retinal vascular endothelium rather than the photoreceptors or the pigment epithelium. The inner retina is supplied by capillary beds whose endothelial cells are sealed to one another by tight junctions, and that seal is the inner blood-retinal barrier. The barrier is what keeps fluid and solutes out of the retinal layers; its failure is the mechanism of macular edema and of the retinal leakage seen in diabetic eye disease.

The study reports that blue light exposure reduced claudin-5, the endothelial tight junction protein, to roughly half of control levels in a murine endothelial line and roughly two thirds in primary human retinal microvascular endothelial cells, after six hours; that electron microscopy showed the junctions replaced by a gap; that the loss was produced by activation of a metalloprotease, ADAM17, which cleaves the junction protein; that blocking that protease pharmacologically or genetically prevented the loss; that in the resting state the protease is held inactive by a retina-enriched inhibitory G protein, GNAZ, from which blue light releases it; and that removing that G protein reproduced the damage without any light at all. In mice, a regimen of six hours per day for three consecutive days produced angiographic leakage together with attenuation of the electroretinogram b-wave and of the oscillatory potentials – that is, a measured change in the electrical response of the inner retina, not only a change in a protein.

What the Foundation draws from it, and what it does not

The Foundation does not cite this study for any proposition about dose. That restraint is deliberate and the reason is recorded in full at Appendix C.66. The study reports its exposures in lux and does not report irradiance or the peak wavelength of the diodes it used. Lux is a photometrically weighted unit, weighted by a function that is small in the blue, so a stated illuminance of near-monochromatic blue light corresponds to a radiometric exposure one to two orders of magnitude greater than the same stated illuminance of white light. The study's own comparison of its chamber to a display screen at reading distance is therefore a comparison of illuminance and not of blue-light dose, and the comment does not repeat it. Nor does the comment adopt the study's opening assertion of a rising incidence of retinopathy from consumer devices.

What the Foundation draws from it is narrower and does not depend on the exposure level. Blue light acting on the retina has at least one route of action that runs through vascular endothelium, proteolytic cleavage of a junction protein, and the integrity of a barrier – a route whose target tissue, molecular mechanism, and functional endpoint are all different from those of the photochemical lesion that $B(\lambda)$ was measured to describe. The study also establishes that this route is wavelength-dependent and not merely energy-dependent: red light at the same facility left both the junction protein and the activation state of the protease unchanged. So there is an action spectrum for this effect. Nothing in the record establishes that it is the same action spectrum as $B(\lambda)$, and no one has measured it.

Why this matters to a limit

A numerical limit is only protective against the mechanism whose threshold it was derived from. A limit calibrated to outer-retinal photochemical lesion thresholds in primates is a statement about

outer-retinal photochemical lesions. It is not, and was never measured to be, a statement about the concentration of a tight junction protein in the inner retinal vasculature, about the activation state of a metalloprotease, or about the amplitude of the oscillatory potentials. Whether the lesion limit happens also to be protective against these other routes is an empirical question that has not been asked.

This is the same structural point the comment makes in Part V.C.2.h about effects outside the eye, applied one level in: the framework does not merely stop at the boundary of the eye, it stops at the boundary of one retinal tissue and one injury mode. The Foundation accordingly asks that any framework the Department or the Food and Drug Administration adopts state on its face which tissue, which endpoint, and which action spectrum its numerical limits rest on, and that a limit derived from outer-retinal photochemical lesion thresholds not be represented, in agency guidance or in reliance on a recognized consensus standard, as establishing that an exposure is without effect on the retina.

h. The most adverse review of the human evidence, and why the Foundation cites it

The Foundation states the following at the outset of this subsection, because a comment that conceals adverse authority forfeits the credibility of everything else in it. The most directly adverse peer-reviewed document in this comment's record is Appendix C.67, a 2023 review of the human clinical literature on blue light and the retina. Its concluding assessment is this:

> "We find it difficult to express with certainty that blue light exerts a harmful effect at the level of the human retina".

The Foundation does not dispute that assessment, does not characterize it as an outlier, and does not ask the Department to set it aside. It is the considered conclusion of three authors at a university department of physiology and ophthalmology, reached after a search of five databases restricted to human clinical studies and trials, and the Foundation treats it as the current state of the human clinical literature.

Why that conclusion does not answer this comment

The proposition the review declines to affirm is not the proposition on which this comment rests. This comment does not assert that light-emitting diode products in ordinary use have been demonstrated to injure the human retina. Part V.A.2 states the evidentiary standard the Foundation holds itself to, and Part V.C.2.e states what the Foundation asserts and what it does not. The assertion is that a class of electronic products emitting optical radiation is in universal use, that the Secretary's duties under 21 U.S.C. § 360ii apply to it, and that no performance standard, no exposure limit, and no systematic program of research or testing has been established for it. Whether harm has been demonstrated is a different question from whether the statutory duties have been discharged.

And the reasons the review gives for its uncertainty are, when read, a description of an inadequate research record rather than a description of an established absence of effect. The review states that many findings are "theoretical or based on observations in cell culture or animal experiments"; that the small number of participants makes generalization difficult; that few studies have adequate follow-up; and that research groups have defined the mesopic condition inconsistently, "ranging from 0.1 lx to 50 lx", with wavelength and stimulus duration likewise varying between studies. A literature that cannot answer a question because its exposures are not standardized, its samples are small, and its follow-up is short is a literature that has not been required to answer it.

The review does not stop at uncertainty. The same concluding passage states that as more groups study the subject with designs resembling contemporary conditions, results are beginning to converge, and that they "all point towards the possible noxious effect of long-term blue light exposure". The Foundation quotes both halves of that conclusion and relies on neither beyond its terms.

What the review supplies that the Foundation does rely on

Three things. First, the methodological findings just quoted, which are direct evidence on the research-needs question and are used at Part V.K and in the Foundation's response to that question: the absence of a standardized exposure specification is itself the reason the literature cannot be synthesized, and that is a condition a federal standard would remedy. Second, the review's own Future Directions section, which is a research agenda written by clinicians in the field and recommends objective electrophysiological and imaging endpoints in place of the questionnaires that dominate the existing studies.

Third, and most consequential, the review reports a human study the Foundation had not previously identified. It describes work by Gagné and colleagues as the first to show that short exposures to blue light can affect both cone and rod electroretinogram responses – in the review's characterization, even where the exposure fell within the standard safety range – with the b-wave reduction present under both scotopic and photopic conditions and still measurable an hour after the exposure ended, and with that study's authors treating the reduction as temporary and declining to draw a conclusion about hazard. If that report withstands direct examination, it is a measured change in human retinal electrophysiology at an exposure within the range the present framework treats as acceptable, and it bears directly on Part V.C.2.f. The Foundation states it here at second hand, attributed to the review, and draws no conclusion from it pending reading of the underlying paper.

2. Blue-light hazard assessment — IEC 62471 and ANSI/IES RP-27

The vocabulary in which optical radiation injury is assessed is the vocabulary of hazard, and it carries with it a quantitative structure that this comment relies on. The structure is worth setting out before the literature is reviewed, because it determines what the published compliance statements about LED products actually mean.

a. The recognized hazards, and the weighting function

IEC 62471, Photobiological safety of lamps and lamp systems, published jointly as CIE S 009, assesses a lamp against several distinct optical radiation hazards: the actinic ultraviolet hazard to skin and eye, the near-ultraviolet hazard to the eye, the blue light hazard to the retina, the retinal thermal hazard, the infrared hazard to the eye, and the thermal hazard to skin. The corresponding American document is the ANSI/IES RP-27 series. The ICNIRP guidelines on limits of exposure to incoherent visible and infrared radiation are the underlying source for the limit values.

The blue light hazard is the one principally at issue. It is a photochemical injury to the retina, distinct in mechanism from thermal injury, and it is assessed not on raw emitted power but on radiance weighted by a hazard function, written $B(\lambda)$, which expresses the relative effectiveness of each wavelength in producing the injury. The function peaks in the short-wavelength region of the visible band, at 445 nanometers on the guidelines of the International Commission on Non-Ionizing Radiation Protection of 2013, and falls away steeply to either side.

b. The exposure metric is a dose

This is the point the Foundation asks the Department to carry forward into the rest of this comment. The quantity the standard limits is not a radiance. It is a radiance accumulated over time. The blue light hazard dose is the weighted radiance multiplied by the duration of exposure, and it is expressed in joules per square meter per steradian. The limit is:

$$D = L \cdot t, \text{ not to exceed } 10^6 \text{ J/(m}^2\cdot\text{sr)}$$

where L is the blue light hazard weighted radiance in watts per square meter per steradian and t is the exposure time in seconds. Dose and duration are therefore not concepts imported into this subject from chemical toxicology. They are the native terms of the field, and they appear in the governing international standard in exactly that form.

The Foundation makes the point because the vocabulary has caused confusion. Optical radiation is not a chemical agent, and the vocabulary of chemical injury does not belong to it. But the two properties that make chemical exposure a regulated subject — that effect depends on how much is delivered, and that delivery accumulates with time — are both expressly built into the way optical radiation exposure is measured. Nothing about electromagnetic radiation places it outside a dose-and-duration framework. The framework is already there.

c. Where the framework stops: ten thousand seconds

The limit has a structure that is not always noticed, and the arithmetic of it is the most important technical fact in this subsection.

A source whose weighted radiance is 100 watts per square meter per steradian reaches the dose limit of 10^6 joules per square meter per steradian in exactly 10,000 seconds. Below that radiance a source cannot reach the dose limit within 10,000 seconds at all. Above 10,000 seconds the standard ceases to integrate, and the criterion becomes a limit on radiance itself rather than on accumulated dose.

Ten thousand seconds is two hours and forty-six minutes.

The exposure limit is accordingly constructed around a single viewing episode of at most that length. It is not a limit on what a person accumulates across an eight-hour shift beneath the luminaires described at Part VI.F; across a night spent in a bedroom reached by a roadway luminaire; across a career of driving at night facing oncoming headlamps; or across a lifetime. For exposures of that kind the standard supplies no accumulated quantity, because beyond its breakpoint it stops accumulating.

The Foundation is not criticizing the standard for failing to do what it never undertook to do. IEC 62471 is addressed to acute exposure and says so. The criticism is of the use that is made of it. A product described as compliant with IEC 62471, or classified in the Exempt Group or Risk Group 1, has been assessed against an acute limit evaluated over a single episode. That classification is frequently reported, and read, as though it answered the question whether long-term exposure to the product is safe. It does not answer that question. It does not address it.

The same limitation, stated in 2014 by the author of the 2024 review

The Foundation has set out that argument from the arithmetic of the standard. It is able to set it out a second way, which carries more weight, because the proposition is stated as a limitation of the framework by the author who later led the intergovernmental review described at subsection f.

Christophe Martinsons of the Centre Scientifique et Technique du Bâtiment published in 2015, in the Springer Handbook of Advanced Lighting Technology, a chapter titled Photobiological Safety. Appendix D.5. Its section 4.6 is headed Limitations of the CIE/IEC blue light hazard assessment and is divided into three subsections: Potential effects of low-level chronic exposures, Potential effects of long-term exposures, and Sensitive populations. Those are the three propositions this comment advances. They appear as section headings in a reference work written by a specialist in the field, eleven years before this comment and ten years before the Final Response of May 24, 2024.

On chronic exposure the chapter states:

> "The maximum exposure limits defined by the ICNIRP and used to define the risk groups in IEC 62471 are not appropriate for repeated exposures to blue light as they were calculated for a maximum exposure of one eight hour day."

That sentence supplies something the Foundation's own arithmetic did not. Above the ten-thousand-second breakpoint the criterion becomes a limit on radiance rather than on accumulated dose, and the Foundation has said that the standard then stops accumulating. The chapter says what the radiance limit was constructed for: a maximum exposure of one eight-hour

day. The two statements are consistent and together they are more precise than either alone. The framework integrates dose up to 10,000 seconds, and above that applies a radiance limit derived for a single working day. Neither reaches a year, and neither reaches a lifetime.

On what had already been measured by 2014, the same subsection states:

> "The first published results show that retinal damage induced by chronic exposure to white LEDs can be detected at much lower levels than the ICNIRP exposure limits."

The Foundation asks the Department to set that sentence beside the chronology at subsection f. The 2024 intergovernmental review reports that since 2012 several independent teams have found retinal damage well below the exposure limit. The chapter shows that its author was already reporting that as a published result in 2014. The finding on which the 2024 review rests was not new in 2024. It was a decade old, in print, in a reference work, from the same author.

The first published results, identified, and what the limits were constructed to detect

The Foundation can now identify the first published results to which that chapter refers, because its author is one of their nine authors. In July 2015 Jaadane, Boulenguez, Chahory, Carré, Savoldelli, Jonet, Behar-Cohen, Martinsons and Torriglia published in Free Radical Biology and Medicine a study of retinal damage from commercially available light-emitting diodes. Appendix C.78 records it. It is the earliest of the three studies by this group that this comment relies on, the others being at Appendix C.75 and Appendix C.63, and it is the one that states what the exposure limits were built to detect.

The passage is in the first paragraph of their results, and the Foundation quotes it in full because every element of it matters. The word used for injury is the authors' own.

> "Until today, regulations of light toxicity on the retina have established ELV (exposure limit values). These ELV are based on a study of fundus examination following a single exposure to light during 8 h. They establish that light is toxic to the eye when there is a bleaching of the retina."

Three elements of the limit are named in two sentences, and the Foundation asks the Department to notice each of them separately.

The endpoint is bleaching of the retina. Not loss of function, not loss of cells, not oxidative modification of proteins or nucleic acids. A visible whitening of the tissue.

The method is fundus examination. The injury must be of a kind, and of a magnitude, that an examiner looking into the eye can see.

The exposure is a single episode of eight hours. Subsection b and the arithmetic above establish that the limit integrates dose only to ten thousand seconds; this sentence states the experimental basis from which that construction came.

The same authors then applied that endpoint to their own animals. Dilated fundus examination was performed immediately after exposure by a veterinary ophthalmologist with two assistants. In rats exposed from twelve hours to three days, to commercially available white light-emitting diodes and to four blue sources at 507, 473, 467 and 449 nanometers, no bleaching of the retina was detected in any animal.

In the same animals the authors report interphotoreceptor edema; activation of microglia and infiltration of macrophages, indicating retinal inflammation; oxidation of DNA and RNA and of proteins, by two separate markers; loss of photoreceptors; and three modes of cell death, caspase-independent apoptosis, necroptosis and necrosis. The regulatory endpoint was negative. The injury was extensive.

That is the whole of the Foundation's argument in this subsection, and it is now stated from a primary source rather than inferred. A limit that defines injury as bleaching of the retina visible on

fundus examination cannot detect injury that does not bleach the retina. This is not a criticism of the limit's arithmetic, which is sound, nor of the investigators who established it, who were measuring what the instruments of their time could measure. It is a statement about what the limit was constructed to find. An exposure assessed as presenting no risk under a framework built on that endpoint has been assessed as unlikely to produce a visible lesion in a single day. It has not been assessed for anything else, and Part I.C.7 sets out why a determination of safety that rests on such an assessment is not a finding about the matters this comment raises.

One number from the same study belongs here with a warning attached. The authors state that the irradiance flux in their experiments was about one thousandth of that used in the earlier experimental work they cite, and give their own figure as a corneal irradiance dose of approximately 0.0026 joules per square centimeter, obtained from commercially available sources rather than from the laboratory devices used previously. The warning is that this is a corneal quantity and the 2.2 joules per square centimeter discussed at subsection f is a retinal quantity. The two differ by the optical gain of the eye and must not be compared. Appendix C.78 records both figures and states the distinction, and no arithmetic relating them appears anywhere in this comment.

On long-term exposure the chapter is equally direct:

> "The ICNIRP exposure limit values do not take into account the possibility of an exposure over an entire lifetime. Very little is known about the effects of life-long cumulated exposures to blue light emitted by LEDs."

And it characterizes the predecessor European Opinion described at Part V.K.9 in these terms: that IEC 62471 gives limits protective against acute effects, while long-term effects are only marginally considered and estimated to be of negligible or small risk.

On sensitive populations the chapter states that IEC 62471 does not take into account the sensitivity of certain specific population groups, and lists four:

- People with a pre-existing eye or skin condition that artificial lighting can trigger or aggravate.
- Aphakic and pseudophakic subjects, who cannot or can only insufficiently filter short wavelengths.
- Children, because their skin and visual system are not mature.
- Elderly people, because their skin and eyes, and particularly the retina, are more sensitive to optical radiation.

The chapter then makes a recommendation, and the Foundation quotes it because it is the recommendation this comment makes at Part IX.L, published in a reference work in 2015:

> "The photobiological standards relative to lighting systems should be extended to cover children – especially infants less than 2 year old – and aphakic or pseudophakic individuals, taking into account the corresponding phototoxicity curve A(λ) published by the ICNIRP in its guidelines."

One technical point in that recommendation deserves separate mention, because it concerns the structure of the limit rather than the policy. The guidelines define two action spectra for blue-light photoretinopathy: B(lambda) for the eye with a crystalline lens, and A(lambda) for the eye without one. The chapter records that the guidelines themselves recommend using the aphakic spectrum A(lambda) when assessing infants under the age of two, because of the greater transparency of the infant crystalline lens.

The Foundation draws the consequence that follows and no more. The hazard framework already contains a second, more protective weighting function, and the body that wrote the limits already recommends applying it to the youngest children. A product-compliance statement expressed as a risk group does not say which weighting was used. Part V.C.2.g sets out the measured

transmittance differences by age, and Part IX.F asks that emission characteristics be disclosed; a statement of which action spectrum a determination applied belongs in that disclosure.

d. Cumulative optical dose is an established framework for one waveband and absent for another

It is worth stating why this matters beyond the drafting of one standard. Cumulative dose is not a foreign idea in optical radiation photobiology. For ultraviolet radiation and the skin it is the accepted framework: cumulative lifetime ultraviolet dose is the organizing concept of photocarcinogenesis, and regulatory and clinical practice are built on it. The agency's own performance standard for sunlamp products, 21 C.F.R. § 1040.20, regulates a lamp in spectrally resolved radiometric terms precisely because of what accumulated ultraviolet exposure does. Part II.C.2.

So the field accepts that optical radiation delivers a dose, that the dose accumulates, and that accumulation across years is the relevant exposure for some injuries. What is absent for the visible band is not the concept. It is the evidence, and the research that would produce it.

An experiment published in 2023 illustrates what the absence of a long-term dose framework means in practice, and the Foundation sets out its exposure figures because they are the kind of figures a federal evaluation would have to produce. Hiramoto and others exposed hairless mice to light-emitting diode illumination for ten minutes a day, every day, for one year. Four spectral conditions were used. The blue condition ran from 380 to 500 nanometers with a peak at 479, the green from 500 to 560 with a peak at 538, and the red from 600 to 700 with a peak at 629; each of those three delivered 40 kilojoules per square meter per session. Skin cancer was induced in the blue group and in no other. Appendix C.26.

Converted to the units in which optical exposure is ordinarily expressed, 40 kilojoules per square meter is 4 joules per square centimeter per session, delivered over ten minutes, which is an irradiance of approximately 6.7 milliwatts per square centimeter. Over 365 daily sessions the cumulative delivered energy is approximately 1,460 joules per square centimeter. The Foundation states those figures because they can be stated: the study reports its exposure in radiometric units and the arithmetic follows.

Now set that against the framework described at subsections b and c. The blue-light hazard exposure limit is a dose, radiance-weighted and integrated over time, and it stops at ten thousand seconds — under three hours. This experiment delivered 3,650 minutes of exposure spread across a year and reported an outcome at the end of it. Whatever the merits of the study, and Appendix C.26 sets out several reasons for caution, no federal instrument describes the exposure it administered. The hazard framework cannot express a dose accumulated over a year because it was not built to; it addresses acute photochemical injury to the retina, and this concerned the skin over twelve months.

The Foundation draws the conclusion it has drawn throughout this Part. The missing quantity is not a concept. The concept is dose, and the Department has used it: § 1040.20 prescribes a recommended exposure schedule with duration and spacing for sunlamp products, which is a dose framework for a light-emitting product administered over repeated sessions across a lifetime. Part IX.J.5. What is missing is any determination of what cumulative optical dose, in what waveband, over what period, is acceptable for the products described in Part VI. Paragraph 360ii(a)(4) directs the Secretary to study and evaluate conditions of exposure to electronic product radiation. A cumulative dose over time is a condition of exposure, and for the visible spectrum the Foundation has found no federal statement of one.

e. What the Foundation asserts, and what it does not

The Foundation does not assert that a cumulative dose-response relationship has been established between long-term exposure to visible light from LED products and any particular injury. It has not been established, and Part V.A sets out how this comment weights evidence.

The Foundation asserts four things, each of which is either a matter of record or a matter of arithmetic.

Optical radiation exposure is measured as a dose, in the governing international standard, in units of joules per square meter per steradian.

The exposure limit in that standard is constructed for exposures not exceeding 10,000 seconds, and above that duration it ceases to accumulate.

The exposures that this comment is concerned with — occupational, residential, roadway and lifetime — are longer than that by orders of magnitude, and are therefore outside what the limit was constructed to assess.

Section 360ii(a)(4) directs the Secretary to study and evaluate emissions of, and conditions of exposure to, electronic product radiation. The gap between an acute limit and a chronic exposure is precisely the subject that direction describes.

The question is not whether the Department should assume an answer. It is that the question has not been asked, and the statute assigns the asking of it to the Secretary.

f. Whether the limit itself is settled

One further matter belongs in this subsection, because it bears on the weight the governing standard can carry. In October 2024 the International Energy Agency's 4E Solid State Lighting Annex published Solid State Lighting: Review of Health Effects, by Christophe Martinsons of the Centre Scientifique et Technique du Bâtiment, Jennifer A. Veitch and Ashley Nixon of the National Research Council of Canada, Sarah Loughran and Rohan Mate of the Australian Radiation Protection and Nuclear Safety Agency, and Rachael Harris and Linda Shen of Monash University.

The Foundation identifies the authorship because it bears on how the document should be read. It is an intergovernmental technical review rather than advocacy, and one of its authoring institutions is a national radiation protection authority — the body that performs in Australia a function this subchapter assigns to the Secretary. On the blue light hazard it reports the following, at page 31:

> "Since 2012, several independent teams have found retinal damage well below the ICNIRP exposure limit using more sensitive detection techniques and different animal models, including rats but also living macaques."

On the state of the question within the field, at the same page:

> "There is currently no consensus between the lighting community and many retinal experts about the need to revise the current ICNIRP exposure limit to the blue light hazard."

And at page 10, among its recommendations:

> "we recommend that photobiological safety committees engage in a systematic review and update of the blue light hazard exposure limits."

On the two questions this subsection has been concerned with — chronic exposure and the measurement of short-wavelength content — the report states at page 15 that "it is not possible yet to conclude anything about the effect of long-term chronic exposures to SSL products on the development of AMD," and at page 33 that "More measurement data are needed to know the risk levels of SSL technologies emitting below 430 nm".

The Foundation is careful about what it draws from this. It does not assert that the exposure limit is wrong, and it does not assert that retinal injury from general illumination has been established. The report says there is no consensus, and the Foundation adopts that characterization rather than a stronger one. Three propositions follow, each of which is a matter of record rather than of inference.

The exposure limit on which the Final Response of May 24, 2024 relied is the subject of an unresolved question among the bodies that set it, and the call for its systematic review is joined by a national radiation protection authority.

Section 360kk(a)(1)(A) directs the Secretary, in prescribing a standard, to consider the latest available scientific and medical data in the field. A report of this kind, published after the determination, is within that category.

The report addresses its recommendation to photobiological safety committees. Paragraph 360ii(a)(3) directs the Secretary to maintain liaison with and receive information from professional organizations on present and future potential electronic product radiation. Part II.E.4.

The Foundation asks the Department to state whether it has considered this report, and if so what conclusion it drew from it. The question is not rhetorical. If the Department has reviewed it and is satisfied that the limit requires no revision, that is an answer the Foundation would accept as responsive, and it is an answer that would itself constitute the evaluation § 360ii(a)(4) directs.

The numbers behind that statement, and the regulatory chain they bear on

The 2024 review states that independent teams have found retinal damage well below the exposure limit. It does not say by how much. One of the studies in that literature does, and the Foundation sets out both the chain of derivation it challenges and the challenge, because the chain has not previously been stated in this comment.

The chain runs as follows, and it is short. Limit exposure values for domestic lighting rest on action spectrum curves. Those curves give a retinal threshold dose at 445 nanometers of 22 joules per square centimeter for primates and 11 for rodents. The primate value was used to establish the lighting regulations. The regulations weight polychromatic light by the blue light hazard function B(λ), which peaks at 445 nanometers, and a device is labeled as presenting no risk if after 10,000 seconds of exposure the weighted retinal dose is below 2.2 joules per square centimeter.

Two features of that chain deserve to be stated before it is challenged. The regulatory limit is one tenth of the measured primate damage threshold, which is the safety factor built into the standard. And the entire structure rests on animal threshold measurements, as Part V.K.3 records the 2018 Opinion acknowledging.

One of those teams, and the figure the 2024 review omitted

The Foundation can now identify one of the independent teams to which the 2024 review refers, and state the figure. In 2017 Jaadane, Behar-Cohen, Martinsons, Torriglia and colleagues published in the Journal of Cellular and Molecular Medicine a study of white light-emitting diode exposure on the retinal pigment epithelium of rats. Appendix C.75 records it. Two of its features matter here before any result is stated. The source was ten commercially available warm white lamps of a named retail model, which the authors describe as widely used in residential lighting, behind a diffuser fitted to suppress point-source effects. And the exposure was expressed not in lux or in watts per square meter but as a retinal radiant exposure dose in joules per square centimeter, computed by the same French building science laboratory that characterized the apparatus, which is the unit the exposure limit is expressed in. It is, so far as the Foundation has found, the only study in Appendix C whose exposure is reported in the units of the limit it is to be compared with.

The authors state their design in terms: the doses used were intentionally fixed below the damage threshold from which the exposure limit values were calculated. Rats received constant white light-emitting diode exposure for 4.75, 6, 12, 18 and 24 hours, corresponding to computed retinal doses of 4.14, 5.23, 10.5, 15.7 and 20.9 joules per square centimeter. Four animals per condition. At the lowest of those doses the actin cytoskeleton of the pigment epithelium was disorganized and a protein kinase marker of oxidative stress had translocated to the plasma membrane. At 5.23

joules per square centimeter the tight junctions were disrupted. Serum albumin leaked into the interphotoreceptor space, increasing with exposure, which is the direct demonstration that the outer blood-retinal barrier had failed. Cell death was by necrosis, apoptosis having been excluded by negative staining.

The figure the Foundation draws attention to is in the discussion. Taking the lowest dose at which damage was observed, 4.14 joules per square centimeter in total, the authors report that the blue part of the spectrum accounts for 14 percent of it, which is 0.58 joules per square centimeter. The basic restriction from which the blue light hazard exposure limit is derived is 2.2 joules per square centimeter. The damage was therefore observed at a blue-light retinal dose of roughly one quarter of the limit, and the authors say so: far below the figure presumed to be completely safe.

That is a strong claim and the Foundation states the three qualifications that bear on it, because a claim of this importance should be presented with its weaknesses rather than without them.

The 0.58 figure is a band fraction and not a weighted quantity. The limit is expressed as a dose weighted by the blue light hazard function described at subsection a, which rises to a peak at 445 nanometers and falls away on either side. Fourteen percent of the total spectral energy is not the same arithmetic. The two quantities are of the same order and the comparison is informative, but it is an approximation and the direction of its error is not stated in the paper.

The computed retinal dose depends on an assumed pupil diameter, and the assumption is generous. The authors took 5 millimeters, noting that they did not dilate the animals' pupils and reasoning that the irises of albino rats absorb little light. Their own cited sources give other values: one source between 0.4 and 1.2 millimeters, another 0.5 millimeters. Retinal dose scales with pupil area, so across that range the computed dose could overstate the delivered dose by a factor between about seventeen and about one hundred. The error runs in the direction that favors the Foundation's reading, since a dose smaller than stated would place the observed damage further below the limit rather than above it. But it means the absolute figures carry an uncertainty of as much as two orders of magnitude, and the Foundation does not treat 0.58 joules per square centimeter as a measured quantity.

The dose was delivered over far longer than the limit contemplates. The shortest exposure, 4.75 hours, is 17,100 seconds, and the longest is 86,400. The limit is constructed for exposures of no more than 10,000 seconds, as subsection c sets out. The authors raise this themselves. It cuts both ways: a dose spread over a longer period is less injurious per unit time, which is an argument for the limit; and the framework does not address exposures beyond its ceiling at all, which is the argument of subsection c and the reason this comparison is being made outside the domain the limit was written for.

With those qualifications the finding stands as this. A commercially available residential lamp, operated so as to deliver a retinal dose the investigators deliberately kept below the threshold on which the exposure limit is based, produced disorganization of the pigment epithelial cytoskeleton, disruption of tight junctions, failure of the outer blood-retinal barrier and necrotic cell death in a rat. And the detection required immunohistochemistry, electron microscopy and protein analysis: the authors note that the earlier work in this line found damage without any visible alteration at fundus examination, which is the examination the threshold was originally defined by. Subsection c explains why a limit calibrated to a visible lesion does not detect what these methods detect.

The Foundation sets this beside the 2024 study described in the following paragraphs, which shares three authors with it. The 2017 study reports damage below the threshold the limit was derived from. The 2024 study re-measures the threshold itself and reports it overestimated. The two are the same argument approached from opposite ends by overlapping investigators across

seven years, and Part V.A.1 records what that overlap means for the weight the two can bear together.

In February 2024 Françon, Behar-Cohen and Torriglia published in Environment International an in vivo study of that threshold in rats, funded by the French agency for food, environmental and occupational health safety. Appendix C.63. The second author was an external expert of the 2012 predecessor Opinion described at Part V.K.9. Their findings bear on the chain at three separate points.

On the threshold. They report that the phototoxicity threshold currently accepted for rats is overestimated by a factor of 50 for blue light and by a factor of 550 for white light. A tenfold safety factor does not survive an overestimate of either size.

On the weighting function, first ground. They report that green light drives the phototoxicity of white light by promoting an inflammatory response, and that the green content of white light produced eight times more macrophage invasion of the retina than the blue content. The hazard function weights 507 nanometers at a small fraction of its value at 445. A weighting function that discounts the wavelength doing the damage is not measuring the hazard.

On the weighting function, second ground. They report that red light mitigates damage, inhibiting the nuclear translocation of an enzyme involved in cell death and reducing the number of cells showing a marker of that death by 33 percent, and that the weighting does not evaluate the red content of white light at all. The function therefore omits a protective component as well as discounting a damaging one.

The Foundation asks the Department to notice that the second and third of those findings converge, from a different laboratory and a different mechanism, with the long-wavelength argument at Part V.B.6. That argument rests on work from a London group on mitochondrial function and visual performance. This is a Paris group working on retinal cell death. Neither cites the other's endpoint, and both conclude that the long-wavelength content which light-emitting diode sources omit is doing something the short-wavelength content is not.

The authors state the consequence for human limits themselves:

> "As current human phototoxicity thresholds were estimated with the same methods used for rats, our results suggest that they might need to be reconsidered."

And they state the consequence for products, which is the sentence this comment asks the Department to weigh most carefully:

> "the commercial LED that are currently classified as safe for the retina could actually induce retinal damage if used daily at high luminance."

The Foundation does not adopt that sentence as a finding about any product in American commerce, and Appendix C.63 sets out at length why it cannot: the work is in young albino rats, at acute doses, in a single laboratory, and the factor of 50 and the factor of 550 are overestimates of a rodent threshold rather than of the human limit. What the Foundation asks the Department to weigh is narrower and does not depend on accepting the finding. A peer-reviewed study, funded by a national health agency, co-authored by a member of the European scientific committee whose Opinion the determination of May 24, 2024 relies upon, published three months before that determination, concludes that the method by which the governing limit was derived requires re-assessment and that products classified as safe may not be. Section 360kk(a)(1)(A) directs the Secretary, in prescribing a standard, to consider the latest available scientific and medical data in the field. The Foundation asks whether this paper was among the data considered.

The authors also record a second and independent line to the same effect, which the Foundation notes without having read it: that Hunter and others, in work of 2012 and 2018, identified a potential overestimation by a factor of 20 in the current human safety standards.

g. Age-dependent ocular transmission, and who actually receives the dose

Subsection b describes the blue-light hazard exposure metric as a dose delivered to the retina. A dose at the retina is not the same quantity as a dose at the cornea, and what separates them is the eye through which the light passes. That eye is not the same at every age.

The crystalline lens absorbs short-wavelength light, and it absorbs progressively more of it over a lifetime as it yellows. The consequence is that the same source, viewed at the same distance for the same time, delivers a larger short-wavelength retinal dose to a child than to an adult, and a larger dose to an adult than to an elderly person.

The magnitude is available from an institutional source rather than from the Foundation. The Scientific Committee on Emerging and Newly Identified Health Risks, the predecessor of the committee whose 2018 Opinion is described at Part V.K, stated the following in its Opinion on the health effects of artificial light adopted on March 19, 2012. Appendix D.1.

Age	Reaching the retina at 400 nm	Reaching the retina at 460 to 480 nm
Children under 9 years	around 15 percent	about 65 percent
At 10 years	not stated	about 60 percent
Adults 60 to 70 years	about 1 percent	about 40 percent

The Committee adds a further observation about the youngest group which the Foundation reports because it concerns a waveband the eye is ordinarily assumed to exclude altogether. In children at or just below about nine years of age, the Committee states that a window exists allowing transmission of about 2 to 5 percent of ultraviolet radiation at 320 nanometers to the retina.

Two things follow from the table. The first is arithmetic: at 460 to 480 nanometers the retina of a child under nine receives roughly 1.6 times the proportion that the retina of a person aged 60 to 70 receives, and at 400 nanometers roughly 15 times. The second is that the variation is not a refinement at the margin. A limit written for one eye is a different limit, in its practical effect, for the other.

The Foundation notes that the narrative review at Appendix C.18 reports the 65 percent figure for children under nine, and that the figure is traceable to this Committee Opinion of 2012. Where this comment relies on it, the Opinion is cited rather than the review.

The regulatory consequence does not depend on the precise number. An exposure limit expressed at the cornea, and a hazard assessment performed against a standard observer, describe the dose received by the eye assumed in the standard. Where the population actually exposed includes eyes that transmit more short-wavelength light than that assumption, the limit understates the retinal dose for those people by a margin the standard does not state. The Foundation does not assert that any existing limit is thereby exceeded in ordinary use, and Part V.C.2.e states what the Foundation does and does not assert about these limits. It asserts something narrower: that the quantity the standard governs and the quantity deposited on a child's retina are related by a factor that varies with age, and that the variation is in the direction of greater exposure for the younger eye.

That bears on two things in this comment. It bears on Part VI, which describes the exposure conditions produced by classroom, street and vehicle lighting, because the populations under that lighting include children in the settings where they spend the most time. And it bears on the request at Part IX.L that sensitive populations be addressed expressly, because age-dependent ocular transmission is a mechanism by which a population is differently exposed to an identical

emission — which is the sort of fact § 360ii(a)(4) directs the Secretary to study and evaluate when it directs attention to conditions of exposure as well as to emissions.

h. The framework is ocular. The evidence is not.

Everything in this subsection so far concerns the eye. The photobiological safety framework assesses hazards to the retina, the lens and the cornea; the blue-light hazard weighting function is a retinal weighting; the exposure limit is expressed as a retinal dose; and subsection g concerns what the ocular media transmit. That is what the framework was built to do, and within its own terms it does it.

The Foundation asks the Department to notice that two of the studies in Appendix C report effects of light that did not enter the eye at all.

At Appendix C.19, a randomized sham-controlled trial delivered 670-nanometer light to an 800 square centimeter area of the upper back of healthy adults for fifteen minutes, and measured the result in capillary blood glucose. The irradiated tissue was skin and underlying musculature. The measured tissue was blood. At Appendix C.15, mice were exposed whole-body to light-emitting diode illumination and the outcome was examined by histology of the liver. In neither case is the eye the route, and in the first the authors chose a body site specifically to avoid it.

The consequence for this comment is structural rather than quantitative, and it is the same consequence Part V.B.6 draws about the absence of a wavelength band. A framework answers the question it was built to ask. A photobiological safety assessment performed against retinal exposure limits will return a result about retinal exposure. If light acts on a person through the skin as well as through the eye, that assessment is not wrong about the retina; it is silent about everything else. A product may conform to every applicable optical radiation safety standard, and that conformity will say nothing whatever about a pathway the standards do not assess.

Paragraph 360ii(a)(4) directs the Secretary to study and evaluate emissions of, and conditions of exposure to, electronic product radiation. The conditions of exposure to a lamp include what reaches the skin of the person under it, and not only what reaches the retina. The Foundation is aware of no federal evaluation of the first. Part II.F.

The Foundation states the limit of what it claims. It does not assert that non-ocular exposure to light from any product in commerce injures anyone, and neither of the two studies cited supports that. The proposition is narrower: that a route of exposure exists, that effects through it have been measured in humans and in animals, and that no instrument in the federal or consensus framework describes it.

The mechanism is identified, and the Foundation now states it. Light is detected in the human body by proteins other than the visual pigments of the rods and cones. Karthikeyan, Davies and Gunhaga, reviewing the field in 2023, describe three non-visual opsins — OPN3, also called encephalopsin or panopsin; OPN4, melanopsin; and OPN5, neuropsin — and set out where they are expressed and what they do. Appendix C.28.

Two features of that account bear directly on this comment.

The first is where these receptors are. The review tabulates expression of OPN3 in human and animal tissue including blood vessels, many regions of the brain, the gastrointestinal tract, the liver and pancreas, immune cells including B-cells and T-cells, adipocytes, heart, kidney, lung, smooth and skeletal muscle, and skin -- fibroblasts, hair follicles, keratinocytes and melanocytes. OPN4 and OPN5 are likewise reported in skin, among other tissues. The review further records that specific wavelengths have been shown to penetrate skin, the skull and other bones, skeletal muscle and soft tissue, and through abdominal structures to reach the developing fetus, with longer wavelengths penetrating further but biologically relevant shorter wavelengths also passing into deeper tissues.

The second is what wavelengths they respond to. The peak absorbances reported are approximately 463 nanometers for OPN3, 480 for OPN4, and 380 for OPN5. The review notes that 480-nanometer light activates OPN3 to 90 percent and OPN4 to 100 percent of maximum, and that light at 400 nanometers activates all three. Part V.B.1 describes the short-wavelength emission peak of phosphor-converted white light-emitting diodes. These receptors are tuned to the region of the spectrum in which those products emit most strongly.

The functional consequences the review describes are not confined to the eye, and several of them correspond to findings already in this appendix:

Metabolism. OPN3 is expressed in adipocytes. The review reports that blue light applied to wildtype adipose cells produced enhanced mitochondrial activity and elevated glucose uptake, with no significant change in OPN3-knockout cells, and that animals lacking OPN3 showed reduced insulin sensitivity and diet-induced obesity. Compare Appendix C.19.

Blood vessels. Blue light between 400 and 460 nanometers is reported to relax the aorta and pulmonary arteries, an effect absent in OPN4-knockout animals and absent in darkness, and in vivo 455-nanometer light increased blood flow where red and green light did not.

Skin. The review reports that skin tissue from wildtype mice, but not from animals with OPN5 ablated, photoentrained in response to 415-nanometer light, and concludes that multiple local circadian clocks exist in mammals. On that account skin is not merely a surface that light falls on; it contains a clock that light sets.

Smooth muscle, immune cells and pigmentation are each described as under opsin-mediated photic control, and OPN3 variants are reported to be associated with asthma risk in one population. Compare Appendix C.20.

The Foundation is careful about one thing, because it would be easy to merge two different mechanisms and wrong to do so. The 670-nanometer effects at Appendix C.19 are attributed by their authors to cytochrome c oxidase in the mitochondrial electron transport chain, not to an opsin. Opsins and cytochrome c oxidase are distinct photoacceptors with distinct spectral sensitivities. What they have in common, and all that the Foundation asserts from both, is that the human body detects and responds to light through routes that do not pass through the retina.

The regulatory conclusion is the one stated above and is now supported rather than merely asserted. A photobiological safety assessment conducted against retinal exposure limits does not evaluate the pathways described in this subsection. It does not measure what reaches the skin, it applies no weighting function corresponding to any of these receptors, and it returns no quantity by which such an exposure could be compared against another. Paragraph 360ii(a)(4) directs the Secretary to study and evaluate conditions of exposure to electronic product radiation. The Foundation submits that the conditions of exposure to a lamp include the light that falls on the person beneath it, and that no federal evaluation of that exposure exists for any product emitting visible light.

One further line of work belongs here, and the Foundation introduces it with its limitation rather than with its finding. In December 2024 a group at the Ulsan National Institute of Science and Technology published in Nature Communications a study of how proteins are damaged by light. Appendix C.61. Working on single protein molecules held in magnetic tweezers, they found that blue light at a peak wavelength of 447 nanometers drives a reaction in which oxygen trapped inside the protein is converted by tryptophan residues into reactive oxygen species, which then damage the protein from the inside. The same decay did not occur in the dark, and did not occur under infrared light at 860 nanometers even at higher power.

The limitation is severe and the Foundation states it before the use. This was purified protein in a buffer and then cells in a dish. It is not a tissue, not an organism and not a health outcome, and the paper reports no irradiance for its blue light at all, so there is no way to relate the exposure to

anything a person encounters. The Foundation does not offer it as evidence that light-emitting diode products damage proteins in people.

It is offered for a narrower proposition that bears directly on this subsection. The target of that mechanism is not a photoreceptor, not a pigment and not a specialized light-sensing molecule. It is the interior of ordinary proteins, and the authors report that roughly nine in ten human proteins contain cavities and roughly a third contain large cavities holding tryptophan. The authors name the tissues they regard as relevant, and they are the tissues exposed to visible light: the skin and the eye.

That is the proposition this subsection has been advancing. A framework addressed to the retina is addressed to an organ. A mechanism that operates on a structural feature common to most proteins is not confined to an organ, and the quantity it would be assessed against is not one the photobiological safety standard measures. The Foundation does not say the mechanism is established in people. It says that the question whether it operates in people at the irradiances they actually receive has not been asked by anyone with the authority to answer it, and that § 360ii(a)(4) assigns the asking.

One convergence is worth recording because it is now the fourth instance, and the fourth is the most striking because it returns to the first molecule in a different role. Appendix C.54 reports riboflavin acting as a photosensitizer near 450 nanometers, producing free radicals and singlet oxygen in milk. The mitochondrial account at Part V.B.6 turns on porphyrin absorbing between 420 and 450 nanometers and producing singlet oxygen. Appendix C.61 adds tryptophan, generating singlet oxygen and hydroxyl radical at 447 nanometers. Appendix C.69 now reports blue light at a peak of 460 nanometers inhibiting succinate dehydrogenase, the enzyme of mitochondrial Complex II, in an intact animal, and proposes as the mechanism the degradation of that enzyme's flavin adenine dinucleotide cofactor – which is derived from riboflavin, and which those authors state is maximally activated at 450 nanometers.

So the same molecule appears twice: as a photosensitizer destroying nutrients in a retail refrigerator case, and as the cofactor of a respiratory enzyme in a living organism. Four instances, in four unrelated systems – food chemistry, mitochondrial respiration, protein folding and the retina – turning on absorption in the same narrow band, which is the band in which the dominant artificial light source of the present era has its peak. The Foundation draws no conclusion from the convergence beyond the obvious one: it is a reason to look. It notes only that a chromophore shared between a food-quality problem the dairy industry already measures and a respiratory enzyme in an animal is not a speculative target.

One qualification corrects the framing of the preceding paragraphs, and it makes the point more authoritative while making it less novel. The Foundation presented the convergence as a pattern it had noticed across unrelated literatures. It is not a discovery. A 2010 review of retinal light injury from the Department of Ophthalmology and Visual Sciences of the University of Wisconsin, recorded at Appendix C.80, gives the chromophores of the retina and the pigment epithelium as including the photoreceptors, flavoproteins, heme proteins, melanosomes and lipofuscin. Flavoproteins are the class to which riboflavin belongs as a cofactor; heme proteins are the class that includes cytochrome c oxidase; and lipofuscin is the pigment whose fluorophore is discussed above. Three of the four instances the Foundation assembled are therefore items on the standard list of retinal chromophores in an American ophthalmology review published before any of the four studies. The Foundation withdraws the suggestion that the convergence is a reason to look and replaces it with something stronger: that the molecules which absorb short-wavelength light in the retina have been identified in the clinical literature for at least fifteen years, and that the question is not what absorbs the light but at what level the absorption matters.

i. A distinction within the eye: hazard and non-image-forming response are different questions

Subsection h concerns routes of exposure that bypass the eye. This subsection concerns a distinction inside it, and the Foundation puts it after h because it is narrower rather than because it is less important. It may be the most consequential sentence in Part V.

Campbell, Sharifpour and Vandewalle, reviewing the non-image-forming effects of light on brain function in 2023, describe the relationship between the hazard framework and the pathway that governs those effects. Appendix C.30. Writing of the blue light hazard, they state:

> "The potential damage from the BLH region is particularly prominent for prolonged and/or intense exposure to wavelengths < ~440 nm, especially when arising from relatively focal light sources. The B[L]H region is therefore distinct from the NIF impacts of diffused light, which have a peak around 460–480 nm wavelength."

The Foundation asks the Department to read that against subsections a through f. The blue light hazard framework is an assessment of photochemical injury to retinal tissue. It is weighted toward wavelengths below about 440 nanometers, and it is most apt to focal sources. The non-image-forming pathway — the one that mediates melatonin suppression, circadian entrainment, alertness, and the effects on cognition and mood described in Part V.G — is driven by melanopsin, whose peak sensitivity these authors place at about 480 nanometers, and it responds to diffuse light filling the field of view rather than to a point source.

Two systems, two wavebands, two source geometries, two biological endpoints. They are not the same question, and conformity with the first is not evidence about the second.

That has a direct consequence for the determination of May 24, 2024 and for every assurance built on photobiological safety conformity. A manufacturer may demonstrate that a luminaire falls within the exempt group of IEC 62471. That demonstration concerns retinal photochemical injury from a focal source, below roughly 440 nanometers. It is silent about what the same luminaire does to the non-image-forming system of the person sitting under it for four hours in the evening, because that is a different waveband, a different geometry and a different pathway, and no standard the Department administers measures it. The Foundation is not asserting that the second effect is harmful. It is asserting that the first assessment does not address it, and that the record contains no federal assessment that does.

The Foundation notes that the two peaks are close enough to be confused and far enough apart to matter. A weighting function emphasizing wavelengths below 440 nanometers and a response peaking near 480 will return different answers about the same product, and a phosphor-converted white light-emitting diode emits across both. Part V.B.1.

j. Where a weighting function comes from, and why it matters that most do not exist

Subsection i describes two weighting functions that return different answers about the same product. The Foundation adds a word about where functions of that kind come from, because it answers a question the Department may fairly put to this comment: what, concretely, would the research it asks for consist of?

A weighting function is an action spectrum. It is a curve giving the relative effectiveness of each wavelength in producing one particular biological response. It is built by exposing subjects to one wavelength at a time, at controlled irradiance, and measuring the response at each. That is how the photopic luminous efficiency function V(λ) was constructed, how the blue-light hazard function was constructed, and how the melanopic sensitivity function was constructed.

Monochromatic exposure of that kind is not a model of how anyone lives. No person is ever exposed to a single wavelength, and a study that administers one is describing an artificial condition. The Foundation states that plainly and then states why it does not matter. The artificiality is not a defect of the method; it is the method. A function describing the separate

contribution of each wavelength cannot be derived from exposures in which the wavelengths are mixed, any more than the weight of each ingredient can be recovered from the weight of the cake.

The consequence is direct and the Foundation puts it as the answer to the question above. Part IX.C.4 asks the Department to adopt the weighting functions appropriate to each response studied. For the photopic response and for retinal photochemical injury, such functions exist and are in use. For the melanopic response one exists and is standardized but is not applied at population scale, as Part V.J.4 sets out. For the remaining responses described in this Part — metabolic, cardiovascular, affective, immune, and the non-ocular pathways at subsection h — no such function exists. The work that would produce them is at the stage of pilot studies with participants in single figures. Appendix C.34 is one such, and the Foundation offers it to show the state of that work rather than for its findings, which rest on seven people.

Until those functions exist, no standard can specify what a product may emit at each wavelength, because there is no agreed basis for saying which wavelengths matter for which endpoint and by how much. That is the gap between the present literature and a prescribable standard, described at Part V.J.4, stated in its most concrete form. It is also the clearest available answer to what the research directed by § 360ii(a)(2) and (a)(4) would consist of. It is not a vague call for more study. It is a specific, bounded, well-established experimental program — derive the action spectra — whose output is exactly the input a performance standard requires.

The Foundation observes finally that this is the precise respect in which the federal efficacy standard described at Part IV.G is inadequate as a lighting policy. A requirement expressed in lumens per watt is a single number relating luminous flux to power. It constrains neither the distribution of wavelengths that produces the flux nor the weighting of those wavelengths against any biological response. Two lamps of identical efficacy may differ entirely in spectrum. A standard that regulates the ratio and ignores the distribution is not a weak spectral standard. It is not a spectral standard at all.

k. How this emitting technology came to be assessed as a lamp, and what that assessment requires in the United States

The framework set out in the preceding subsections is the lamp framework. It has not always been the framework that applied to these devices, and the change is worth setting out, because it explains two features of the present arrangement: which document governs, and how little that document requires in this country.

The classification history

When light-emitting diodes first entered commerce in quantity they were not assessed as lamps. They were assessed under the laser safety standard. IEC 60825-1 brought them within its scope in its first edition of 1993, and that edition was followed by two amendments.

In March 2007 the standard was revised to Edition 2.0, a technical revision replacing the first edition and both amendments. Its foreword states the change in a single sentence:

> “Light emitting diodes (LEDs) have been removed from the scope of this part of IEC 60825”

The standard gives its own reason. The scope records that light-emitting diodes had previously been within scope, and states that lamp safety standards can more appropriately address the optical radiation safety of these devices. The revision does not preclude other standards from including light-emitting diodes wherever those standards refer to lasers, and the standard notes that CIE S 009 may be applied to determine the risk group class of a light-emitting diode or of a product incorporating one or more of them.

Two details of that pointer matter. The standard names CIE S 009 rather than IEC 62471, although IEC 62471 had been published in July 2006; the explanation is that IEC 62471 was created by adopting the text of CIE S 009, and the two are now published as a single dual-logo

document. And the removal is understood not to have been complete: light-emitting diodes used in optical fibre communication applications remained within the laser framework, addressed in IEC 60825-2.

The Foundation states the reason the standard states, and no other. It does not assert a motive for the revision, and it takes no position on who proposed it or why. The chronology and the standard's own explanation are the record. Anything beyond them would be inference, and this comment does not rest on inference where a document speaks for itself.

What followed in Europe is documented. By September 2011, on the account of Underwriters Laboratories, IEC 60825 was no longer usable for evaluating the optical radiation of a light-emitting diode under the European Low Voltage Directive, and conformity with the lamp framework had become mandatory there.

One further document completes the structure. IEC/TR 62778, first published in 2012 and reissued as Edition 2.0 in June 2014, is titled Application of IEC 62471 for the assessment of blue light hazard to light sources and luminaires. By its own account, product safety standards for high-intensity discharge and light-emitting diode products make reference to it. It is the bridge between the measurement standard and actual lighting products. It is also a Technical Report, which the Commission publishes when a committee has collected data of a different kind from what is normally published as an International Standard, and it is therefore not itself a normative requirement on any product.

The four risk groups, and the behavior they assume

The classification scheme assigns a source to one of four groups. For the blue light hazard the governing quantity is the weighted radiance described at subsection a, and the group boundaries can be stated either as radiances or as the maximum exposure duration each radiance implies. The values below are taken from a manufacturer application note and are subject to the verification recorded at the end of this subsection.

Group	Blue light hazard weighted radiance	Maximum exposure duration implied
Exempt Group, also Risk Group 0	up to 100 $W/(m^2 \cdot sr)$	more than 10,000 s
Risk Group 1, low risk	up to 10,000 $W/(m^2 \cdot sr)$	more than 100 s
Risk Group 2, moderate risk	up to 4×10^6 $W/(m^2 \cdot sr)$	more than 0.25 s
Risk Group 3, high risk	above 4×10^6 $W/(m^2 \cdot sr)$	0.25 s or less

The arithmetic of that table is the dose limit of subsection b. A weighted radiance of 100 $W/(m^2 \cdot sr)$ sustained for 10,000 seconds delivers 10^6 joules per square meter per steradian, which is the limit. The group boundaries are not four separate criteria. They are one criterion read at four durations.

The names of the groups describe risk. What the groups actually encode is how long a person may look. That distinction is the one the Foundation asks the Department to hold onto, and Risk Group 2 is where it bites. The ground on which a moderate-risk source is treated as presenting no hazard in ordinary use is not that its radiance is low. It is that a person will look away within a quarter of a second. Manufacturer guidance states this directly: an application note of a major emitter manufacturer describes even Risk Group 2 devices as presenting no risk under normal accidental glances, because the natural aversion reflex usually acts.

That is a behavioral premise, not a radiometric one, and it is load-bearing. Part V.K.1 sets out the Foundation's objection to the aversion response as a protective mechanism, and Part V.E.4

describes the pathway by which short-wavelength light produces discomfort and avoidance. Appendix C.51 reports an animal experiment in which blue light produced strong aversive behavior at an irradiance far below any injury threshold, while yellow light at the same irradiance did not. The Foundation draws the narrow conclusion that follows: aversion is a response to the light. A framework that counts it as a safeguard has taken a symptom and entered it on the other side of the ledger.

Where the measurement is made

The geometry of the assessment is specified, and it is not the geometry in which the products described at Part VI are encountered.

IEC/TR 62778, summarizing clause 6 of IEC 62471, states the condition. General lighting service lamps are assessed at the distance that produces 500 lux, but not closer than 200 millimeters. All other light sources, including pulsed sources, are assessed at 200 millimeters.

Two hundred millimeters is just under eight inches. A manufacturer application note describes it as a worst-case assumption, and for a component inspected at arm's length that is a fair description. For a roadway luminaire, a vehicle lamp or a video display it is not the encounter distance at all.

The assessment route also depends on the geometry. A source subtending less than 11 milliradians is assessed on blue light hazard irradiance; a source subtending more is assessed on radiance. At the 200 millimeter reference distance, 11 milliradians corresponds to a source diameter of 2.2 millimeters, and single-chip emitters up to about 2 square millimeters of active area fall below it. Part V.B.2 derives the angular relations and gives the distances at which apertures from 1 millimeter to 300 millimeters cross the same boundary.

The Foundation is careful about what it draws from this, because the obvious objection is not available to it. It does not argue that a risk group determined at 200 millimeters understates the radiance encountered at thirty meters. It does not. Radiance is conserved along the ray bundle, the retinal irradiance set by a resolved source does not fall with distance, and Part V.B.2 establishes that at length. The scientific committee of the European Commission says the same thing in terms, recording that because its assessment was carried out in terms of source radiance, the conclusion was independent of viewing distance. Part V.K.

The objection is narrower and it survives. What changes with distance is the angular subtense, and the angular subtense determines two things: which assessment route applies, and what the eye is actually imaging. A multi-emitter array assessed at 200 millimeters presents one extended source, and the radiance attributed to it is averaged across the aperture, including the dark area between the emitters. At the distance at which a person meets that luminaire on a street, the eye may resolve a single emitter, whose radiance is higher than the aperture average by the ratio of the aperture area to the emitting area. Part V.B.2 gives the transition distances.

So what a low risk group establishes is this: the hazard of an aperture-averaged radiance, measured at a reference distance, assessed against a limit constructed for a single episode of no more than 10,000 seconds, on the assumption that the viewer looks away. Not one of those four conditions describes the exposures set out at Part VI.

The effect of the reference distance has been measured

The preceding paragraphs state what the reference conditions are. The Foundation is now able to state what one of them is worth, because a national market surveillance authority has measured it on products in commerce.

Between 2021 and 2023 the French consumer protection and market surveillance authority anonymously purchased fifty toys containing one hundred and three light-emitting diodes and had them tested by accredited laboratories against the European standard for the safety of electric

toys, IEC 62115. The results were published in July 2026 by investigators at the French agency for food, environmental and occupational health safety, the national metrology laboratory, the Cochin Hospital ophthalmology research center and the national building science center. Appendix C.59.

Fifteen of the fifty toys, thirty percent, contained at least one light-emitting diode that failed the eye safety limits. Of the one hundred and three diodes tested, fifteen failed. Blue diodes failed at the highest rate, eleven of thirty-four, or thirty-two percent. Approximately eighty-seven percent of the failures were failures of the blue light hazard limit rather than of the thermal limit.

That is the first finding, and the Foundation returns to it below. The second finding is the one that belongs in this subsection.

The investigators tested against two editions of the same standard, the 2003 edition and the 2017 edition, which differ in the distance at which the measurement is made. The 2003 method measures at distances from 14 to 100 millimeters. The 2017 method measures at 200 millimeters. The results were these:

Across the full sample, the 2003 method found fourteen of sixty diodes non-compliant, twenty-three percent. The 2017 method found two of fifty-four, four percent.

In a paired subsample of ten toys and nineteen diodes, tested both ways, eight diodes failed under the 2003 method and one failed under the 2017 method.

The authors attribute the difference principally to the longer assessment distance. The Foundation asks the Department to hold that result still for a moment and consider what it is.

The products did not change. The diodes did not change. What changed was the distance at which the standard directs the instrument to be placed, and measured non-compliance fell by roughly seven-eighths. A compliance rate is not a property of a product alone. It is a property of a product and a measurement convention together, and in this instance the convention did most of the work.

Two further observations follow, and the Foundation separates them because the first is about this product class and the second is general.

As to toys, the direction of the change is the opposite of what the use condition would suggest. A toy is held by a child. Two hundred millimeters is just under eight inches, and the distance at which a small child holds an illuminated toy is not reliably greater than that; the earlier method’s range of 14 to 100 millimeters is closer to how such an object is actually handled. The revision moved the assessment distance away from the condition of use, and non-compliance collapsed. The Foundation does not assert that this was the purpose of the revision, and it has no evidence as to purpose. It states the measured consequence.

As to the general point, this is the clearest demonstration available to the Foundation of the proposition it has been advancing in this subsection on reasoning alone. A risk group, or a statement of compliance, is a statement about a product assessed under a stated set of conditions. Change the conditions and the statement changes, with no change in what the product emits. That is why the Foundation asks at subsection 5 below that a federal performance standard specify reference conditions matched to the geometry in which each product class is actually encountered, rather than adopt a horizontal convention written for a different purpose. Part IX.

One point of caution the Foundation states itself. These results are from the French market, tested against a European toy standard that has no application in the United States, and the sample was assembled by inspectors during store visits rather than by a statistical design, which the authors say in terms makes it unrepresentative. Nothing in it establishes a non-compliance rate for the American market, and the Foundation does not assert one. What it establishes is the sensitivity of a compliance determination to the measurement convention, which is a property of the method and not of the jurisdiction.

The agency that commissioned that campaign reached a further conclusion, about the limits themselves

The campaign described above was not freestanding, and the comment is able to identify the proceeding it belonged to because the two documents carry the same reference. The funding number recorded in the study, 2022-SA-0193, is also the number of a formal request put to the French agency for food, environmental and occupational health safety by two directorates of the French government, the health directorate and the enterprise directorate, on October 25, 2022. The question referred was whether the 2020 revision of the toy standard met an earlier recommendation of the same agency, and whether it adequately accounted for the greater transmission of the young lens. The agency answered on July 8, 2024. Appendix D.1.18.

The answer was not that compliance was uneven. It was that the limits are wrong, and the agency said where they came from. It traced the eye safety limits of the 2020 standard to a single journal article published in 2012, and identified three errors in that article which the standard inherited.

The first concerns which exposure scenario the limits were built on. The 2012 authors compared a normal-use scenario, at 200 millimeters for 10,000 seconds, with a foreseeable-misuse scenario at 100 millimeters for 100 seconds, and concluded that the misuse scenario was the less exposing of the two and could be set aside. The reviewing agency calculates that the misuse scenario is the more exposing, by a factor of about four, and that retaining it would have produced limits about four times lower than those adopted.

The second concerns the conversion of a luminance threshold into a limit on luminous intensity. The threshold taken was 10,000 candelas per square meter. The reviewing agency states that the conversion was performed using the area of the beam at the eye rather than the apparent area of the source, and that for a diode of about 2 millimeters the resulting limit on luminous intensity is too high by a factor of the order of one thousand.

The third is a unit conversion error which the reviewing agency states inflated the limits on radiant intensity, expressed in watts per steradian, by a factor of about ten.

The consequence stated is that the standard as written permits diodes in toys to emit at luminances of the order of 10 to the seventh candelas per square meter. Part V.C.2.i gives the method by which a luminance of that order should be compared with the luminance of the solar disc and states the limits of the comparison, and the Foundation does not repeat the comparison here or draw anything further from it.

What the agency then recommended is the part of the opinion that is unusual enough to state in its own words. It recommended suspending the application of the current version of the standard, using the 2005 version provisionally to assess whether toys meet the essential safety requirements, and beginning the revision of the ocular safety sections without delay. As to toys that pass the 2020 version but fail the 2005 version, it stated that ocular safety is not demonstrated, and that there is a strong presumption of non-conformity with the requirements of the governing European directive.

The Foundation sets out what it takes from this and, as elsewhere in this subsection, what it does not. It does not assert that the three errors are correctly identified. It has not performed the arithmetic, it is not in a position to perform it, and the authors of the 2012 article are recorded by the reviewing agency as having declined to discuss the matter, which means the comment has heard one side. What the Foundation reports is the fact of the finding: that a national health agency, asked by its own government whether a standard was adequate, answered that the standard rests on an arithmetical error and asked for its suspension.

That fact is what belongs in this subsection, and it belongs here for a reason distinct from the one the market surveillance results were offered for. Those results showed that the measured compliance of a product depends on the distance at which the standard directs the instrument to be placed. This shows something one step further back: that the limit against which the instrument reads was itself derived, by a calculation, from an exposure scenario and a geometric assumption that a reviewing

body says were chosen wrongly. A compliance statement is a statement about a product, a measurement convention, and the derivation of the limit. The Foundation asks at Part IX.C that a federal standard specify the first two. It adds here that the third has to be documented and capable of being checked, because in this instance it was checked and it did not hold.

What the assessment yields on actual components, measured

The Foundation is able to give measured figures rather than boundary values, from the same reference chapter, which reproduces assessments carried out by the French agency for food, environmental and occupational health safety on single-chip high-brightness white light-emitting diodes. Appendix D.5.

Source	Luminous flux	Luminance	Maximum permissible exposure and risk group
Cold white	100 lm	1.6×10^7 cd/m^2	Exposure limit never exceeded. Exempt Group.
Cold white	200 lm	3.2×10^7 cd/m^2	50 to 100 s, according to correlated color temperature. Risk Group 2.
Neutral white	100 lm	1.6×10^7 cd/m^2	Exposure limit never exceeded. Exempt Group.
Neutral white	200 lm	3.2×10^7 cd/m^2	100 to 10,000 s, according to correlated color temperature. Risk Group 1.
Warm white	100 lm	1.1×10^7 cd/m^2	Exposure limit never exceeded. Exempt Group.
Warm white	200 lm	2.2×10^7 cd/m^2	Not stated in the source consulted.

Three things in that table are worth stating plainly, and the Foundation states them in ascending order of importance.

First, the luminances. A single-chip white emitter of 200 lumens presents a luminance of approximately 3.2×10^7 candelas per square meter. Part V.B.2 establishes that luminance, and the source radiance it corresponds to, is the quantity that governs retinal irradiance. For comparison, an incandescent filament is of the order of 10^7 candelas per square meter and a sunlit white wall is of the order of 10^4. The emitter is at the filament's order of magnitude or above it, in a package a few square millimeters in area.

Second, the doubling. Between 100 and 200 lumens, with luminance doubling, the cold white emitter moves from the Exempt Group, where the limit is never exceeded at any duration, to Risk Group 2, where it is exceeded in 50 to 100 seconds. The classification is not a gentle gradient. A factor of two in output moved this component across two group boundaries. And the warm white emitter at the same flux presents a lower luminance than the cold white one, which is the spectral point this comment makes throughout: the color of the light and the hazard classification move together.

Third, and the Foundation gives this its own treatment below, the chapter reports that these determinations were made at 200 millimeters, and that the picture changes substantially at a greater distance.

A correction the Foundation makes to its own argument

The chapter states the following, and the Foundation reproduces it because it is adverse and because a comment that omitted it would be unreliable:

> "However, when the viewing distance is increased to one meter, the maximum permissible exposure duration rapidly increases to a few thousands of seconds, up to a few tens of thousands of seconds. These very long exposure durations provide a reasonable safety margin to assert that there is virtually no possible blue light retinal damage from LEDs at longer

viewing distances" – a statement the author confines to the state of the art at the time of writing.

That appears to contradict Part V.B.2, which establishes at length that the retinal irradiance produced by a source the eye resolves does not fall with distance. It does not contradict it. The two statements concern different quantities, and the Foundation sets out the reconciliation because the distinction is the most technically important one in this subsection and because getting it wrong in either direction would be a serious error.

The quantity Part V.B.2 treats is the irradiance delivered to the retinal image of the source. That is set by the source radiance, and it is distance-independent for as long as the eye resolves the source. Nothing in the chapter disturbs it.

The quantity the standard assesses is different. It is the blue light weighted radiance averaged over a field of view that depends on the exposure duration being assessed. The governing guidelines specify that field in three parts. For exposures of 100 seconds or less it is fixed at 11 milliradians. Between 100 and 10,000 seconds it is 0.0011 multiplied by the square root of the exposure time in seconds. At 10,000 seconds, which is the longest duration the blue light hazard framework contemplates, it reaches 110 milliradians. The guidelines give the corresponding retinal image sizes as 190 micrometers and 1.9 millimeters.

The consequence is arithmetic. When a source subtends less than the averaging field, the averaged radiance is the source radiance reduced by the ratio of the source solid angle to the solid angle of the averaging field. The source solid angle falls as the inverse square of the distance. So the assessed quantity falls with distance, by the inverse square, once the source is smaller than the averaging field, while the irradiance delivered to the image of the source does not. Both are correct. They are not the same measurement.

The averaging is not an artifact and the Foundation does not present it as one. It has a stated physiological basis: over a long exposure the eye moves, the retinal image wanders across the retina, and the dose is spread over a larger area than the image itself. Averaging the radiance over the area the image traverses is a reasonable model of that. The 2018 Opinion describes the same mechanism, and Part V.K.8 quotes it.

That analysis is corroborated from inside the committee that wrote the standard, and the Foundation records it because the proposition is unintuitive and its own statement of it rests on arithmetic. The conference paper described at Appendix D.6, by an officer of both the laser and the lamp standards bodies, states the deliberateness of the averaging in the same terms the Foundation has used: "In some cases, this is intended, such as when the field of view represents the angular extent of eye movements for the photochemical retinal limit." And it states the consequence for a small source without qualification: "For the case that the source is smaller than the averaging field of view, the measured radiance is correspondingly smaller than the actual radiance of the source, and the analysis is less restrictive." The Foundation had reached that from the geometry. It is stated as a known property of the method by a person who helps draft the method.

What follows is therefore not that the standard is wrong, but that its protective margin at distance rests on an assumption about how eyes behave, and that the assumption has conditions. Three of them bear on the products at Part VI.

The averaging grows with duration, so the dilution credited to a distant source is largest for the longest exposures. But it never falls to nothing, and the Foundation corrects an earlier version of this passage which said that at short durations there is almost no averaging. The floor is 11 milliradians, not the minimum angular subtense, and a source at the minimum subtense is therefore diluted by the square of the ratio between them even at the shortest duration assessed: about fifty-four fold. The guidelines state the basis for that floor, and it is not the wandering eye but its opposite: 11 milliradians "represents minimal eye movements that can be associated with

staring (fixating) a certain point." A framework that assesses a source at long duration credits it with a spreading of dose that has not occurred at the moment of first exposure, and even at the moment of first exposure it credits the source with the spreading produced by the tremor of a fixating eye.

The model assumes the eye wanders. A person looking fixedly at a source, or a person for whom the source is the brightest thing in a dark field, is not well described by it. Part V.C.3 treats fixation and glare.

A source that re-presents in the same position defeats the spreading rather than benefiting from it. A strobe operating at a fixed point in the visual field returns the image to the same retinal location each time the eye returns to it, which is the opposite of the condition the averaging models. The Foundation has no measurement for this and asserts none; it identifies it as a question for § 360ii(a)(4).

And the chapter supplies the author's own criticism of the reference distance, which the Foundation had reached independently from the geometry. It states that the choice of viewing distance in IEC 62471 is sometimes ambiguous and not realistic in the context of real usage conditions, and gives as examples stage lighting workers in theatres and concert halls, who are exposed at illuminances above 500 lux, and participants in stadia lit for television, who are exposed to levels much greater than 500 lux for extended periods.

The Foundation accordingly narrows what it asserts about distance, and states the narrowed version as the one it asks the Department to consider. It does not assert that a compliance determination made at 200 millimeters understates the hazard at thirty meters. For general illumination at ordinary viewing distances the chapter's conclusion is probably right and the Foundation does not dispute it. What it asserts is that the margin depends on the source being small compared with the averaging field and on the eye behaving as the model assumes, and that neither condition has been evaluated for a high-luminance source presented repeatedly at a fixed position in the visual field, which is what the products at Part VI.C and Part VI.I are. That is a narrower claim than the Foundation might have made and it is the one the record supports.

One further figure from the chapter bears on a question raised earlier in this comment. The chapter states that Risk Group 3 is highly unlikely to be reached for the blue light hazard by any artificial white light source, that it would require a blue light level approximately 400 times the lower boundary of Risk Group 2, and that at a correlated color temperature of 6,000 K it is reached only above a luminance of approximately 4×10^9 candelas per square meter – which is above the luminance of the solar disc. The Foundation records that because it forecloses an assertion it might otherwise have been tempted to make: the products described at Part VI.I are not Risk Group 3 sources, and the Foundation does not suggest they are. The question those products raise is the one at the end of this subsection, which is that no risk group has been determined for them at all.

What the framework requires in the United States

The answer is nothing, and the Foundation states the basis for that answer in the order of its authority.

The primary basis is the regulation itself. Part II.C sets out the contents of 21 C.F.R. part 1040 and establishes that no performance standard prescribed under it reaches a light-emitting diode product. Part II.E.4 establishes that the agency's recognition of IEC 62471, which is complete and rests on the standard's scientific and technical merit, is keyed to thirteen classes of medical device and reaches no other product.

Secondary corroboration is available from industry. Underwriters Laboratories, in a white paper on assessing the photobiological safety of light-emitting diodes published in 2012, stated the position in one sentence:

> "Compliance with photobiological safety requirements in the U.S. and throughout the rest of the world is still voluntary."

The paper identifies mandatory conformity only in the European Union, under the Low Voltage Directive. It makes no mention of this agency, and none of the Consumer Product Safety Commission.

Three further statements in that paper bear on what a conformity determination establishes, and each is adverse to the weight such determinations are commonly given.

On which products are assessed at all: single indicator light-emitting diodes are, in the paper's words, typically not evaluated under the current standards.

On what the limits mean: "Exposure limits are not intended to strictly separate safe from unsafe levels. They may not accurately reflect risk for people more susceptible to optical radiation, such as those with increased photosensitivity or lens transplants." The two populations named are precisely those this comment treats at Part V.C.2.g, on the eye that has lost its crystalline lens, and at Part V.E, on photosensitivity.

On the character of the standard: IEC 62471 "is a horizontal standard. It does not directly address end-product manufacturing, labeling, or user safety requirements."

That last statement is the structural point of this subsection, and it is the manufacturer's own characterization rather than the Foundation's. A horizontal standard supplies a method of measurement and a scheme of classification. It does not say what a product may emit, how it must be labeled, or what a purchaser must be told. Those are the provisions a performance standard contains, and for this emitting technology no federal performance standard contains them.

Three axes of classification, and the confusion between them

There is a category error at the base of the present arrangement, and naming it explains why the three mismatches set out below are not failures of execution. They follow from the structure.

A product that emits optical radiation can be classified on any of three independent axes.

By coherence. Coherent or incoherent. This is a physical property of the emission, and it is the axis on which IEC 60825 and IEC 62471 divide.

That first axis requires a qualification, and the Foundation supplies it because the qualification is the strongest thing it has to say about the present arrangement. Coherence is not a property a source either has or lacks. It is a continuous quantity, measured as a coherence length, and every real source lies somewhere on it. The division the two standards draw is a dichotomy imposed on a continuum.

The optics literature has measured where light-emitting diodes lie. Reported spatial coherence lengths for diode sources run from a few to several tens of micrometers at the emitting plane, the value being set by the material of the chip and the geometry of the emitting structure. A recent study measured 41 micrometers at 0.1 meter for a commercial 525-nanometer device, rising to 77 micrometers at 0.7 meter and 110 micrometers at 1.7 meters; earlier work on a 623-nanometer chip with a 3-millimeter emitting square gives about 0.7 millimeter at 5 meters. Miao Z, Zhang P, Lu F, Han X, Li Q, "Light field analysis for modeling and transmission characteristics of partially coherent light-emitting diodes," Frontiers in Physics 2023;11:1181343, doi:10.3389/fphy.2023.1181343, open access.

The Foundation states at once what does not follow. These are small quantities, and nothing in this literature suggests that a light-emitting diode approaches the coherence of a laser or should be regulated as one. The comment's position at Part II.C.3 is unchanged: diodes and lasers differ in coherence and in collimation and the difference is real. What the measurements establish is narrower, and it goes to classification rather than to hazard. The difference is one of degree along an axis, not a difference in kind between two boxes.

The two kinds of coherence, and the one that can be computed from a data sheet

A distinction has been implicit in the foregoing and the Foundation now makes it explicit, because the word on which the scope of the receiving standard turns covers two different quantities. Spatial coherence concerns the correlation of phase between points across the emitting surface, and it is the quantity the measurements described above report. Temporal coherence concerns the correlation of phase at a single point over time, and it is fixed by the width of the emission spectrum. A source may be appreciably coherent in one of those senses and negligibly so in the other. The word incoherent, standing alone, does not say which is meant.

The second quantity has been carried through a rigorous calculation for a diode device, in the paper described at Appendix D.6. The Foundation states its limits before its findings, because they are real: it is a model and not a measurement, its configuration is deliberately two-dimensional, the devices are organic rather than the inorganic diodes principally at issue here, and the authors expressly set spatial coherence aside for organic devices on the authority of a measurement of them. What the paper supplies is the role the temporal quantity plays, and a relation by which its value can be obtained.

On the principle, the authors state the matter in terms the Foundation adopts, citing the standard treatment of coherence and radiometry:

> "As temporal or spatial coherence decrease this phase difference is no longer consistent in time or space, thus averaging on a large ensemble of sources diminishes these effects dramatically."

A quantity that decreases, with consequences that diminish as it does, is not a category. And the authors do not treat these devices as sitting at the end of that scale: they state that coherence effects must be considered when analyzing such a device, and then specify which coherence they will consider, setting spatial aside and retaining temporal. That sentence is the one the Foundation asks the Department to notice, not for its conclusion but for its form. A working physicist analyzing one of these devices has to say which coherence he means. The scope sentence of the standard does not.

The finding is that the emitted pattern is governed by the ratio of the device thickness to the coherence length. Where the thickness is much smaller than the coherence length, interference effects are noticeable; where it is much larger, the authors report a quasi-Lambertian pattern. They then identify what each regime reflects, and the Foundation quotes it because it bears on Part V.B.8: "the two extremes correspond to radiation patterns which reflect either the device properties, i.e., thickness dependent interference, or the source characteristics, leading to spectral broadening dominated pattern." The Lambertian form, in other words, is what a source produces in the incoherent limit. A source that is not in that limit emits a pattern determined by its own internal structure.

The Foundation declines the inference that lies closest to hand, and says so because it would be convenient. Part V.B.8 records that four packaged inorganic devices measured at two national metrology institutes were none of them Lambertian. Those devices carry integral lenses, a lens is the obvious explanation, and nothing here attributes those measured departures to coherence. What this paper establishes is that coherence is one route by which a source departs from the Lambertian form, not that it was the route in any measurement this comment reports.

The relation that makes the quantity useful is the definition the authors employ: the temporal coherence length is the square of the wavelength divided by the spectral width. Spectral width at half maximum is a published specification for components of this class. The Foundation accordingly sets out what that relation yields for representative emitters, and states that the arithmetic is its own and the widths representative rather than taken from any particular data sheet. For a blue emitter at 450 nanometers with a width of 25 nanometers, about 8 micrometers. For a red emitter at 630 nanometers with a width of 20 nanometers, about 20 micrometers. For a phosphor-converted white source, whose spectrum spans hundreds of nanometers, of the order of

1 to 3 micrometers. The simulations in the paper span 5 to 150 micrometers, so the narrow-band emitters fall inside the range in which that paper finds coherence to govern the pattern.

What follows is narrow and the Foundation states it narrowly. Not that these sources are coherent, which they are not, and not that they should be regulated as lasers, which the comment has never asked. What follows is that the word incoherent names a limit rather than a class; that there are two coherence quantities and the word distinguishes neither; that for the temporal quantity the value follows by arithmetic from the spectral width every manufacturer publishes, and comes out in micrometers rather than at zero; and that an instrument which assigns an entire emitting technology to one side of that boundary by naming it has not measured the thing the word refers to. The Foundation asks for the measurement, not for the reclassification.

One contrary statement is recorded here rather than left to be found. The paper described at Appendix C.86, published in the same literature and relied on at Part V.B.8 for the geometry of diode emission, states the opposite proposition in terms: “LEDs in general have random polarization and they are incoherent light sources because of the spontaneous emission process.” The Foundation does not treat the two as reconcilable by paraphrase, and sets out the difference as it understands it. The measurements described above concern transverse spatial coherence at the emitting plane. The statement just quoted concerns the averaging of phase and polarization in the detected intensity, and its author advances it to explain why the measured angular distribution is Lambertian irrespective of phase. The two are different quantities and neither author addresses the other. The Foundation accordingly relies on the measured coherence lengths for the proposition in this subsection, relies on the other paper for geometry alone, and asks the Department to resolve the question on the primary literature rather than accept either statement on the Foundation’s characterization of it.

The consequence for this subsection is this. The scope of the receiving standard, in the words of the agency’s own recognition record quoted at Part II.E.4, reaches “all electrically powered incoherent broadband sources of optical radiation, including LEDs but excluding lasers.” That sentence does not report a measurement. It assigns a technology to one side of a boundary by naming it. The physics says the technology sits at a measurable, nonzero distance from that side of the boundary, and the standard’s own distinction between the thermal sources it was written around and the semiconductor sources it has absorbed is precisely the distinction the measurement finds. An incandescent filament is a thermal emitter and is close to incoherent in fact. A diode is not a thermal emitter, and its coherence follows from the structure of its chip.

There is a practical consequence as well, and the Foundation records it because it bears on measurement rather than on category. The same study reports that modeling a narrow-beam diode as fully incoherent misstates what arrives at a distant observer, and misstates it in the permissive direction: at two kilometers in vacuum the computed beam radius was 7.89 meters for the measured coherence length and 123.61 meters for the same source treated as fully incoherent, a factor of about 15.7 in radius and, by the Foundation’s arithmetic on those two figures, about 245 in area. The incoherent assumption predicts the light is more spread out, and so weaker at the eye, than it is. That result is confined to sources with a half-power angle of 10 degrees or less and to propagation in vacuum, and the Foundation does not extend it beyond those conditions.

Whether any product described at Part VI falls within those conditions, the Foundation cannot say, and the reason it cannot say is itself the subject of this comment. The half-power angle of a light-emitting diode is a published specification at the component level and is not disclosed at the product level. Part VI.G sets out what that means for one ordinary household article, and Part IX.F asks that the characteristic be disclosed.

By application. A lamp for general illumination, a display, a signal or warning device, a projector, a therapeutic instrument, an indicator.

By emitting technology. A laser, a light-emitting diode, an incandescent filament, a discharge arc, a fluorescent tube.

The three axes are independent of one another, and that independence is the whole of the difficulty. A light-emitting diode may be a general service lamp, a pixel in a video display, a vehicle warning lamp, an indicator on a household appliance, or the emitter in an optical fibre transmitter. Knowing the emitting technology does not tell you the application. Knowing the application does not tell you the technology either: a roadway luminaire may be a discharge lamp or a diode array, and the same street may carry both.

What the revision of 2007 did was move an entire emitting technology from a standard organized on the first axis to a standard organized, in its title, on the second. IEC 60825-1 is a laser safety standard, which is to say a standard about coherence. IEC 62471 is titled Photobiological safety of lamps and lamp systems, which is to say a standard about an application.

The receiving standard straddles the two axes, and the Foundation asks the Department to look closely at how. Its scope is written on the coherence axis and is correspondingly broad: all electrically powered incoherent broadband sources of optical radiation, in the words of the agency's own recognition record quoted at Part II.E.4. Its title and its reference measurement conditions are written on the application axis. The result is a document whose scope admits every incoherent source in existence and whose measurement conditions recognize two applications: general lighting service, and everything else.

Two categories of application, for the entire universe of non-laser optical sources. That is the origin of each of the three mismatches described next, and it is why they cannot be cured by measuring more carefully.

The Foundation says plainly what it does not say. It does not say the standard is defective, or that the committee which wrote it erred. A horizontal standard is meant to be general; generality is its function, and its own publishers state in terms that it does not address end-product manufacturing, labeling or user safety requirements. The error is not in the standard. It lies in treating a horizontal standard as though it discharged the office of a product standard, which the people who publish it say it does not.

Nor is the error the Commission's to correct. Supplying product classes and the conditions that attach to them is the step the international framework leaves to national authorities, and it is the step this subsection asks this Department to take.

How the boundary between the two standards is drawn, and what one of its draftsmen says it is not

The preceding paragraphs describe a division between two instruments and decline to call it an error. The Foundation now sets out how the boundary between them is drawn in practice, because an account of it has been published by a person who holds office in both bodies. The document is described at Appendix D.6. It is a conference paper and not peer-reviewed research, and the Foundation relies on it for what it is: the account of a draftsman. Its author's own biography identifies him as secretary of the working group responsible for IEC 60825-1 and as associated division director of the Commission division responsible for CIE S009 and IEC 62471, as well as a member of the non-ionizing radiation commission whose exposure limits both standards rest on.

The occasion for his paper was an amendment permitting light produced by a laser striking a phosphor to be assessed under the lamp standard rather than the laser standard, provided its radiance stays below one megawatt per square meter per steradian divided by the angular subtense in radians. He identifies the emission mechanism as the one at issue here, calling it "the same principle used to produce white LEDs based on blue LED chip." So the provision concerns a source that produces white light in the manner of the products at Part VI, and routes it between the same two standards this subsection is about.

The author then measures that threshold against the exposure limit. For a source of 5 milliradians the threshold permits 200 megawatts per square meter per steradian. The broadband retinal thermal exposure limit for the same source size at a quarter-second exposure is 5.7 in those units.

The ratio is 35, and because both quantities vary as the inverse of the angular subtense the ratio holds at every source size. His conclusion is the sentence the Foundation asks the Department to read twice: “This clearly shows that the value given in IEC 60825-1 of (1 MW m-2 sr-1)/α … is not a safety limit; thus the products that approach that value will be RG3 under the current as well as under the upcoming edition of IEC 62471.” On what that means for an eye, he writes that at a 2 millimeter pupil the risk stays negligible, but that at a 5 millimeter pupil and a factor of 35 above a limit built on a 7 millimeter pupil, “the injury threshold for retinal injury might be exceeded also for the human case.”

The Foundation states carefully what it takes from this and what it does not. It does not assert that any light-emitting diode product sits near that threshold, and this paper gives no measurement of any product in commerce. The proposition is about the architecture rather than about any device: the criterion that decides which of two safety standards governs a product is, on the account of one of the people who drafts them, not itself a safety criterion. A product may be routed out of the laser standard into the lamp standard and arrive there in the most hazardous group the lamp standard defines. That is consistent with what Part II.E.4 records of the scope sentence of the receiving standard, which assigns by naming the emitting technology rather than by measuring what it emits.

The same paper supplies a calibration for the exposure limits themselves, and the Foundation presents it in both directions because it runs both ways. The author computes the effective radiance of the sun at 7.2 megawatts per square meter per steradian and states that “The sun exceeds the exposure limit for 0.25 s exposure duration by a factor of 2.5,” noting that the older guidelines and the American threshold limit values are exceeded as well. Read one way that tells against the Foundation: a limit that a natural source everyone has looked at exceeds by two and a half times cannot be read as a boundary of injury, and exceeding it does not establish harm. The Foundation accepts that and says so. Read the other way it tells against the condition on which the safety conclusions at Part V.K rest, because the author explains the result by an assumption rather than by a measurement: the limit is built on a 7 millimeter pupil, and “When a pupil diameter of 4.5 mm is assumed for the determination of the effective ocular exposure, the exposure limit is not exceeded.” Whether a source exceeds the limit therefore turns on which pupil the assessor assumes. That is the proposition Part V.K.3 advances about conditional conclusions, stated here by a member of the commission that sets the limits.

Three products, and what the framework says about each

The Foundation takes three examples from Part VI, chosen because in each the reference conditions of the framework fail to correspond to the conditions of use, and because the three fail in different ways.

An indicator lamp on a household appliance. On the account quoted above, a single indicator emitter is typically not evaluated at all. Whatever the merits of that practice for a dim indicator, the category is defined by the component rather than by its output, and it is the category into which a bright short-wavelength indicator falls. Part VI.G sets out two ordinary components of the same physical size whose published specifications differ by a factor of about fifty in solid angle and by more than two hundred in luminous intensity, and which are indistinguishable to a purchaser of the appliance. The category reaches both and distinguishes neither.

A large video display. Part VI.J. The reference condition is 200 millimeters, or for a general lighting service lamp the distance producing 500 lux. A display some nine meters across is encountered at distances from tens to hundreds of meters, and Part VI.J gives the distances at which its angular subtense crosses the framework’s own boundaries. A self-luminous surface of that size at those distances is not the object the reference condition was written for.

A pulsed vehicle warning lamp or deterrent strobe. Here there are two mismatches rather than one. The reference distance for a pulsed source is 200 millimeters. And the protective

premise of Risk Group 2 is that the viewer looks away within a quarter of a second, which a strobing source defeats by construction: it re-presents, repeatedly, for as long as it operates, and a deterrent strobe is designed to be aversive. The safeguard the classification relies upon is the effect the product is built to produce.

The Foundation is explicit about what it does not assert. It does not assign a risk group to any of these products, and it cannot. No determination has been made and published for any of them in the United States, and the system under which such a determination would be made is voluntary here. The Foundation notes only that high-power blue and green emitters in the 450 to 510 nanometer range are described by a manufacturer as capable of reaching Risk Group 2, and it draws no conclusion from that about any particular product in American commerce.

The risk group of a blue light-emitting diode deterrent strobe in use on American streets is unknown. That is not a rhetorical observation. It is the finding, and it is a finding about the regulatory system rather than about the product: a classification scheme exists, the agency has recognized the standard that contains it on the ground of its scientific and technical merit, and no one is required to apply it to this product or to tell anyone the answer.

What the Foundation asks

The request follows from the agency's own practice and from its own stated preference, and the Foundation frames it that way deliberately.

Part II.E.4 records two things the agency has said and done. It has recognized IEC 62471 as a complete standard, on the ground that it has scientific and technical merit, with a stated scope covering light-emitting diodes and with the electronic product radiation control subchapter cited in the same record. And it has said, of international standards in the adjacent field, that it acknowledges the advantages of one set of criteria and requirements worldwide.

On that footing the Foundation asks the Department to prescribe a performance standard for light-emitting diode products under 21 U.S.C. § 360kk, taking the measurands, the weighting function and the classification scheme of IEC 62471 – the quantities the agency has already assessed and recognized – and supplying what a horizontal standard by its own terms does not: product classes; reference conditions matched to the geometry in which each class is actually encountered; a treatment of repeated and pulsed presentation; a duration basis not confined to a single episode of under three hours; and labeling and reporting sufficient to let a purchaser and a public entity know what they are installing. Part IX.

That is what the agency did for laser products. Section 1040.10 does not restate IEC 60825-1. It prescribes classification, reference conditions, labeling and reporting for the American market, and the agency has since recognized the international standard alongside it and accepted conformity with the international standard as an enforcement alternative. The two instruments are complementary, and the agency built both. For light-emitting diode products it holds the international instrument and has never written the domestic one.

The model already exists in part 1040, and it is built on two axes

The objection that this would be complicated is a fair one, and the Foundation answers it with the agency's own regulation rather than with reassurance. Part 1040 is already organized on more than one axis, and the arrangement works.

Part 1040 contains four sections. Set beside each is the basis on which it defines the class of product it governs.

Section	Heading	Basis on which the product class is defined
1040.10	Laser products	Emission. The section sorts products into classes by accessible emission limits, which is a property of what the product emits rather than of what it is

		for.
1040.11	Specific purpose laser products	Application, layered on top of § 1040.10. Its subsections address medical laser products; surveying, leveling and alignment laser products; and demonstration laser products.
1040.20	Sunlamp products and ultraviolet lamps intended for use in sunlamp products	Application, together with waveband.
1040.30	High-intensity mercury vapor discharge lamps	Emitting technology.

So within a single part the agency classifies by emission, by application, by application nested inside an emission class, and by emitting technology. The complication is not hypothetical and it has already been managed once, in the part that would receive the standard this comment asks for.

The mechanism of § 1040.11 is the one the Foundation particularly asks the Department to notice, because it is the answer to the problem described at subsection k above. A medical laser product must comply with all of the applicable requirements of § 1040.10 for laser products of its class, and, in the regulation's words, in addition the manufacturer shall do a series of further specified things. The emission classification stays generic. The application-specific requirements layer on top of it. One set of measurands serves every product; the obligations differ by use.

Paragraph (b) of that section goes further, in a way that bears directly on Part VI. A surveying, leveling or alignment laser product must comply with the requirements for a Class I, IIa, II or IIIa product. The application therefore caps the permissible class. The regulation does not merely require that a higher-class product be labeled; for that use it forbids the higher classes outright.

That is the instrument the Foundation asks for, and the analogy is close. A surveying laser is an intense source directed into public space by an operator for a purpose unrelated to the people who encounter it. So is a blue light-emitting diode deterrent strobe. The agency's response in the first case was to decide which classes may be used for that application. The Foundation asks for the same kind of determination in the second.

The product classes, and the federal definitions that already exist

The Foundation identifies five classes, and for each one says whether a federal definition is already available. This matters because it bears on how much work the Department would actually have to do.

- Light-emitting diode general service lamps. The class already exists in federal law. Title 10 C.F.R. § 430.2 defines general service lamp at length, expressly including general service light-emitting diode lamps and general service organic light-emitting diode lamps, and expressly excluding appliance lamps, colored lamps, bug lamps, infrared lamps, marine signal service lamps and a long list besides. The Department of Energy has conducted five rulemakings on that definition. Part IV.G. This Department would not need to define the class. It would need to prescribe an emission standard for a class that is already defined.
- Light-emitting diode vehicle lamps, including flashing warning lamps. The class exists in federal law. FMVSS No. 108 regulates vehicle lamps photometrically, Part II.H.5, and SAE J595 addresses the intensity of flashing warning lamps, Part II.E.4. What is absent is any photobiological criterion attaching to either.
- Light-emitting diode roadway and area lighting. Part VI.B. The Foundation has located no federal product definition. The Illuminating Engineering Society publishes recommended practice, which is voluntary and non-federal.

Light-emitting diode displays and dynamic message signage. Part VI.J. The Foundation has located no federal product definition. The Manual on Uniform Traffic Control Devices addresses changeable message signs as traffic control devices rather than as emitting products.

Light-emitting diode indicator lamps on consumer products. Subsection k above records that these are, on the account of a testing laboratory, typically not evaluated at all under the present standards.

The Foundation does not ask the Department to invent these classes from nothing. Two of the five are already defined in federal law and administered by other agencies, and paragraph 360ii(a)(3) directs the Secretary to maintain liaison with other federal departments and agencies. Part II.E. The definitions can be borrowed. The emission criteria cannot be borrowed from anyone, because no other agency holds the authority that § 360kk confers, and each of the agencies the Foundation asked has said so. Part II.H.

How this request relates to the one at Part IX.G

The Foundation sets the two requests side by side so that they are read together rather than as alternatives, because each is incomplete without the other.

Part IX.G asks the Department to develop a classification system organized by the spatial, spectral and temporal characteristics of the emission, rather than by luminous output alone. That request concerns what is measured. This subsection asks for the complementary thing: product classes that fix the conditions under which those characteristics are measured, and that determine what is permissible for a given use.

The emission characteristics are the measurands. The product class determines where the instrument is placed, over what duration the measurement is integrated, and which classes may lawfully be used for that application. Sections 1040.10 and 1040.11 are precisely those two things, and the agency wrote both. Neither alone would have been sufficient for laser products, and neither alone will be sufficient here.

The Foundation adds one point in anticipation, because the objection is foreseeable. A domestic performance standard of this kind would not divide the United States from the international framework. Adopting the international measurands is alignment, and it is the alignment the agency says it prefers. Supplying product classes and reference conditions is not divergence from the horizontal standard, because the horizontal standard expressly does not address end-product requirements and leaves them to be supplied elsewhere. The European Union supplied them through the Low Voltage Directive and the product standards that reference IEC/TR 62778. The question for this Department is not whether to depart from the international framework. It is whether to complete it domestically, as it has already done once, for the other half of the same subchapter.

3. Disability glare, veiling luminance, and intraocular straylight

Part V.C.1 sets out a framework that asks whether an exposure produces a lesion. This subsection concerns an effect of light that produces no lesion at all and that is, for one large class of the products at Part VI, the effect that matters most. The proposition is not the Foundation's. It is stated in the ophthalmic literature in the following form: because the remote risk of retinal injury from distant illumination is considered generally low, "glare-induced visual impairment has to be regarded the main hazard for mobility-related tasks i.e., road and air traffic." Appendix C.85.

If that is right, then for every product a driver or a pedestrian encounters in the public way, the framework Part V.C.1 examines is addressed to the wrong endpoint. A source may be incapable of injuring the retina and still be capable of preventing a person from seeing what is beside it. No federal instrument addresses the second possibility, and the Foundation is not aware that any federal body has considered it.

The definition, and the two divisions that follow from it

The International Commission on Illumination defines glare as a condition of vision in which there is discomfort, or a reduction in the ability to see details or objects, or both, caused by an unsuitable distribution of luminance or an unsuitable range of luminance values. Two kinds follow from that definition and the comment keeps them apart. Discomfort glare is a psychophysical sensation producing annoyance and avoidance, and is treated at Part V.C.4. Disability glare is a physiological interaction that impairs vision, in the words of the literature, up to the extent of visual incapacitation. This subsection is about the second.

Within disability glare there is a further division, and the Foundation adopts it because it determines what a standard would have to limit. Appendix C.85 states it as follows. Veiling glare is the generalized effect of forward scatter within the eye: light from the source is scattered by the cornea, lens and other media, floods the inner eye, and lays a veil of luminance across the whole retinal image, so that the contrast of every target is reduced. Scotomatic glare is spatially specific: the loss is tied to the retinal location that corresponds to the external source, and appears as a region of reduced or absent sensitivity around it. The first is a property of the observer's optics as much as of the source. The second follows the source.

That distinction matters for the statutory question in a way the Foundation asks the Department to notice. A hazard that arises from scatter within the eye can be mitigated at the eye, and much of the literature on straylight is addressed to exactly that: filters, coatings, surgical correction of ocular opacities, lens implants. A hazard that follows the source cannot be. It is a property of the emission, and the only place to limit it is at the emission. Part II.G.3 describes the mitigations that exist; none of them is a limit on what the product emits.

What has been measured in people, and what it showed

The Foundation has found one study that measures this effect functionally, in human subjects, with both a dose axis and a wavelength axis. It is set out at Appendix C.85 and the Foundation states its limits before its findings: thirty-one healthy volunteers, monochromatic sources, a clinical perimeter rather than a roadway, and a research framing addressed to deliberate dazzling rather than to illumination.

Subject to those limits, the findings are these. A source placed off the visual axis, 15 degrees below and 10 degrees to the left of center and deliberately kept off the fovea, produced measurable loss of sensitivity across the central visual field. The loss rose with intensity at every wavelength tested. It was distributed across all quadrants out to the 30-degree limit of measurement, with absolute scotomas appearing at that limit, and with the deepest loss near the retinal location corresponding to the source. In the quadrant most affected the number of absolute scotomas was comparable with the number found in the physiological blind spot. And the authors characterize the exposures that did this as subthreshold.

Three consequences follow for this Part. The first is that the observer does not have to be looking at the source. The impairment was produced by a source the subject was not fixating and which was kept away from the center of vision by design. The second is that the impairment is not confined to the direction of the source: it was scattered across the entire field measured. The third is that it occurred below the threshold at which the frameworks at Part V.C.2 operate. Taken together these describe an exposure that every instrument discussed in this comment would record as safe and that measurably degraded what the subjects could see.

The result that bears on units, and on Part V.J

One feature of that study is of more use to this Department than its findings about glare, and the Foundation sets it out separately because it is the clearest instance in the record of a proposition argued at Part V.J.1 from first principles.

The three sources were characterized in both systems of units, radiometric and photometric, and the measured values are reproduced at Appendix C.85. The impairment they produced was ordered 530, then 470, then 625 nanometers, at every intensity. The irradiance of those sources was ordered with 625 highest at every intensity. The illuminance was ordered 530, then 625, then 470 at every intensity. The impairment ordering matches neither.

The red source delivered about one and a half times the irradiance of the blue and nearly eight times its illuminance, and impaired vision least. The green source delivered slightly less irradiance than the blue and about thirteen times its illuminance, and impaired vision most. The authors describe the result as unexpected and resolve it by the state of adaptation: the background was mesopic, at 0.255 candelas per square meter, and the spectral luminous efficiency of the eye under those conditions is shifted toward the short wavelengths relative to the photopic function by which photometric units are defined.

The Foundation draws the conclusion, and states that the arithmetic comparing the three orderings is its own rather than a finding put in that form by the authors. Photometric reporting failed to predict the effect because it weights the emission by an observer who was not present. Radiometric reporting failed on its own because an unweighted total discards the distribution. What predicted the response was the spectral composition of the source read against the adaptation state of the eye. That is why the request at Part IX.C.1 is for spectral power distribution with photometric quantities supplied in addition rather than instead, and it is why Part V.B treats the spectral characteristic as independent and not as something a single brightness figure can stand in for. The conditions under which this matters most are the mesopic ones, which are the conditions of the roadway at night. Part I.G.

What a limit on this effect looks like, in the one field that has built one

The preceding paragraphs describe an effect for which the Foundation has located no limit of any kind. Before turning to that absence, the Foundation sets out what the corresponding limit looks like in the adjacent field, because it answers in advance the objection that an effect of this kind is too subjective, too variable between observers, or too dependent on circumstance to be the subject of a quantitative standard. It is none of those things. It has been quantified, from human subject experiments, and the result was proposed for incorporation into international safety standards.

Williamson and McLin, publishing in the Journal of Laser Applications in 2018 and described at Appendix C.87, derived exposure limits for visual impairment caused by visible laser light. The first author is at the United Kingdom's Defence Science and Technology Laboratory. The second is at the Optical Radiation Bioeffects Branch of the 711th Human Performance Wing of the United States Air Force. They define the limit as the irradiance at the eye above which a defined object can no longer be detected, name it the Maximum Dazzle Exposure, and state its relation to the limit the existing standards already contain: it "is analogous to the established concept of Maximum Permissible Exposure (MPE) which sets the laser irradiance limit above which there is a risk of permanent eye damage."

The reason they built it is the reason this subsection exists, and the Foundation quotes it because the parallel is exact except for the emitting technology. "Cases of permanent eye damage caused by lasers are still relatively rare, with the risks of eye damage from laser systems being well understood and comprehensively documented in international laser safety standards. However, despite the significantly greater frequency of laser eye dazzle events, there is an absence of equivalent guidance for laser eye dazzle effects in these standards." Substitute the emitting technology at issue in this comment for the word lasers and the sentence states the Foundation's position.

The limits are resolved by three variables, and the Foundation draws attention to them because each is a variable this Part has argued must enter any adequate specification. The extent of the impairment, as a defined obscured field running from 2 degrees to 40 degrees. The state of adaptation, as three ambient luminances approximating night, dusk or dawn, and day. And

wavelength, by a weighting applied to every value. The resulting limits, which the authors propose for adoption into standards, are these, in microwatts per square centimeter at the eye.

Acceptable dazzle level	Night (0.1 cd/m²)	Dusk or dawn (10 cd/m²)	Day (1,000 cd/m²)
Very low – 2° obscured	0.001	0.6	40
Low – 10° obscured	0.04	30	2,000
Medium – 20° obscured	0.16	120	8,000
High – 40° obscured	0.6	450	30,000

Two features of that table bear on this comment and the Foundation states that the arithmetic in both is its own rather than a finding the authors put in that form. The first is the dependence on adaptation. Holding the severity of impairment constant, the irradiance required in daylight exceeds that required at night by a factor of 40,000 at the mildest level and 50,000 at each of the other three. This subsection and Part V.B.2 both argue that darkness aggravates a given emission. Here is that proposition quantified, by a defence research establishment, at four severities.

The second is the relation between the two limits, and it is the more important. The same paper states that the injury limit for a ten-second visible exposure is 1,000 microwatts per square centimeter. At night, the irradiance that obscures 40 degrees of the visual field is 0.6 of those units, about one thousand seven hundred times below the injury limit. The mildest recognized impairment arrives about one millionth of the way to it. In daylight the relation inverts, and there the authors state it themselves: beyond the mildest level, “greater levels of dazzle require irradiances that exceed the visible wavelength MPE–i.e., the observer would be at risk of eye damage if exposed to these levels of dazzle.”

The Foundation asks the Department to take from that what it takes itself, which is a proposition about limits rather than about any product. A limit addressed to injury is not a conservative proxy for a limit addressed to impairment. Whether it constrains impairment at all depends on the ambient condition, and in darkness it does not constrain it within three orders of magnitude. Part V.K.3 records that the safety conclusion of the 2018 Opinion is conditioned on exposure below limits constructed from observed injury, and that the same Opinion states that reversible effects including dazzle and glare may nonetheless occur. The table above indicates how much room there is between those two statements.

The Foundation states the limit of the comparison before it is put to it. These are laser values and they do not transfer. They are derived for a monochromatic collimated beam, and the position at Part II.C.3, that diodes and lasers differ in coherence and in collimation and that the difference is real, is unchanged. The Foundation does not ask the Department to apply any number above to any product within 21 U.S.C. § 360kk. What transfers is the method and the demonstration that the method works: define the impairment, quantify its extent, resolve it by the state of adaptation, weight it for wavelength, and derive a limit in the units the existing instruments already use. That is a template, and it exists because one research community decided that an absence of guidance on impairment was a defect in its safety standards rather than a reason to confine those standards to injury.

What is limited, and what is not

What the governing guidelines say they do not address

Before stating the absence of any limit, the Foundation sets out a passage from the instrument that supplies the limits. The guidelines on limits of exposure to incoherent visible and infrared radiation are the document on which the photobiological safety standard rests and on which the safety conclusion examined at Part V.K is expressly conditioned. They address the effect this subsection concerns in one sentence, and the sentence is a disclaimer.

> "Just as optical radiation protection levels do not protect against visual disturbances from glare, these guidelines do not preclude potential light-induced modulation of physiological rhythms since the effects are not necessarily adverse responses."

The Foundation asks the Department to read the two halves of that sentence separately, because each disposes of a different question. The first half states that protection levels of this kind do not protect against glare. It is stated not as a limitation to be remedied but as a known property of the instrument, by way of analogy to the second half. So the effect described in this subsection is outside the exposure limits by the design of the exposure limits, and the absence of any federal limit on it recorded below is not an oversight in the translation of the international framework into American law. It is a faithful translation of a framework that does not reach the effect. The second half states that the guidelines do not preclude light-induced modulation of physiological rhythms, which is the subject of Part V.F.

The preceding paragraphs of the same discussion are worth having as well, because they show that the exclusion is not for want of awareness. The guidelines record that "Environmental illumination influences human health and well being by altering circadian, neuroendocrine, neurobehavioral and melatonin responses", that an action spectrum for some of those responses has been described, and that among the reported side effects of therapeutic levels of illumination are "photophobia, ocular discomfort, headache, and enhanced glare sensitivity." Four of the responses this comment is about are named in the document that sets the limits, in the passage in which it explains that they are not what the limits are for.

What follows is the proposition on which this subsection and Part V.K.3 converge, and the Foundation puts it without embellishment. A safety conclusion conditioned on compliance with these exposure limits is a conclusion about the injuries the limits were constructed to prevent. It is not a conclusion about glare, and the authors of the limits say so. The Department is accordingly asked to note that the three expert assessments examined at Part V.K, each of which conditions its safety finding on these limits, cannot by that route have addressed the effect this subsection describes, whatever else they addressed.

The Foundation has not identified any federal limit bearing on disability glare from any product within 21 U.S.C. § 360kk. There is no federal limit on the luminance of an emitting surface, which Part V.C.4 identifies as the quantity that drives glare and which the light-emitting diode has raised beyond any earlier source. There is no federal limit expressed as a permissible veiling luminance, and no federal measurement convention for straylight. Federal Motor Vehicle Safety Standard No. 108 limits luminous intensity at certain angles above the horizontal, which operates indirectly on glare, but it limits intensity rather than luminance and was not derived from any criterion about vision. Part II.E.5 and Part VI.B.

The Foundation accordingly asks for two things in this subsection, and both are at Part IX. The first is that the study required by paragraph (a)(4) include functional endpoints and not only injury endpoints, since an instrument that records only lesions will record nothing here. The second is that any measurement protocol adopted under paragraph (a)(2) characterize the emission spectrally and characterize the adaptation state of the observer it is meant to protect, because the evidence above shows that an exposure summarized in a single number, in either system of units, did not predict what it did to vision.

4. Discomfort glare and its measurement

The report described at Part V.C.2.f treats discomfort glare, and two of its statements belong here. On prevalence, at page 11: "It is the most common cause of immediate complaints about lighting." On the adequacy of the means of predicting it, at the same page:

> "Future lighting standards should include more accurate ways to predict discomfort glare by considering both the non-uniformity of SSL light source and the spectral distribution of light."

That recommendation names the two emission characteristics identified at Parts V.B.1 and V.B.2 — the non-uniformity of the emitting surface and the spectral distribution — and states that present standards do not adequately account for either. The Foundation relies on it for that proposition and for no more. Parts IX.H.6 and IX.H.7.

a. The quantity, and why it differs from the quantity used elsewhere in this Part

Discomfort glare is driven by luminance. Luminance is luminous intensity per unit of apparent emitting area, expressed in candelas per square meter, and it is a photometric quantity: it is weighted by the photopic luminous efficiency function described at Part I.G. The Foundation draws attention to that because it is a departure from the rest of this Part. The argument at subsections d and h above, and at Part IV.C, is that photometric units are the wrong units for the non-visual responses and that receptor-weighted quantities are required instead. Discomfort glare is the exception. It is a response of the visual system, and luminance is the appropriate quantity for it. The Foundation states this rather than allowing the two arguments to merge, because a comment asserting that photometric units are simply wrong would be overstating its case and would be corrected. Two distinct complaints are at issue in this Part: a non-visual aversion response, for which Appendix C.51 identifies a melanopsin-mediated pathway and for which melanopic quantities are required; and discomfort glare, which is visual and for which luminance is required. They call for different measurements and the Department should be asked for both.

A second feature of luminance bears on every product class at Part VI. Because luminance is intensity divided by apparent area, a source delivering the same luminous flux from a smaller emitting surface has a higher luminance. The light-emitting diode is the smallest and brightest emitting surface ever deployed at scale in general illumination, as Part V.B records. The quantity that governs discomfort is therefore the quantity on which this technology departs most sharply from everything that preceded it, and it is a quantity that no specification required of any product within this Department's authority reports.

There is a further point about luminance which the Foundation puts here because it bears on every product class at Part VI, and which it takes from the industry rather than asserting against it. Appendix D.3 describes a component maker's white paper of February 2023 addressed to what it calls high-luminance directional lighting. The document sets out five attributes it identifies as critical, and the first and third are a small light emitting surface and a small emitting angle. It states the design principle in terms: "What matters is not only flux, but flux per emitting area, called lumen density."

Flux per emitting area is luminance. The quantity the preceding paragraphs identify as the one that drives glare, and which no federal instrument limits, is the quantity the industry identifies as the thing to maximize. The Foundation does not suggest there is anything improper in that. A spotlight that is not concentrated is a failed spotlight, and the engineering is addressed to the purpose the product is sold for. What the Foundation asks the Department to notice is the direction of travel. There is a commercial and technical gradient pushing this quantity upward, it is explicit in the trade literature, and there is nothing on the other side of it.

The same document illustrates what that produces. In a comparison of two emitters of 1.2 square millimeters behind the same dome lens, each supplied with 500 lumens, it reports an on-axis intensity of 84,153 candelas for a square emitting surface and 112,940 candelas for a round one, with beam angles at half maximum of 3.13 and 2.77 degrees and beam distances to one lux of 290 and 336 meters. The change from a square emitting surface to a round one, with no change in the power supplied, raises the on-axis intensity by about 34 percent. The Foundation records those figures because they are among the few published values in this comment for what a contemporary directional product actually emits, and because the beam angles place these devices within the regime discussed at Part V.C.2.k.

b. The Unified Glare Rating, and the term that answers the question people actually ask

The established means of predicting discomfort glare from an interior lighting installation is the Unified Glare Rating of the International Commission on Illumination. It is a logarithmic function of a summation over the glare sources in the field of view, of the form:

$$UGR = 8 \log_{10} \left[(0.25 / L^{b}) \times \Sigma \left(L^{s2} \, \omega / p^{2} \right) \right]$$

Four quantities appear in it, and each corresponds to something a person experiences:

L^{s}, the luminance of the glare source, in candelas per square meter.

ω, the solid angle the source subtends at the eye, in steradians, which is a function of its apparent size and its distance.

p, the Guth position index, which weights the source according to its angular displacement from the line of sight; a source directly ahead contributes more than the same source in the periphery.

L^{b}, the background luminance against which the source is seen.

The Foundation asks the Department to attend to the last of these, because it is the term that answers the most common account given in the reports collected at Part VII. Background luminance sits in the denominator. The rating therefore rises as the surround darkens: the same source, unchanged in every respect, produces a higher predicted discomfort in a dark environment than in a lit one. A person who reports that a particular light is intolerable at night and unremarkable by day is not describing an idiosyncrasy, and is not describing a change in the product. That person is describing the behavior of the term the governing metric places in its denominator. The experience is not outside the standards. It is what the equation in the standards predicts.

Two consequences follow at once. The first is that an indicator lamp on a domestic appliance, a charging light, a display in standby, or a street luminaire seen from a darkened bedroom are the worst case the metric can describe, because each combines a high source luminance with a near-zero background. The second is that this is a computable and foreseeable condition rather than an unforeseeable one. Nothing about it requires new science.

c. The validity domain, which is where the metric fails for this technology

The Unified Glare Rating was developed and validated for the sources in general use when it was developed: comparatively large luminaires of moderate luminance, in interiors, viewed at the distances and angles of an office or a similar room. Two limits follow, and the Foundation states them as limits of the metric rather than as criticisms of it.

The first is geometric. The source term enters as luminance squared multiplied by solid angle. For a fixed luminous flux, reducing the emitting area raises luminance and lowers solid angle together, and the metric was neither derived nor validated across the range of source sizes that light-emitting diode products now span. The Commission places stated bounds on the solid angle over which the rating is applicable. A small, intensely bright emitter viewed at close range falls at or beyond the edge of that range, and an unshielded diode die is the clearest instance of such a source. The metric does not say that such a source is acceptable. It does not apply to it.

The second is that the Unified Glare Rating is a metric for interiors. It is not the metric used for roadway or exterior installations, which are assessed by different quantities again, and vehicle lamps are governed by neither: Federal Motor Vehicle Safety Standard No. 108 specifies luminous intensity in candela at defined angular test points, as Part II.G.3 records, and contains no luminance requirement, no background-luminance term and no glare rating of any kind. The exposures that generate the largest number of reports at Part VII are therefore distributed across three different measurement regimes, one of which does not address the phenomenon at all.

The position index, measured for this technology in 2024

One term of the rating has since been measured for light-emitting diode sources, and the Foundation sets out what was found because part of it supports the argument above and part of it does not.

The position index entered the literature in 1949, in work by Luckiesh and Guth. In April 2024 Abboushi, Miller, Rodriguez-Feo Bermudez, Irvin and Royer, of Pacific Northwest National Laboratory, published in LEUKOS, the journal of the Illuminating Engineering Society, a human-subjects study measuring the position index for overhead light-emitting diode sources. Appendix C.62. They state that the applicability of the index to modern diode sources had not previously been evaluated.

Three of their findings support the argument of this subsection.

The first is their statement of the gap itself. A term that has been in use in glare prediction since 1949 had not been evaluated for the source type that now dominates general illumination, and a national laboratory said so in 2024.

The second concerns source size, which is the characteristic Part V.B.2 identifies as the one on which this technology departs most sharply from its predecessors. The authors used a source of approximately 0.0004 steradian, about a third of the solid angle used in the 1949 work, and they attribute part of the difference in their results to that. They state that the present practice of applying the same position index irrespective of source size warrants further study, and that the interaction between source size and the index remains untested.

The third concerns luminance. The authors observe that the 1949 values may have been influenced by the use of a single anchor and a limited luminance range, and that this bears on their applicability to current light-emitting diode sources with potentially higher luminance. Their own test sources reached luminances of the order of a million candelas per square meter.

What the same study tells against

Two of its findings are adverse to positions this comment might otherwise take, and the Foundation states them here rather than in a footnote.

The first is the direction of the discrepancy. Measured against an on-axis reference, the geometric mean position index for a source 60 degrees above the line of sight was 53 in the 2024 study, against 16.9 in the 1949 work, and the gap widened with increasing vertical angle. The position index enters the rating in the denominator and squared. A value three times larger therefore reduces that source’s contribution to the summation by approximately a factor of ten, which on the logarithmic scale of the rating is a difference of about eight units. The consequence is that a rating computed with the 1949 values predicts substantially more discomfort from a high, off-axis source than the 2024 measurements support, not less. As to that term and that geometry the established metric is conservative, and the Foundation does not suggest otherwise.

The second is spectral. The authors compared a cool source of approximately 4,550 K with a warm source of approximately 2,500 K and found no statistically significant difference in the position index or in the luminance at the borderline between comfort and discomfort, at either background level, with the direction of the small differences inconsistent across positions. They state that their study calls into question the effect of spectral power distribution on discomfort glare.

That is directly contrary to the recommendation quoted at the opening of this subsection, that future standards predict discomfort glare by considering the spectral distribution of light, and it bears on the Foundation’s own petition to limit the correlated color temperature of vehicle headlamps, described at Part IV.C.5. The Foundation reports it for that reason. Three qualifications belong with it and none of them is offered as a rescue. The authors themselves hypothesize that the adaptation periods of two to five minutes between spectral conditions may have weakened any spectral effect. The comparison was between two correlated color temperatures of broadly similar sources rather than across the range of spectra at issue. And

discomfort glare is one response among several; a null result for it says nothing about disability glare at subsection 3, about the melanopsin-mediated aversion at Appendix C.51, or about the retinal hazard, each of which is spectrally weighted by a different function.

The Foundation accordingly does not claim that warmer light is less discomfort-glaring, and any passage elsewhere in this comment that implies it should be corrected. What it claims is narrower and survives: that the metric's terms were derived for sources unlike the present ones, that their dependence on source size is untested by the field's own account, and that no federal instrument requires any of it to be computed for any product.

Where the research capacity sits

One institutional observation follows and the Foundation makes it once. This study was performed at a national laboratory of the Department of Energy. So was part of the work on near-infrared content described at Part V.B.6, and researchers of the same laboratory are among the authors of the intergovernmental review at Part V.C.2.f. The federal capacity to conduct human-subjects research on the visual effects of light-emitting diode products exists, is in use, and sits in the department whose statutory concern is the efficiency of the product rather than its effect on the person. Paragraph 360ii(a)(3) directs the Secretary to maintain liaison with other Federal departments and agencies with related interests, and paragraph (a)(6) directs consultation. Part II.H.4 and Part IV.G.

d. What is and is not a property of the product, and which provision reaches each

The Foundation puts the following to the Department because it bears on the choice of instrument rather than on the existence of a problem, and because it concedes something.

Contrast is not a property of a product. It is a relationship between a source and its surround, and the surround is a function of where the product is installed, when it is operated and what else is lit. No emission limit on a lamp can control the background luminance against which the lamp will be seen, because the lamp does not know what room it is in. A performance standard prescribed under 21 U.S.C. § 360kk cannot, by itself, address the condition described at subsection b.

The two terms of the problem divide cleanly, however, and each falls to a different provision of the statute.

Source luminance is a product property. It is fixed by the emitting area and the drive current at the point of manufacture. A manufacturer can reduce it without reducing luminous flux, by distributing the same output over a larger emitting surface or by diffusing it, which is the elementary technique recorded at Part II.G.3 for indicator lamps. A limit expressed in candelas per square meter is a limit on a product characteristic, and that term is within the reach of § 360kk.

Background luminance, and therefore contrast, is a function of installation, timing and use. It is reached not by a performance standard but by the procedures and techniques for minimizing exposure that § 360ii(a)(5) directs the Secretary to develop, test and evaluate — shielding, aiming, dimming, adaptive control, curfews, and the defeat of standby illumination in sleeping areas — and by recommendations under § 360ii(b)(1)(B). Part II.G.3 sets out that these techniques already exist for every product class at Part VI, and that what is absent is the federal evaluation of them.

That division is the Foundation's answer to a question the Department may fairly ask of this whole Part: granted a problem, which of your provisions do you say reaches it? For discomfort glare the answer is both, in different parts, and the Foundation does not ask for a performance standard to do work that a performance standard cannot do.

e. The status of the metric

The Unified Glare Rating is a recommended practice. It is published by a standards body, used by lighting designers in the design of installations, and incorporated by reference into national lighting standards in some jurisdictions. It is not an emission limit on any product, it is computed for an installation rather than for a lamp, and no federal rule within this Department's authority requires its use or sets a value for it. The position is therefore the same as that recorded for temporal light modulation at Part V.D.3 and for the seven circadian lighting documents at Appendix C.42: a quantitative metric exists, the field uses it, and nothing binds anyone. The single metric that does describe the most common complaint about lighting is a voluntary design recommendation, computed for installations rather than for products, and not valid for the source geometry that provokes the complaint most often.

f. The metrics used outdoors, and a manufacturer's account of why each of them fails

Subsection c records that the Unified Glare Rating is a metric for interiors, that roadway and exterior installations are assessed by different quantities, and that vehicle lamps are governed by neither. This subsection identifies those different quantities and sets out what is said about them, and the Foundation takes the account from a manufacturer of the equipment rather than from a critic of it. Appendix D.3 describes a white paper published by Cree Lighting on March 3, 2022, under the title Is Street Lighting Damaging Our Health?

The document identifies five instruments in current use. Three are the methods within the European roadway standard EN 13201: the Threshold Increment, the G-star luminous intensity classes, and the D-star disability glare index. To these it adds the Glare Rating index of CIE 112, adopted for other outdoor purposes, and the G rating of the Illuminating Engineering Society technical memorandum, which the document describes as one of the most commonly used methods for outdoor lighting and which is the American instrument in the list. Its general statement is that each was derived from research conducted before light-emitting diodes existed as a light source, and that most lighting standards do not specify design targets for discomfort glare at all, while those that do are not used universally and rest on subjective ratings that favor older technologies.

Its criticism of each is specific, and the Foundation reproduces the substance because the specificity is what makes the document useful:

Of the Threshold Increment: the calculation averages the luminance of the luminaire rather than taking the highest value, it assumes point source optics, and it does not represent user experience for high luminance, non-uniform and multi-point luminaires.

Of the G-star classes: the calculation rests on maximum luminous intensity at angles above 70, 80 and 90 degrees, while the vision cone of the human eye above the horizon is limited to 50 degrees, so that the luminance delivered at the reference angles affects the human visual field only partially and only at distance. The document's conclusion is that this "renders the metric ineffectual."

Of the D-star index: it is based on luminance at 65 degrees only, dividing maximum luminous intensity by the flashed area of the luminaire, where the maximum intensity is not necessarily at 65 degrees and the flashed area is simplified to the optical surface, so that the non-uniformity and intensity of diode sources "make this metric ineffective."

Of the CIE 112 Glare Rating: it evaluates the average luminance over the luminaire aperture, which the document calls "a highly inaccurate assumption now that we have luminaires with visible arrays of LEDs," and which "misstates the area and the luminance."

Of the Illuminating Engineering Society G rating: it rests on zonal lumens, is therefore based only on luminous flux, "does not consider true luminaire luminance," and does not consider luminaire uniformity or the size of the luminance opening.

One further figure in that document is worth stating on its own because it is a numerical mismatch rather than a general criticism. The document states, twice, that the eye begins to see direct light at 65 degrees from the nadir of a streetlight while the luminaire visual comfort level is evaluated at 70 degrees, which it says is normally where most of the roadway optic's peak intensity lies. If that is right, the assessment angle and the angle at which a person first sees the source directly are not the same angle, and the difference falls in the direction that omits the peak.

The Foundation asks the Department to weigh the source of these criticisms rather than to take them on trust. They are made by a manufacturer of the luminaires being criticized, in a document addressed to specifiers and public authorities, and they are made against the instruments by which that manufacturer's own products are shown to comply. A party has little commercial incentive to publish that the measurements its products pass are inadequate to the hazard. Where such a party does so, the statement is worth more than the same statement from a critic, and the Foundation relies on it accordingly. It does not rely on it as a scientific finding: the document is not peer reviewed, it cites few sources, and it argues for a change in standards from which its author would benefit.

The consequence for this comment is the one stated throughout Part V.C. Every metric named above is voluntary in the United States. None is an emission limit on a product. The Threshold Increment, the G-star and D-star classes and the CIE Glare Rating are European or international instruments with no force here, and the Illuminating Engineering Society memorandum is a technical memorandum of a professional society. A person standing under an American streetlight is protected by none of them, and the manufacturer's position is that even where they are applied they do not describe what that person experiences.

5. Age, astigmatism, cataract, and intraocular lenses as modifiers

This subsection concerns the people for whom the quantities in this Part do not describe the exposure. The optics of the eye are not uniform across a population, and three of the departures are common, well characterized and relevant to every product in Part VI. The Foundation sets out what it can support and marks what it cannot, because this is a subsection where the temptation to argue beyond the evidence is strong.

The optical mechanisms, which are established

Astigmatism, uncorrected or incompletely corrected, spreads the image of a point source into a line or a flare rather than a point. The relevant consequence for this comment is not blurred vision but the distribution of light within the retinal image: the same flux from the same source is spread over a different area and in a different shape. Part V.B.8 establishes that these sources present small emitting areas at very high luminance, which is the condition under which the difference between a well-formed and a poorly formed retinal image is largest.

Age changes the crystalline lens. It becomes less transparent and acquires a yellow tint, which reduces the short-wavelength light reaching the retina, and it scatters more, which raises the veiling luminance across the retinal image. Those two changes work in opposite directions for blue-light exposure and in the same direction for glare. Part V.C.3 sets out the scattering mechanism and Part V.F the spectral one.

Cataract extraction and replacement with an intraocular lens removes the yellowed crystalline lens and substitutes an implant. Where the implant does not filter short wavelengths, the retina of a person in the eighth decade receives short-wavelength light at levels characteristic of a much younger eye, while the retina itself retains the cumulative exposure history and the age-related vulnerability of its own decade. This is the one instance in the whole of Part V where a medical intervention alters a person's optical exposure to a regulated class of emission, and the Foundation draws it to the Department's attention for that reason.

What the Foundation can presently support by measurement, and what it cannot

The mechanisms above are optics and are not in dispute. What the Foundation has been able to find far less of is measurement of the consequence in people exposed to these products. One study bears on it directly and the Foundation gives it with its weight stated.

A survey of 206 attendees at Portuguese summer festivals, described at Appendix C.95, asked about sensitivity to lighting and recorded refractive condition. Sensitivity differed significantly by refractive condition ($p = 0.0375$), with astigmatism at 3.51, hyperopia at 3.62 and presbyopia at 3.88 on a five-point scale, against emmetropes at 2.75 and myopes at 3.08. The authors report that 33.1 percent of festivalgoers with refractive errors experienced heightened sensitivity to artificial and stage lighting. The same survey found sensitivity to stage lighting varying significantly with age ($p = 0.0472$), highest in the 66 to 75 group.

The Foundation states the limits of that evidence in the same breath, and they are considerable. It is self-report, not measurement. It is cross-sectional, and the authors say expressly that the design limits any inference of causation. The sample of 206 carries a margin of error the authors give as 6.8 percent, and they state that they are identifying trends rather than drawing generalized conclusions. Nothing about the light at any festival was measured. And the scale anchors are not stated in the published paper as the Foundation read it, so the means above are comparisons between groups rather than values on a known scale.

What the study therefore supports is narrow and the Foundation claims no more than it: in one surveyed population, people with astigmatism, hyperopia or presbyopia reported greater sensitivity to artificial and stage lighting than people with no refractive error, and the difference reached conventional significance. That is consistent with the optics and it is not a demonstration of it.

What the people who administer the exposure limits say about this population

The subsection so far has argued from optics and from one survey. There is a third source, and it is better than either, because it is a statement about the limits themselves by a body that tests products against them.

A white paper of Underwriters Laboratories, described at Appendix D.3 and relied on at Part V.C.2 for the history of the standards, states that the photobiological exposure limits are not intended to strictly separate safe from unsafe levels, and that they may not accurately reflect risk for more susceptible people, including those with increased photosensitivity or lens transplants.

The Foundation asks the Department to weigh the source as well as the statement. Underwriters Laboratories sells photobiological testing against these limits. The statement is against its commercial interest, it is published in its own name, and it names the two populations this subsection and Part V.C.3 are about.

What follows is a sharper proposition than the optics alone support, and the Foundation states it in its final form. The argument of this subsection is not merely that certain eyes receive a different exposure from the average eye. It is that the numerical limits by which optical radiation is assessed are not represented by the body administering them as protective of the people whose eyes differ in exactly these ways, and that the person with a replaced lens is therefore outside the protection of a framework that was voluntary to begin with. A performance standard prescribed under 21 U.S.C. § 360kk would have to decide what it does about that population. The present arrangement has not decided; it has disclaimed.

Why this belongs in a comment to this Department

Because a performance standard prescribed under 21 U.S.C. § 360kk is written for a population and not for an average eye, and because the populations described here are large. Presbyopia is universal after middle age. Astigmatism is among the commonest refractive conditions. Cataract surgery is among the commonest surgical procedures performed in this country. A standard whose protective premise is the optical performance of a young emmetropic eye does not protect

any of them, and the Foundation asks the Department to make the population assumption explicit in whatever it prescribes rather than leaving it implicit as the present voluntary framework does.

D. Temporal Light Modulation (Flicker)

1. Pulse-width modulation, modulation depth, and frequency

This subsection states what temporal light modulation is, where it comes from in these products, how it is measured, what limits exist, and what the people who write the governing documents say is not yet known. It is built principally on a 2024 review in IEEE Transactions on Industry Applications, described at Appendix C.91, and the Foundation begins with who wrote that review because the authorship determines the weight of everything taken from it.

The source, and why its authorship matters

The review has six authors. One is of a French public research institute and one of a French university laboratory. The other four are of the lighting industry: the standards and regulations function of Signify, the director of engineering services of Cree Lighting, a lead scientist of Lutron Electronics, and a consultant who also holds a university appointment. The paper states its own standing: a joint working group of the IEEE Industrial Applications Society and the Illuminating Engineering Society was formed to review the knowledge on this subject, its survey was incorporated into the IEEE 3001.9 and IES RP-48-2023 Recommended Practice of May 2023, and "This paper is authored by members of the joint IES / IEEE working group." What follows is accordingly not the Foundation's characterization of the state of knowledge. It is the characterization given by the authors of the American recommended practice, four of them employed by manufacturers, published in a peer-reviewed journal of the institute that issued it.

Where the modulation comes from

The review identifies five origins, and the Foundation sets them out because the third is the one at issue throughout this Part. Modulation at twice the mains frequency, so 100 or 120 hertz, in sources run from an alternating-current converter, its depth depending on the electrical design of the driver. Modulation at the 20 to 100 kilohertz switching frequency of high-frequency drivers, often superimposed on a residual 100 or 120 hertz component. Pulse-width modulation, which the review describes as "a square wave modulation profile with constant frequency, usually of a few hundred Hz, and 100% modulation depth", with the duty cycle varied to set the average light level, and which "is used in many dimmable LED lighting systems." Low-frequency broadband modulation introduced by phase-cut dimmers. And transient modulation from disturbances on the supply, for which the review lists causes including sudden load changes, powerline communications, lightning and wind, and distributed generation from wind and solar.

The Foundation draws attention to one feature of that list. The dimming method in general use operates at full modulation depth by construction. The depth is not a defect of a particular driver that better engineering would remove; it is how the method works, and the only variables are the frequency and the duty cycle. Part V.D.2 sets out what is known about the visibility of exactly that waveform.

Modulation depth, and the objection that fluorescent lighting flickered too

That objection is the commonest and the most reasonable one this Part attracts, and the Foundation answers it here rather than waiting to be put to it. The objection is that modulation is not new, that fluorescent and even incandescent lighting modulated at mains-related frequencies for a century, that people lived under it, and that a comment complaining of modulation in the newer technology is complaining of a characteristic of electric light itself.

What the sources permit the Foundation to say about depth, and what they do not

The Foundation begins by stating what it does not have, because the temptation here is to compare two numbers that are not comparable. It has no measured peak-to-peak modulation depth for any fluorescent lamp or for any light-emitting diode product. It has three statements of different kinds from three sources, and it also notes that the sources use two different quantities: the flicker percent, which is the modulation depth and which Part V.D.1 defines above as the magnitude of the variation relative to the average, and the flicker index, which is the ratio of the area under the curve to that over it and which, in the instrument maker's words, "specifies the duty cycle of the signal". The two are not interchangeable and a figure given in one must not be reported as the other.

Arranged by technology, and with the quantity named in each case, the record is as follows.

- Incandescent lamps modulate at the supply frequency, and the ecological study at Appendix C.94 describes the "intensity of flicker" as low, giving the quantity as a low flicker index. The reason is the thermal inertia of the filament, which continues to radiate between current peaks.
- Fluorescent lamps on magnetic ballasts modulate at twice the supply frequency, and their depth is not fixed. The authors of IEEE Std 1789-2015 state that "The peak-trough modulation depth of the 100-120Hz flicker from older fluorescent lamps with magnetic ballasts varies with the component phosphors, some of which exhibit persistence, varying the chromaticity of the light through its cycle". The persistence of the phosphor is what prevents the lamp from extinguishing fully between half-cycles, and it is therefore a physical limit on how deep the modulation of such a lamp can be.
- Light-emitting diodes driven at twice the supply frequency are compared with fluorescent lamps by the same authors, and the Foundation quotes the comparison rather than quantifying it: such devices "may have a depth of modulation greater than that from most fluorescent lamps. The effects of the flicker are therefore likely to be more pronounced in these cases". The reason is the converse of the fluorescent case. The emitter has no thermal inertia and, in the ordinary case, no persistent phosphor intermediary of the kind that limits a fluorescent lamp, so its output follows its current.
- Light-emitting diodes dimmed by pulse-width modulation are the case in which a figure is available, and it is definitional rather than measured. The review at Appendix C.91 defines the method as "a square wave modulation profile with constant frequency, usually of a few hundred Hz, and 100% modulation depth", the duty cycle being varied to set the average output. Full depth is not an observed value of a particular product; it is what the method is.
- Light-emitting diodes dimmed by amplitude control are the case in which there is no modulation to measure, and the Foundation records it here because it is the answer rather than the problem. The authors of the standard describe a method "in which the current through the LED is continuous and not pulsing" and state that it "does not use flicker to adjust brightness and therefore, should not induce flicker related health risks".

What the figure of 35 percent is, and what it is not

The Foundation is precise about this because the figure is the most useful number in Part V.D and because it is easy to misuse. The authors of the standard state that "The peak-trough modulation depth known to induce headaches from fluorescent lighting at 100Hz is about 35%", citing the double-masked study described at Part V.D.3. That figure is the modulation depth of the lighting used in the experiment that doubled the incidence of headaches among office workers. It is therefore a dose shown sufficient to produce an effect. It is not the characteristic modulation depth of fluorescent lighting, it is not a maximum, and above all it is not a threshold below which nothing happens, because no lower depth was tested. The Foundation does not assert and does not imply that 35 percent is a safe boundary.

The three answers to the objection

The first answer uses the figure correctly. A modulation depth of about 35 percent at 100 hertz was shown, under masked conditions, to double the incidence of headaches in office workers. The dimming method in general use in the newer technology operates at full depth by construction, at frequencies of the same order. Whatever else is unknown, a method that operates at full depth operates above a depth that has already been shown sufficient to produce the effect in question. The comment does not need to know the depth of any particular fluorescent lamp to make that point, and it does not make the comparison numerically.

The second answer concerns where the depth comes from. In the fluorescent case the depth is a consequence of the physics and is bounded by it: the phosphor persists, and the lamp cannot modulate fully. In the pulse-width case the depth is the design. It is not a defect that better engineering would remove, because full extinction between pulses is how the method sets the average level. So the two technologies are not two instances of one phenomenon differing by degree of imperfection. One is limited by its physics and the other is maximized by its control method, and the comparison the objection invites therefore runs the wrong way.

The third answer is the one the Foundation asks the Department to weigh longest, because it accepts the objection entirely and is unaffected by it. The double-masked study that found a doubling of headaches was a study of fluorescent lighting. The reduced speed of visual search in two masked studies was under fluorescent lighting. The enlarged saccades over text, the increased heart rate in agoraphobic individuals, the phase-locked thalamic firing in the cat: all fluorescent. The evidence that modulated light affects people is, almost in its entirety, evidence gathered under the previous technology. The objection that fluorescent lighting flickered too is therefore not an argument that modulation is harmless. It is the observation that the predecessor technology modulated, that the studies run on it found effects, and that nothing was required of it either. A regulator told that a hazard is not new is being told that it has been present and unaddressed for longer than supposed.

What the Foundation does not claim

Four things, stated so that the passage is not read for more than it says. It does not claim that fluorescent lighting was safe; the one masked study run on it found an effect. It does not claim that every light-emitting diode product modulates deeply; a device on a well-filtered constant-current driver may modulate very little, and a device dimmed by amplitude control essentially not at all, which is why Part IX asks for a performance standard rather than for a prohibition. It does not claim that 35 percent and 100 percent are measurements of two comparable things. And it does not claim that depth alone determines effect: the sources are unanimous that frequency, depth, duty cycle, luminance, field of view and visual task all bear on it, and the authors of the standard say so in terms.

What is measured, and over what range

The quantities are the modulation frequency, the modulation depth and the flicker index, and the review records that these three were found insufficient because they were “loosely correlated to the temporal light artifacts perceived by human vision”, which is why the standards bodies formed joint groups to develop perceptual measures. The laboratory method for capturing the waveform is the joint American national standard ANSI and IES LM-90-20 of 2020, which the review describes as “covering modulation frequencies 1 Hz and 3 kHz”.

Two consequences follow and the Foundation separates them. The first is the Foundation’s own arithmetic and is attributed as such: the same review states that the phantom array effect occurs from about 100 hertz to about 10 kilohertz, so the American laboratory measurement standard covers less than a third of the frequency range in which these authors say one of the three effects occurs. The second is the review’s own statement, and it concerns verification rather than range: “Portable instruments are now available to perform on site TLM waveform measurements and return TLM and TLA metrics. However, there is no standard covering the field measurement of

these parameters.” There is, that is, no standardized way to measure what a product is doing where it is installed.

The conditions the review specifies for a valid measurement are worth stating for the same reason. Modulation “should be measured without daylight, without any unwanted light from another lighting/display installation nearby and without any moving objects or people in the field of view of the measurement device.” A quantity defined under those conditions is not a description of what a person is exposed to in a street or a store.

The Foundation records the statement in the review that runs against its position, and does so here rather than later. “The temporal light modulation in a real-world application, consisting of multiple light sources is generally lower than the TLM performance of a single light source due to the averaging out of the light modulation from the different light sources.” In a room lit by many luminaires the modulation seen is therefore expected to be less than any one product’s rating, and a comment that ignored this would overstate the interior case. The limit of the proposition is that the averaging requires several independent sources in the field of view. It does not reach a single dominant source seen against a dark field, which is the headlamp, the warning beacon, the message sign and the lone luminaire overhead at night, and those are the products at Part VI. The review adds that combination of waveforms “could, in principle, lead to beat frequencies if the frequencies slightly differ between luminaires”.

What limits exist, and the three tiers of coverage

The review’s survey of standards resolves into a gradient, and the Foundation sets it out in a table because the shape of the gradient is the point. For flicker there is a measure and a limit accepted worldwide. For the stroboscopic effect there is a measure but no agreed limit, and the American figure is four times the European one. For the phantom array effect, for the stroboscopic effect on machinery, and for eyestrain, migraine and headache, the review records the measurement method as nonexistent.

Effect	Measure	Measurement method	Limit value
Flicker	PstLM	CIE TN 012:2021; IEC TR 61547-1	PstLM = 1 (most standards and regulations worldwide)
Stroboscopic effect, hand and body motion	SVM	CIE TN 012:2021; IEC TR 63158	EU Ecodesign 2019/2020: 0.4. NEMA: 1.6
Stroboscopic effect, machines and tools	None stated	Nonexistent	None stated
Phantom array effect	None stated	Nonexistent	None stated
Eyestrain, migraine, headache, other neurophysiological effects	Normalized modulation	Nonexistent	IEEE Std 1789

The table reproduces the substance of the review’s own summary of standards and guidelines for the rows that bear on this comment. The word nonexistent is the review’s.

Three things in it require comment. First, the one firm limit is not firm in its domain. The response function behind it “was originally derived using a small size luminous stimulus with sharp edges, seen in central vision in well-lit conditions. However, PstLM can be assessed, and is now used, outside its original range of lighting conditions, included in dim environments (mesopic conditions).” Second, the stroboscopic measure is expressly confined: its “upper frequency limit is 2000 Hz”, it requires illuminance above 100 lux, and “It is not applicable in dark environments, nor with outdoor lighting.” The measure for the one artifact with an agreed measurement method does not reach outdoor lighting at night. Third, the divergence on the limit for that measure is large and is stated by these authors in these words: “Unlike the flicker metric

PstLM, there is currently no consensus on an acceptable upper limit for SVM. The European eco-design regulation EU 2019/2020 defined the limit at 0.4, following an interim two-year period during which the accepted limit had first been set at 0.9. The NEMA specifies a maximum SVM of 1.6, which is considerably higher than the EU limit." The European figure is binding and the American figure is a recommendation of a trade association, and the recommendation is four times the binding limit.

For displays the review states that neither perceptual measure applies, because they were built to predict human perception and not artifacts created by image sensors, and that "There is currently no standard metric associated with TLAs observed on electronic devices." That belongs with the asymmetry recorded at Part V.B.2, where the display industry was found to specify the one emission quantity the lighting industry does not.

What the authors of the recommended practice say is not known

The review treats the health effects as established. "The known health effects of TLM are eyestrain (asthenopia), headaches, migraine, and photosensitive epilepsy", and in the conclusions, "Headaches, migraines, and eyestrain have been commonly reported, studied, and confirmed in the scientific literature." It explains why such effects are hard to attribute to a cause, which is a point the Foundation makes at Part VIII in support of adverse event reporting: "Eyestrain, headaches, and migraine happen during, or after, prolonged exposures to TLM, typically of one or several hours. The delay in the onset of these effects makes it difficult to identify TLM as a critical factor of lighting systems."

It also states that the conditions of exposure have changed since the American standard was written: "the ubiquity of solid-state lighting and solid-state display technologies profoundly changed the characteristics of human exposure to TLM. Longer exposures to an increasing number of modulated light sources are becoming the norm. The human response to these repeated stimuli is still unclear but some recently published results are now available."

And then the passage for which the Foundation principally cites this review. On who is affected: "The case of sensitive people is worth considering because a significant fraction of the general population is known to suffer from symptoms associated with the exposure to TLM." On what is known about them.

> "An unknown fraction of the general population is particularly sensitive to temporal light modulation. This population is not well understood but includes migraineurs and people suffering from headaches induced by flickering lights, those suffering from pre-existing conditions such as photosensitive epilepsy, and some people who have suffered head injuries such as traumatic brain injuries."

And on whether they are protected.

> "Safe TLM levels were defined for photosensitive epilepsy, but there is insufficient data to define safe levels for other categories of sensitive people."

The conclusions put the same point as a recommendation rather than a finding. The symptoms "seem to occur more frequently and more intensely for a fraction of the general population which is yet to be rigorously identified. For these well-known effects, more research should be done to provide dose-response relationships to be able to improve health and safety requirements for sensitive people." And of one group specifically: "Other conditions, such as traumatic brain injuries, require specific protective measures against exposure to modulated light sources."

The Foundation asks the Department to take four things from that and states them in the order of their certainty. That the health effects of this characteristic are confirmed in the literature, on the authority of the authors of the governing recommended practice. That a significant fraction of the population suffers symptoms from it, while the size of the particularly sensitive fraction remains unknown and the people in it remain unidentified. That safe levels exist for one condition only,

photosensitive epilepsy, and that for every other category of sensitive person the data to set a safe level are insufficient. And that the improvement called for is not of research alone but of "health and safety requirements for sensitive people."

The Foundation adds the observation that the review's own account of the present position concedes, in the three qualifiers of a single sentence, what is missing: "International standards and regional regulations now include requirements providing a certain degree of protection against undesired visual effects of temporal light modulation that may occur at high levels." A certain degree of protection, against visual effects, at high levels. The paper nowhere states that existing requirements are sufficient, and where it addresses health effects and sensitive people it states the contrary. The Foundation does not suggest that these authors call for regulation of their employers' products. They call for research, for better design, and for improved requirements. The Foundation asks only that the Department notice who is saying that requirements need improving.

What the instruments can measure, and the condition they require

The subsection above establishes that the American laboratory standard covers 1 hertz to 3 kilohertz while the authors of the recommended practice place one of the three artifacts between 100 hertz and 10 kilohertz. The remaining question is what the instruments do, and for that the Foundation turns to a manufacturer of them. The knowledge-base article described at Appendix D.3 is product literature of a German instrument maker, written to tell purchasers what its flicker meters will and will not do. The Foundation relies on it for that and not for its account of the science.

The ceiling is stated plainly: "The meters are designed for the detection of flicker frequencies up to 5 kHz". The tables show that ceiling falling as the operator lengthens the measurement time to gain frequency resolution, to 2.5 kilohertz, then 1.2, then 0.6, and at the longest settings to 75 and 33 hertz; and that the full speed is available only in part of the amplifier range, the page noting "3dB Range 0 to 5 = 10 kHz, Range 6 to 8 = 200Hz".

The Foundation now sets the three figures beside one another, and the arithmetic is its own. The effect is placed by the authors of the recommended practice at up to 10 kilohertz, and a peer-reviewed experiment found it statistically visible to 7 kilohertz. The American laboratory method is written to 3 kilohertz. A current commercial field instrument is designed to 5 kilohertz. Neither the standard nor the instrument covers the range in which the people who write the standards say the effect occurs. The Foundation does not suggest that this is anyone's fault, and the tables show the engineering reason, which is that frequency ceiling and frequency resolution trade against each other in a sampled measurement. It states the consequence only: a product could modulate at a frequency at which this artifact is reported to be visible and no routine measurement would record it.

The illuminance floor, which matters most for the products at Part VI

The second limit is not about frequency at all, and the Foundation regards it as the more consequential of the two. A flicker measurement requires enough light to measure.

> "Basically, the signal to be measured should be strong enough (e.g. at least 100lx are recommended). Only then is it possible to guarantee a good signal to noise ratio for the flicker measurement".

Below that, the manufacturer states, the error in both the frequency and the flicker parameters "increases greatly", and "small flicker signals can be below the noise level and are thereby cannot be detectable". The worked illustration on the page is a reading at 78 lux, already described as a bad signal-to-noise ratio.

One hundred lux is an interior light level. The Foundation asks the Department to consider what follows for the products described at Part VI, which operate outdoors at night. Vertical

illuminance at a pedestrian's eye from roadway lighting is of the order of a few lux, and the ambient against which a vehicle lamp or a beacon is seen is lower still. At those levels this class of instrument is below the illuminance at which its maker says the measurement can be guaranteed, and small modulations fall under the noise floor altogether. The Foundation states the limit of the inference: the manufacturer is describing a general-purpose field meter measuring ambient illuminance with a cosine diffuser, and a measurement aimed directly at a bright source at close range is a different case which the page does not address. What the page establishes is narrower and sufficient, which is that the ordinary field instrument for this purpose is specified for interior light levels.

Read with the preceding subsection, three statements about the nighttime outdoor case now come from three independent sources and all point the same way. The authors of the recommended practice state that the stroboscopic measure "is not applicable in dark environments, nor with outdoor lighting", and that there is "no standard covering the field measurement of these parameters". The instrument maker states that the measurement needs about 100 lux. And the experiment at Appendix C.90 confines its one frequency recommendation to interiors, expressly excluding areas with "darker finishes or very low ambient light conditions". At night, outdoors, there is no applicable metric, no field measurement standard, and an instrument specified for an illuminance two orders of magnitude above the condition.

One further source bears on the nighttime case, and it is of a different kind from the three above. Those are statements by the authors of standards and by the makers of instruments about what can be measured. This one is a measurement of people. A cohort study of 400,343 attendees at stroboscopically lit events, described at Appendix C.99 and treated at Part VI.K, divided them by whether the event took place in darkness or in daylight and found an incidence density ratio for epileptic seizures of 3.5, with a 95 percent confidence interval of 1.7 to 7.8.

The Foundation offers that for one purpose and states the purpose narrowly. The state of adaptation of the viewer is treated in the measurement literature as a condition under which instruments work less well. In the clinical literature it is a variable capable of moving an incidence rate by a factor of three and a half. The products described in Part VI operate in the second condition and are assessed, when they are assessed at all, by instruments specified for the first.

Two refinements to the account above

The first concerns the domains of the metrics, which the instrument maker states more explicitly than the review did. The flicker severity metric is "proposed in CIE TN006 for the assessment of perceived light flicker for frequencies up to 80 Hz"; the Assist perception metric "mainly deals with signals below 80Hz"; and the stroboscopic measure addresses modulation "typically up to 2 kHz" and is appropriate only "when the average light level is > 100 lx". The table above should therefore be read with the frequency domain in mind as well as the limit value: the one metric with a worldwide limit is a metric for frequencies below about 80 hertz.

The second is a qualifier on the European requirement, and the Foundation flags it rather than resolving it. The same page describes the requirement as applying to "non-dimmed LEDs and OLEDs", with the stroboscopic limit of 0.9 in force from September 2021 and the tightening to 0.4 expected in 2024. The phrase will bear two readings, that the limits reach only products which cannot be dimmed, or that they apply to any product measured at full output. The Foundation has not read the regulation and takes neither reading. It records why the question matters: Appendix C.92 reports a lamp whose measured flicker rose from 63.9 to 80.1 percent when it was dimmed, with its duty cycle falling to one part in eight. If the only binding numerical limit on temporal modulation anywhere is tested at full output, it is silent about the state in which modulation is worst.

What determines whether modulation is seen at all, which is not frequency alone

Every criterion described in this subsection is expressed in two variables, frequency and modulation depth. A neurophysiological review of the processing of flickering light, described at Appendix C.96, states the determinants of whether modulation is distinguished from steady light, and the list is longer:

> "Distinguishing between flickering and steady light is dependent on the factors mentioned in the review article by Mankowska et al.: (1) the frequency of modulation, (2) the amplitude of modulation, (3) the average illumination intensity, (4) the position on the retina at which the stimulus occurs, (5) the wavelength or colour of the light-emitting diode, (6) the intensity of ambient light, or (7) the viewing distance and (8) size of the stimulus."

Two of those eight are what the measurement standards and the recommended practice address. The Foundation asks the Department to notice the other six, and to notice that the fifth names the light-emitting diode expressly. Average illumination intensity, ambient light intensity, viewing distance and the size of the stimulus are all properties of the exposure situation rather than of the lamp, and all four differ between an office ceiling and a roadway at night in the direction that makes the modulation more apparent, not less. The position on the retina is the variable that distinguishes the phantom array from flicker, treated at the following subsection. The wavelength is addressed by no instrument the Foundation has found, and Part VI.I describes a product in service whose emission is more than eighty percent blue.

This is the evidentiary basis for a proposition the comment advances throughout Part V and states here in its general form. The criteria in existence for temporal modulation are not wrong. They are partial. They constrain two of at least eight variables known to govern whether the modulation is resolved, they were developed for interior general lighting and for broadcast content, and nothing has been assembled that could be applied to a lamp aimed at a person outdoors at night.

The same review records an effect at the frequency band this subsection is principally about. It states that "light from lamps flickering at a high frequency, i.e., 100–120 Hz, can induce headaches or migraines". That is the band produced by rectification at twice the supply frequency, which the review at Appendix C.90 gives as the first of the five origins of modulation, and it is the band in which the one product this comment has measured was found to operate: Part VI.I reports a measured 100.1 hertz at 63.9 percent modulation in a lamp in service on American streets. The Foundation records the qualifier the review uses, which is "Occasionally", and does not enlarge it.

2. Stroboscopic effect and phantom-array effect

This subsection concerns two effects that are often named together and are not the same thing. The Foundation separates them before describing either, because the evidence it has bears on one of them and not on the other.

The stroboscopic effect is the apparent alteration of the motion of a moving object viewed under a modulating source. The observer is still and the object moves. It is the effect that makes a rotating tool appear stationary, and its hazard case is industrial.

The phantom array effect, also called the ghosting effect, is the appearance of a row of repeated images when the eye moves rapidly across a small bright modulating source. The source is still and the observer's eye moves. Its hazard case is anybody who looks from one thing to another in a space containing such a source, which is to say everybody.

The Foundation addresses the phantom array effect in this subsection and states plainly that it does not yet address the stroboscopic effect, which requires the literature on the stroboscopic visibility measure that the Foundation has not assembled. The heading is retained because the subsection will be completed.

The study the Foundation relies on, and who paid for it

The principal evidence is a 2024 experiment published in Lighting Research and Technology and described at Appendix C.90. The Foundation puts the funding first. The work was performed at Pacific Northwest National Laboratory and supported by the Lighting Research and Development Program of the Building Technologies Office within the Office of Energy Efficiency and Renewable Energy of the United States Department of Energy, and the authors declared no conflicts of interest. The Department is therefore not being asked to weigh the submission of an affected party. It is being asked to weigh federally funded research produced inside the government's own laboratory system by a sister agency with a statutory interest in promoting these products rather than in restricting them.

Fifty-five people, 25 with a history of migraine and 30 without, spanning ages 22 to 81, judged 85 modulation waveforms produced by a single small light-emitting diode against a black background while moving their eyes between two targets 45 degrees apart at a pace set by a metronome. The waveforms included sinusoids from 120 to 10,000 hertz at modulation depths from 100 percent down to 5 percent, rectangular waveforms across the same range at two depths and two duty cycles, six waveforms measured from commercial lighting products, and a non-modulating control against which every judgment was tested.

What the experiment found about frequency

Modulation remained visible far above the frequencies at which it is commonly assumed to stop mattering. Sensitivity peaked between 400 and 800 hertz. Stimuli up to 7,000 hertz were statistically more visible than the non-modulating control across all participants, and sinusoids at full modulation were still more visible than the control at 7,000 hertz. At 10,000 hertz the effect was not distinguishable from the control on sample averages, and the Foundation accepts that result as a genuine null because the authors report the false-positive rate alongside it: detection of the pulse-width-modulation waveform fell from 73 percent of all observers at 4,800 hertz to 16 percent at 10,000 hertz against a 15 percent rate of observers reporting the non-modulating control as visible. Five of the most reliable participants nonetheless reported seeing it at 10,000 hertz.

Two propositions follow for this Department, and the Foundation separates them because only the first is established by this study alone. The first is that the frequency range within which modulation is perceptible, by this mechanism, extends into the thousands of hertz and not merely to the hundreds. The second is that the frequencies at issue are exactly those produced by the drive electronics of these products, since pulse-width modulation at full depth was the most visible and the most annoying waveform class tested. Of the pulse-width waveforms below 1,200 hertz the authors report that they were visible to every participant capable of reliably detecting the effect at all, with mean annoyance above 4 on a scale whose upper anchor at 8 reads "extremely annoying, I need to leave the room".

What it found about who sees it

The authors state that the question had not previously been studied: "no research has investigated if or how PAE sensitivity varies between people with and without migraine. Likewise, there has been no research on physiological symptoms following exposure to the PAE – for either migraine or non-migraine groups." They found that it does vary. In the model of visibility, a history of migraine carried an odds ratio of 3.31, with a confidence interval of 1.22 to 8.94, and the interaction of migraine with frequency was significant, the migraine group being relatively more sensitive at the higher frequencies. Younger participants saw more stimuli, though the Foundation notes that while the direction of the age effect is firmly established its magnitude is not, the linear fit between age and the number of stimuli seen having an R-squared of 0.08.

The reported consequences outside the laboratory were larger than the differences in what was seen inside it. Of the migraine group, 72 percent reported being bothered by the effect more than rarely against 40 percent of the others; 84 percent reported physical symptoms they attributed to it against 47 percent; 64 percent reported headache against 10 percent; and 60 percent reported

having changed a behavior, such as leaving a restaurant, against 17 percent. In the four hours after the session, 64 percent of the migraine group reported discomfort or an adverse reaction against 19 percent, and 41 percent a headache against 8 percent.

The Foundation states the limit of those figures in the authors' own terms rather than in its own, and does so here rather than in a footnote, because the figures are striking and a reader is entitled to the qualification at the same time. The task was visually demanding, requiring an hour or more of repeated eye movements, and the authors write that accordingly "the negative outcomes (for the migraine group in particular) cannot be explicitly linked to the TLM itself." They further record that all participants were warned at recruitment that symptoms were possible and that the migraine group answered an additional symptom questionnaire, so that "It is possible the migraine group inferred a higher likelihood of headaches afterward, which could have increased the number of post-experiment headaches reported." The Foundation does not assert that this effect causes headache. It asserts that a federally funded experiment found a large difference in reported symptoms between two groups and could not exclude expectation as a contributor, and that the right response to such a finding is the further study the authors call for.

The range of individual sensitivity, which is the finding this comment has been unable to obtain elsewhere

Six participants saw fewer than one stimulus in ten above threshold, three of them saw none, and two never perceived the effect at all. Seven saw at least three quarters of the 85 stimuli. Some observers detected it at a modulation depth of 5 percent. Of the predictive measure the authors write that "it cannot predict any individual's ability to see the phantom array, as there is extreme variation in sensitivity to the PAE." The Foundation asks the Department to hold that sentence against the structure of every instrument described in this Part. Each of them sets a single threshold derived from a population average. The specialists who built the measure for this effect say that such a threshold cannot speak to an individual, and the spread in their own sample runs from people who cannot see the effect at all to people who see it at a twentieth of full modulation.

What it found about the governing document, stated in both directions

The international document for temporal light modulation is CIE 249. Its function for this effect was provisional, and the authors report that it was developed on data extending only to 1,200 hertz while the competing measure rests on data to 2,000 hertz, both well short of the range at which the effect was found here to be visible. Measured against it: "CIE 249 suggests threshold visibility at 76% modulation for 2400 Hz sine waves, but threshold visibility was 49% in this experiment." The authors' conclusion is unqualified: "This experiment does not support the use of the PAE threshold modulation function published in CIE 249."

The Foundation states the qualification that runs against its own position, because the paper states it and a comment that omitted it would be misrepresenting the source. The failure of that function is a failure about how sensitivity falls with frequency, not a uniform permissiveness. The authors write that "Aside from relative differences, both the CIE 249 function and PAVM function predict lower absolute threshold modulation", meaning that in absolute terms both predict visibility at lower modulation than this experiment measured. They add that absolute thresholds depend on background and contrast, ambient illumination, stimulus size and shape, the scanning angle, saccade speed and personal sensitivity. So the proposition the Foundation advances is the narrow one: the international function understates sensitivity at the frequencies lying beyond the data from which it was built, and those are the frequencies at which these products operate.

The frequency the authors propose, and why its conditions matter more than the number

The authors offer a figure, and they attach conditions to it in the same sentence. At 10,000 hertz the pulse-width waveform "was not statistically more visible or more annoying than DC, making this a reasonable target minimum frequency if PWM is utilized in lighted environments similar to

those in the experiment space (i.e. not areas with larger eye movements, darker finishes or very low ambient light conditions)."

The Foundation asks the Department to read the parenthesis. The three excluded conditions are larger eye movements, darker surroundings and very low ambient light. Those are the conditions of the nighttime street, which is where the products described at Part VI operate: roadway luminaires, vehicle headlamps and warning beacons, and dynamic message signs, all of them viewed against a dark field by an observer whose eyes are moving across a wide visual scene. The authors say what is known about that case: "Others have examined higher frequencies using luminous targets in very dark surrounds, in which case some observers can reliably see the PAE above 10 000 Hz." The one frequency figure in this literature that an engineer might take as a design target is therefore expressly limited to interior conditions, and above it, outdoors at night, the effect is reported to remain reliably visible.

What the authors asked for

The Foundation ends this subsection with the authors' own statements, because they are the statements of federal grantees at a national laboratory and not of this commenter. On the weight of what they found: "this is strong evidence that TLM is a major problem in lighting and should be remedied, even if it requires trade-offs with other performance attributes." On what any threshold depends upon, which is the proposition this comment makes throughout Part VII: "if a general population is used to model threshold visibility, and individuals with migraine and other sensitive individuals were excluded as subjects, then the average values may not be protective for some at the more sensitive end of the normal distribution. In that case, more strict performance criteria can be set to account for more sensitive observers." And on what should now happen: "We advocate for rapid uptake of metrics and specifications to mitigate the PAE – and other responses to TLM – such as those proposed in IES TM-39."

The Foundation adopts that call and states the one thing it adds. The measures the authors point to are a recommended practice of a professional society, which binds no manufacturer and reaches no product. The authors advocate rapid uptake because uptake is voluntary and has not occurred. Nothing in Title 21 prevents the Secretary from setting a performance standard for this characteristic under 21 U.S.C. § 360kk, and the quantity to be limited, the method of measuring it and the performance levels have all been worked out and published by the Department of Energy's own grantees and the society that received their work.

Corroboration from the authors of the recommended practice, and the fact that the international model was never validated

The preceding account rests on a single experiment, and the Foundation said so. Two of its propositions are independently confirmed by the review described at Appendix C.91, which matters because that review is written by members of the joint working group that produced the American recommended practice and four of its six authors are employed by lighting manufacturers.

On the frequency range, the review states in its conclusions that the phantom array effect may appear "from about 100 Hz to about 10 kHz" with maximum visibility at 600 hertz, and its summary table of effects against frequency runs to 10 kilohertz and marks the upper extent of both the neurophysiological and the health effects as an "Unknown boundary." The proposition that this effect reaches into the kilohertz range is therefore not the Foundation's inference from one experiment. It is the stated position of the people who write the recommended practice, and they draw from it a conclusion about design: "The electrical design of power supplies, drivers and dimmers should minimize the occurrence of undesired effects of temporal light modulation in this wide frequency range."

On the international document the review supplies something the experiment could not. The experiment tested the threshold function of CIE 249:2022 against measurement and found it

unsupported. The review states why that result was available to be found: the report "contains a tentative visibility model which has not been experimentally validated yet." And of the field as a whole, as of the review's writing, "There is currently no metric to quantify the visibility threshold or the sensitivity function to the phantom array effect." The Foundation notes that these two papers appeared in the same year and that the measure the experiment endorses was published in a recommended practice of 2024. What is not in doubt is that the only model in an international document had not been validated against experiment, and that when it was tested it failed.

The review also reports thresholds from experimental work the Foundation has not obtained, and they are far below anything in the American framework. At 600 hertz the threshold modulation depth for a sine wave was "7% for a white-light stimulus observed in dark conditions" and "about 3%" for a red-light stimulus in dark conditions. The effect was significant down to 80 hertz, where the threshold was 10 percent for red light against 35 percent for white. The Foundation does not rely on these figures.

Finally, the review names where the effect is met, and the Foundation quotes it because the naming is done by the industry rather than by this commenter: "In real-life application, the phantom array is best seen in indoor and outdoor luminaires (and displays) using PWM dimming at low illuminance levels. It is also noticeable in automotive headlights and rear lights." Outdoor luminaires at low illuminance, displays, automotive headlights and rear lights. Those are the products at Part VI.D, Part VI.E and Part VI.F. On waveform it corroborates the experiment: "The effect is more visible under rectangular versus sinusoidal TLM and when duty cycles are low (typically 10% or 30%, versus 50%)".

Whose response a limit should be built on, and what the same author says should be done in the meantime

The first author of that experiment published a letter in the same journal in the same year, described at Appendix D.7. The Foundation states its character before using it: it is correspondence, not research, its substance is reports made to the author by members of the public, and nothing in it is cited here as evidence that modulation causes any symptom. It is cited for two statements the author makes in her own voice.

The first concerns the structure of every instrument described in this Part. Having reported the finding that sensitivity differs with history of migraine, she writes this.

> "The significance of this is perhaps average response of a population is an inadequate target for establishing a flicker metric. Perhaps we should address the 15% of the population that gets migraines instead. Or, should we focus on the very sensitive few that are almost completely debilitated by this issue?"

That is the question this comment puts at Part VII, asked by the author of the measure the recommended practice adopted. The Foundation notes that the prevalence figure is given without a citation in the letter and is therefore presented here as the author's, and that the three candidate targets she names are a question and not a recommendation. What the passage establishes is narrower than an answer and sufficient for this comment: the choice of the population whose response fixes a threshold is a choice, it has not been made deliberately, and the specialist best placed to make it says the conventional choice may be inadequate.

The second statement concerns what should be done before the research is complete. The Foundation quotes the passage whole, including the half that tells against regulation, because an agency reading a selective quotation would be right to discount everything around it.

> "We need to know what populations experience these discomforting or disabling responses, how many people this represents, what characteristics of the TLM waveform are responsible for the problematic symptoms, and the mechanism by which the eye/brain system is affected. We need it soon if we are to avoid imposing limits on the manufacturing of products which are

> cost-effective, efficient, useful, fun and even inspiring. In the meantime, the responsible action is to reduce TLM in electric light sources to ensure fewer people are affected by them."

The Foundation reads that passage as it is written. The author hopes that research will make limits on manufacturing unnecessary, and she says so. She nevertheless states that the responsible action in the meantime is to reduce modulation. The Foundation asks the Department to weigh the second sentence at its full value and not to discount it on account of the first: a researcher who would prefer that her field avoid regulation, and who says so in print, has no interest in overstating the case for acting before the mechanism is known. That she states the interim duty anyway is the reason the Foundation quotes her.

Two further reports from the neurophysiological literature, both given with their weight

The review at Appendix C.96 reports two findings that bear on this subsection, and the Foundation gives them with the limits their own authors place on them, because neither is strong and the comment does not need them to be.

The first concerns the upper bound. Having given the ordinary critical fusion threshold as 50 to 90 hertz, and having noted a report of discrimination at 500 hertz which its authors explain by saccadic eye movement, the review states that "there have been reports that a stroboscopic effect can occur even with the light flickering at more than 1000 Hz if objects in the rest of the visual field are moving". The condition in that sentence is the whole of its interest. The effect is reported not for a stationary observer viewing a stationary scene, which is the condition under which flicker is assessed, but for a visual field containing movement, which is the condition of every road, workplace and public space in Part VI.

The second concerns whether modulation that is not seen is therefore without effect, which is the proposition on which a perception-based criterion depends. The review states:

> "There is limited evidence that the visual cortex responds to a flickering stimulus, not only when the flickering is perceivable, but also when the stimulus seem to be steady."

The Foundation reproduces the hedge as well as the claim. The review calls the evidence limited, says of the functional imaging study it rests on that few healthy subjects participated, and the Foundation has not read that study. What the sentence establishes is not that unperceived modulation has effects. It is that the question has been asked in the neurophysiological literature, that the answer presently available points toward a cortical response to modulation perceived as steady, and that the evidence is thin. That is a reason for the research directed by paragraph 360ii(a)(2), and the Foundation advances it as nothing more.

One caution from the same review belongs here rather than being left for a reader to supply. Its authors report a conclusion that critical flicker fusion "has limited value as a clinical measurement", because the threshold depends on both the gain of the visual system and its processing speed and does not separate them. Wherever this comment uses a fusion frequency, including in the ecological collation at Part V.I, that limit applies.

The upper bound, from the clinical review

The Epilepsy Foundation review described at Appendix C.98 states the upper frequency bound for this phenomenon in a single sentence, in the section it devotes to light-emitting diodes:

> "Frequencies up to 11 kHz generate a visible pattern on the retina when a saccade is made across a flickering LED, and this pattern is more visible to individuals who complain of eye strain."

Two features of that sentence bear on this subsection and on Part V.D.1. The figure is eleven kilohertz, against a measurement standard whose stated range reaches three kilohertz and commercially available instruments specified to five. A modulation that produces a visible retinal

pattern at eleven kilohertz is a modulation that no instrument in ordinary use can detect and no standard in existence addresses. And the association is with eye strain: the pattern is more visible to the people who report the symptom, which is the population Part V.D.5 and Part VII concern.

The Foundation records what the sentence is and is not. It is a statement in a review, carrying one citation, and the Foundation has not read the underlying study. It is nonetheless the highest frequency at which any document before the Foundation reports a visible effect of modulation, and it comes from the body whose criteria this comment otherwise applies.

One further matter belongs here and is developed at Part V.E.7. The phenomena described in this subsection are all effects occurring while the modulation is present. There is evidence, in an animal model and with the underlying cortical response reported in humans, that a flash produces cortical activity persisting for seconds after it has ended. If that is so for the products in Part VI, a lamp flashing more than twice a second is delivering each flash into the response evoked by the one before it. The Foundation does not assert a consequence. It observes that the measurement standards described in this Part characterize a waveform and that no criterion anywhere in them contemplates a response that outlasts the stimulus producing it.

3. IEEE 1789-2015 recommended practices and their status

Appendix D.2 sets out IEEE Std 1789-2015 in full. This subsection states what it recommends, what it excludes, what has become of it, and what follows for this Department. The Foundation treats it at length for a reason it states plainly: it is the only document in existence that attaches a number to the temporal characteristic of a light-emitting diode product, and the comment's argument at Part V.B is that each of the three emission characteristics needs one.

The present status of the document, which changed while this comment was being prepared

Two things about what this document is, and one about what has become of it.

It is a recommended practice and not a standard, and its title says so: IEEE Recommended Practices for Modulating Current in High-Brightness LEDs for Mitigating Health Risks to Viewers, published June 5, 2015. Nothing in it binds anybody and the Foundation has never suggested otherwise. Recommended Practice 3 is drafted as an obligation within the document, which is a different thing from being an obligation at law.

And the publishing body has stopped maintaining it. Its record for this document gives the status as inactive-reserved, with an inactivation date of March 26, 2026. The Foundation states what that does and does not mean so far as it has established it. An inactive designation does not withdraw a document or declare it wrong. It means the body is no longer maintaining it. The recommendations are unchanged, the reasoning is unchanged, and the research the drafters relied on is unchanged. What has lapsed is the maintenance.

The Foundation does not conceal that this cuts against it in one respect, and states the objection in its strongest form before answering it. This comment relies on this document in forty-two of its paragraphs, more than on any other single instrument, and an opponent is entitled to say that a document whose own body has ceased to maintain it is a thin foundation on which to ask for a federal standard. The Foundation agrees that it is a thin foundation. That is the point of this comment.

Because of what this document was carrying. As the opening of this subsection records, it is the only document in existence that attaches a number to the temporal characteristic of a light-emitting diode product, and Part V.B establishes that each of the three emission characteristics needs one while the other two have none. So the position as of March 2026 is this. The single numerical limit anywhere, addressed on health grounds to the temporal modulation of these products, is a voluntary recommendation which the body that wrote it has ceased to maintain, and the Foundation has identified no successor.

The Foundation asks the Department to read that as the answer to the objection this comment meets most often, which is that the voluntary consensus system is the proper place for these questions and that federal action is premature. Part I.C and Part II.E treat that objection generally. Here is the particular. The voluntary system's one numerical health limit for this characteristic lapsed into inactive status in March 2026, seven months before this comment was filed, with nothing in its place. A system which produced one such limit in its history and has stopped maintaining that one is not a system to which a health agency can defer. Part IX.I asks for a standard under § 360kk. This is why the asking cannot wait on the consensus bodies.

It is also an instance of the duty at paragraph 360ii(a)(3), which directs the Secretary to maintain liaison with and receive information from other agencies, professional organizations and standards bodies, and which Part II.E develops. The inactivation of the only health-based numerical limit on any emission characteristic of these products is precisely the kind of information that paragraph contemplates being received. The Foundation has identified no record that this Department is aware of it.

What it recommends

The regulated quantity is modulation, defined as 100 times the difference between maximum and minimum luminance divided by their sum. A source that goes fully dark between pulses has a modulation of 100 percent whatever its peak luminance. Three practices are given, in ascending stringency, and the third is different in kind from the other two.

Recommended Practice 1, for limited biological effects: below 90 Hz, modulation less than 0.025 times the frequency.

Recommended Practice 2, the no-observable-effect level: below 90 Hz, modulation less than 0.01 times the frequency.

Recommended Practice 3, seizure prevention: "For any lighting source, under all operating scenarios, flicker Modulation (%) shall satisfy the following goal: Below 90 Hz, Modulation (%) is less than 5%."

The first two begin with the words "If it is desired." The third does not, and the document explains why: it "is a strict rule for seizure prevention and should be adhered to at all times for all operating conditions." Its terms are any lighting source, all operating scenarios, and shall. Within a body of recommendations it is the one provision drafted as an obligation.

What it excludes, and why that matters here

The document is confined to the temporal characteristic and says so. Clause 7 provides that "Other possible negative lighting features, including those associated with wavelength (e.g., blue light hazard, ultraviolet), glare, and periodic arrays or patterns of lights are not considered."

The Foundation asks the Department to read that against the three emission characteristics identified at the opening of Part V.B. The spatial characteristic has no federal limit and is excluded here. The spectral characteristic has no federal limit and is excluded here. The temporal characteristic has no federal limit either, and the one document that quantifies it is a voluntary recommended practice of a professional institution which disclaims the other two. That is not a criticism of the institution, which confined itself to its subject. It is a description of the regulatory position: there is no instrument before this Department, binding or voluntary, that addresses all three, and the only one that addresses any of them quantitatively binds no one.

Three further features of its construction bear on the rest of this Part. The recommendations are independent of luminance, of spectral content and of exposure duration, the document reasoning that exposure duration is rarely controlled in practice and should in general be regarded as prolonged; so a brief exposure is not exempt under this framework. They apply to the entire light source and not to the modulation of a single emitter within it, which is the question Part V.J.3 raises about composite waveforms and which Part V.D.4 applies. And they are deliberately not

application-specific, because the drafters assumed that the flicker characteristics of future products would be uncontrolled and that nearly the whole United States population would be exposed to a potentially hazardous condition at least once in a year.

The sentence the Department should notice

The purpose clause of the document opens as follows: “Presently, there are no standards on safe modulating frequencies for high-brightness LEDs.” That was published on 26 March 2015. A working group of the IEEE Power Electronics Society, convened in December 2008 and reporting seven years later, recorded that no standard existed, assembled a formal risk assessment on the model used by government product-safety bodies, and published the numbers a standard would need. Eleven years after that, the sentence is still true, and the numbers are still voluntary. Part IX.B asks the Department to say at what modulation depth and frequency a light-emitting diode product ceases to be safe. One answer has been on the public record since 2015 and has never been adopted by anyone with the authority to make it binding.

What the drafters said they were concerned about, five years before the standard issued

The working group that produced this standard published an account of its own concerns in 2010, described at Appendix D.6. Its authors were Arnold Wilkins of the University of Essex, Jennifer Veitch of the National Research Council of Canada and Brad Lehman of Northeastern University, and it states that it summarizes a public report of the PAR1789 group and represents that group’s ongoing work. The Foundation sets out what it says because a standard is better understood against the account its drafters gave of the problem, and because this one is now old enough to be read against what the same people published fourteen years later.

The Foundation states the authors’ disclaimers first, because they are emphatic and because the rest is worth nothing if they are concealed. “This report does not attempt to make recommendations on safe flicker frequencies or modulation depths for LED lighting”. “This report endorses no technology for driving LED lamps”. And in its conclusions: “This paper assigns no health risk to the biological effects of flicker in the various LED lamps. The hope is that by discussing the issue of flicker within the power electronic community, it will be possible to decide as a community whether or not standards or recommended practices are necessary. We do not attempt to do so here”. In 2010 the drafters of this instrument were expressly not recommending that anything be required of anyone.

The distinction on which the standard rests

The document defines visible flicker as that “consciously perceivable by a human viewer” and invisible flicker as that which is not, and divides the health account accordingly: effects that are “the immediate result of a few seconds’ exposure, such as epileptic seizures”, associated with visible flicker at about 3 to about 70 hertz, and effects that are “the less obvious result of long-term exposure, such as malaise, headaches and impaired visual performance”, associated with modulation above the frequency at which flicker can be seen. The second of the four contributions the paper claims for itself is “Human biological effects due to invisible flicker at frequencies below ~165Hz”.

That proposition is the one this comment has most needed a source for, and the Foundation now states it in the drafters’ own words rather than its own. On the retina: “Measurements of the electroretinogram have indicated that modulation of light in the frequency range 100-160Hz and even up to 200 Hz is resolved by the human retina although the flicker is too rapid to be seen”. On the brain, in an animal model: modulation at 100 and 120 hertz was shown “to cause the phase-locked firing of cells in the lateral geniculate nucleus of the thalamus, part of the brain with short neural chains to the superior colliculus, a body that controls eye movements”. And in healthy people, two minutes of exposure to flicker about 20 percent above an observer’s fusion frequency produced a measurable loss of sensitivity to visible flicker afterward.

The Foundation is careful about the verb. The retina resolving a modulation is an electrophysiological measurement, not an injury, and the drafters do not say otherwise. What the sequence establishes is that light modulated too fast to be seen is nevertheless registered by the retina, reaches the thalamus in an animal model at the frequencies at which mains-driven lamps modulate, and changes visual sensitivity in healthy observers after two minutes. Whether the endpoint is adverse is the next question, and the drafters answer it with one study.

The one human health result, with its dose and its caveat

> “Under double-masked conditions the 100Hz modulation of light from fluorescent lamps has been shown to double the average incidence of headaches in office workers, although this effect is attributable to a minority that is particularly affected”.

And the dose: “The peak-trough modulation depth known to induce headaches from fluorescent lighting at 100Hz is about 35%”. So the drafters of this standard had, in 2010, a masked study reporting a doubling of headache incidence at a stated frequency and a stated modulation depth, and they recorded that the effect was carried by a minority. The Foundation asks the Department to hold the second clause beside the passage at Appendix D.7, in which the author of the 2024 measure asks whether the average response of a population is an adequate target at all. The observation is the same observation, fourteen years apart.

What the drafters said about this technology specifically

Their health account is largely of fluorescent lighting and displays, because that is where the literature stood in 2010, and the Foundation says so rather than implying a body of light-emitting diode research that did not exist. On this technology the drafters made one comparison and it is the one that matters: “LEDs driven so that they flicker at a frequency twice that of the AC supply may have a depth of modulation greater than that from most fluorescent lamps. The effects of the flicker are therefore likely to be more pronounced in these cases”. That is not a claim that the technology introduced a new hazard. It is a claim about degree at the same frequency, made by the authors of the standard, and it is the form of argument the Foundation adopts at Part V.B.9.

They also set out how a lamp that modulates invisibly comes to modulate in the seizure range, which is a failure analysis rather than a health claim and which the Foundation regards as the most actionable material in the document. Of the two common drive topologies, each modulating at twice line frequency when working, they write that “there is risk of failure that can cause LED current modulation at AC line frequency, thereby entering the range of frequencies that may induce photosensitive epilepsy”. A single open-circuit failure in one leg of a rectifier bridge does it. So does an open circuit in one of two anti-parallel strings. So, partially, does uneven aging: a 50 percent rise in one string’s resistance gives a 60 hertz component amounting to “over 33% of the DC component”. And they report a measurement: a commercial lamp of 64 red, green and blue emitters, connected to an ordinary residential dimmer, flickering at an average of 3.153 hertz, which “is in the range that has been shown to be a risk for causing photosensitive epileptic seizures”.

That the remedies were available in 2010 and were described as easy

The drafters identified two, and the Foundation quotes them because Part IX turns on whether a remedy is technically available. On dimming: there are “alternative approaches to dimming, such as amplitude dimming, in which the current through the LED is continuous and not pulsing”, and that approach “does not use flicker to adjust brightness and therefore, should not induce flicker related health risks”. On failure: “it is not difficult to create shut-down or other safety prevention circuits that prevent flickering in the 3Hz-70Hz range when the lamp is in failure mode”.

The Foundation draws no conclusion about any manufacturer from those two sentences and asks the Department to draw one about the regulatory position. In 2010 the people writing the American recommended practice stated that a dimming method without flicker exists, and that a circuit preventing failure-mode flicker in the seizure band is not difficult to build. Sixteen years

later the instrument they produced binds no one, pulse-width modulation remains the dimming method in general use as Part V.D.1 establishes, and no performance standard under 21 U.S.C. § 360kk addresses any of it.

Two things in the document that run against this comment

The Foundation records both. The first concerns geometry: "Point sources of light are less likely to induce seizures and headaches than a diffuse source of light that covers most of a person's field of vision", from which the drafters conclude that general lighting is more likely to be hazardous in this respect than an instrument panel. That is not a contradiction of Part V.B.8, where the concern is retinal irradiance from a small bright source rather than the cortical representation of a stimulated area, but the two must not be conflated and the comment does not argue that a small source is worse for every purpose. The second concerns natural light: the first row of the drafters' own table attributes seizures, on clinical histories, to "Sunlight through roadside trees or reflected from waves". Flicker capable of provoking a seizure is not peculiar to artificial sources, and the Foundation has never contended otherwise.

4. Flicker in vehicle lamps, warning beacons, and displays

The three preceding subsections concern modulation that nobody wants. Flicker from a switching driver is an artifact of the electronics, and the engineering question is how to suppress it. This subsection concerns the products in which modulation is the purpose. A warning beacon is built to flash, and the flashing is not a defect to be minimized but the function the purchaser is paying for. The Foundation sets this class apart because the regulatory consequence is different: where modulation is intended, no one has an incentive to reduce it, and the only thing that would limit it is a limit.

What the federal position is

For lamps on motor vehicles, Federal Motor Vehicle Safety Standard No. 108 specifies luminous intensity in candela at defined angular test points. Part II.E.5 and Part VI.B set out what it does and does not contain. It carries no limit on the luminance of the emitting surface, no spectral requirement, and no limit on temporal modulation. The Foundation notes that this is the only federal standard setting numerical limits on the output of any product this comment concerns, and that the quantity it limits is not one of the three identified at Part V.B as bearing on the biological response.

For warning beacons in the public way, the governing instrument is not a federal standard at all. It is the Manual on Uniform Traffic Control Devices, which States adopt or amend, and which is addressed to the uniformity of traffic control rather than to the exposure of persons. Part II.E.6 describes the agency that publishes it and the answer that agency gave when asked about health effects.

What the instrument prescribes, counted

The Foundation takes the rectangular rapid-flashing beacon as its worked example, because its operating pattern is prescribed element by element and can therefore be examined without measurement. Chapter 4L of the California Manual on Uniform Traffic Control Devices, Section 4L.03, provides at Standard 07 that within each 800-millisecond flashing sequence the left indication is illuminated for approximately 50 milliseconds; both indications are dark for approximately 50; the right is illuminated for 50; both dark for 50; the left illuminated for 50; both dark for 50; the right illuminated for 50; both dark for 50; both illuminated for 50; both dark for 50; both illuminated for 50; and both dark for approximately 250 milliseconds. Standard 06 provides that the device shall provide 75 flashing sequences per minute. Standard 08 provides that the flash rate "shall not be more than 5 flashes per second, to avoid frequencies that might cause seizures."

Counting the illuminations that sequence prescribes:

The left indication is illuminated four times per sequence, at elements A, E, I and K. Four illuminations in 800 milliseconds is exactly 5.0 per second.

The right indication is illuminated four times per sequence, at elements C, G, I and K. Again exactly 5.0 per second.

Across the assembly there are six illumination events per sequence, at elements A, C, E, G, I and K, which is 7.5 per second.

Two observations follow, and the Foundation states them separately because they are of different kinds. The first requires no assumption: the pattern the standard prescribes delivers, per indication, exactly the maximum the standard permits. There is no margin at all between the normal operating pattern of the device and the ceiling the standard sets for the stated purpose of avoiding frequencies that might cause seizures. The second requires a convention: whether the governing rate is the 5.0 per second of each indication or the 7.5 per second of the assembly depends on whether the pair is treated as one source or two, and the Manual does not say.

The convention the technical literature supplies, and the quantity the Manual omits

On the first question IEEE Std 1789-2015 is explicit. Clause 8.1.1.3 provides that its recommended practices "describe the boundary functions of operation for the entire LED light source and not for the individual modulation of a single LED within the light source." On that convention the assembly is the unit and the rate is 7.5 per second, above the ceiling the Manual sets. Part V.J.3 raises the same question in its general form for arrays of independently driven emitters.

The second point is larger and the Foundation asks the Department to weigh it beyond this one device. The Manual limits flash rate. It states no limit on modulation depth. IEEE Std 1789 limits modulation depth as a function of frequency and states no limit on rate as such. Modulation is defined in that document as 100 times the difference between maximum and minimum luminance divided by their sum, so a source that extinguishes completely between pulses has a modulation of 100 percent whatever its peak luminance. The prescribed sequence above extinguishes completely, for intervals of 50 and 250 milliseconds.

The consequence is a proposition about regulatory design rather than about this product. A device may satisfy a frequency ceiling exactly while operating at the maximum possible value of the quantity the frequency ceiling was adopted to control. Limiting one parameter of a modulated emission, while leaving the parameter that determines its magnitude unconstrained, does not constrain the exposure. That is the same structure the Foundation identifies at Part V.B.1 for photometric limits that leave radiance free, and at Part V.C.4 for intensity limits that leave luminance free. It recurs because the instruments were each written to control one variable for a purpose that was not photobiological.

The comparison the Foundation draws, and the limit of it

Recommended Practice 3 of IEEE Std 1789-2015 provides: "For any lighting source, under all operating scenarios, flicker Modulation (%) shall satisfy the following goal: Below 90 Hz, Modulation (%) is less than 5%." Appendix D.2 sets out why that provision is differently drafted from the rest of the document and is described by its authors as a strict rule for seizure prevention to be adhered to at all times for all operating conditions.

Read according to its terms, and taking the prescribed pattern above, the device operates below 90 Hz at a modulation of 100 percent, which is twenty times that figure. Against Recommended Practice 1 the ratio is of the order of eight hundred, and against the no-observable-effect level of Recommended Practice 2 of the order of two thousand. The Foundation sets out the arithmetic so that it can be checked rather than taken on trust.

The Foundation states the objection to that comparison itself, because it is a real one and the comment is worth less if the Department has to find it. The stated scope of IEEE Std 1789 is LED lighting and dimming applications. It addresses flicker as an artifact of driving electronics in

illumination products, and the Foundation does not assert that its drafters had signaling devices in view; nothing in the document suggests they did. Recommended Practice 3 is nonetheless drafted in terms of any lighting source and all operating scenarios, and the document's own explanation of why it declined to write application-specific practices was that the flicker characteristics of products then unbuilt could not be anticipated.

The Foundation therefore does not assert that these devices contravene IEEE Std 1789, which binds no one and which may never have been meant to reach them. It asserts something narrower and, it submits, more useful to this Department. The only document in the United States that attaches a number to modulation depth for seizure prevention sets that number at five percent below 90 Hz. Devices are installed in the public way, by public agencies, which operate at one hundred percent below 90 Hz. Whether the first figure ought to govern the second is a question of scope that no federal body has considered, because no federal body has taken responsibility for the question. Part II.E.6 records the answer the agency that approves these devices gave when it was asked. Part IX.B asks this Department to supply the figure that is missing.

Displays

The third class named in this subsection is treated elsewhere and is identified here so that the heading is not misleading. Dynamic message signs and billboards are at Part VI.J. Displays inside vehicles are the one class of modulated emitter in the transportation environment that is subject to a quantified federal attention protocol, which is described at Part V.E.1 together with the asymmetry it creates.

A report concerning these lamps, and the frequencies measured in them

The Foundation records one further item under this heading and states its status first. The document at Appendix D.7 is a letter to a journal, not research, and the accounts in it are reports made to its author by members of the public. It is recorded here for two things: an account that concerns the lamps this subsection addresses, and a measurement the author reports making herself.

The account is of a person who reported difficulty crossing streets safely at night, attributed to automotive tail lights, daytime running lights and marker lights which he described as switching fully on and off two hundred times a second and producing "a repeating retinal pattern that produces a deceptive impression of where the vehicle is and what direction it is moving." The author adds that it makes him disoriented and that he fears for his safety. The Foundation does not advance that account as evidence of anything and the frequency in it is the correspondent's estimate, not a measurement. It is recorded because of what it alleges, which is not discomfort but misperception of the position and heading of a vehicle by a pedestrian at night. If modulation of a vehicle lamp can do that, the consequence is a collision rather than a headache, and the agency with jurisdiction over the lamp is the one this comment addresses at Part I.

The measurement is the author's own and concerns a different correspondent, who reported seizures and named bus tail lights, aircraft cabin lighting, and dashboard and instrument lighting. Of those products the author writes: "Having measured them, I know the frequency can range from 120 Hz up to over 840 Hz, and they use pulse-width modulation (PWM) to control LED output. Seizures are not supposed to happen from those high frequencies. I used to discount these incidents. I do not anymore, although I still think they are rare."

Two things follow and the Foundation separates them by how much they rest on. The first is a measured fact about products in service: lamps of these classes are driven by pulse-width modulation at frequencies from 120 hertz to above 840 hertz. That is squarely within the range in which Part V.D.2 establishes the phantom array effect to be visible, and above the range the standard laboratory method was written to cover for other purposes. The second rests only on the author's own account of her reasoning: a specialist who holds that seizures are not expected at those frequencies, and who measured the products, nevertheless stopped discounting the reports.

The Foundation does not convert that into a claim that these lamps provoke seizures, and the letter does not either.

5. Interference with clinical measurement

The subsections above concern what modulated light does to a person who sees it. This one concerns something different in kind, and the Foundation gives it a heading of its own for that reason. Modulated light from one regulated product can corrupt the reading of another regulated product, and where that second product is a clinical instrument the harm reaches the patient through the treatment decision rather than through the eye. The Foundation raises it in this comment because both products are within the authority the Department exercises: the instrument as a medical device, and the lamp as an electronic product that emits optical radiation.

The event

The peer-reviewed report described at Appendix C.92 arose from an event in a neonatal intensive care unit. An infant, intubated and with ventilation well established, would not according to the monitor reach a saturation above 90 percent, and the fraction of inspired oxygen was being increased by a closed-loop controller in response. The authors report what happened next.

> "Surprisingly, an abrupt increase in the recorded saturation occurred when the examination LED (light-emitting diode) lamp … was switched off. Within seconds, the monitor indicated 100% saturation, and the FiO_2 was reduced to ambient air. Each time the lamp illuminated the infant, a similar drop in oxygen saturation (SpO_2) could be observed."

The sensor was never in the lamp's central beam and was lit only by scattered light. The effect was reproduced by putting another person's instrumented finger in that stray light, and it stopped when the sensor was covered. The authors draw the conclusion that matters for the scope of this comment: "The effect disappeared when an opaque shield was placed over the sensor. This indicated that the interference was caused by light and not electromagnetic interference."

The Foundation asks the Department to notice what was then done and what came of it. "For clarification, the occurrence was brought to the attention of all manufacturers involved. Neither the manufacturers, nor a review of scientific literature could provide an explanation for this phenomenon." The manufacturers of the monitor, the oximetry module, the oxygen controller and the lamp were told, and none could say why it happened.

What was measured, and what was modeled

The lamp was measured. It operates by pulse-width modulation at 207 hertz, with a compact flicker degree of 63.9 percent undimmed and 80.1 percent fully dimmed, emitting light for only 37 percent of the time undimmed and 13 percent fully dimmed. The Foundation records the direction of that result because it is counter-intuitive and bears on Part V.D.1: dimming the lamp made its flicker worse and cut its duty cycle to about one part in eight.

The mechanism was modeled rather than measured, and the Foundation keeps the distinction. A pulse oximeter alternates red and infrared emission with a dark measurement between each, and subtracts the dark measurement to cancel ambient light. That works on an assumption the authors state plainly: "Assuming the ambient light to be constant at least during the measurement cycle, this will eliminate the disturbance of the ambient light in the measurements of the red (infrared) signal. Ambient LED light, on the other hand, is not constant and therefore will not be eliminated by subtraction of the dark measurements, and can subsequently induce a stroboscopic effect." The instrument's cycle repeats 311.25 times a second, which the authors note is almost exactly one and a half times the lamp's modulation frequency.

In the model, a distortion of one tenth of the constant component of the signal produced a reported saturation of 85 percent, which then stopped falling however much the interference increased, and a reported pulse of 108 beats per minute against a true rate of 140. The error

depends on the frequency relationship and not on the light alone: at a sampling rate of 300 hertz the same distortion gave 96 percent instead of 85.

Why the false reading is dangerous, which is not because it is large

A saturation of 85 percent and a pulse of 108 are both unremarkable values in a newborn. That is the point. Of the erroneous pulse rate the authors write that it "corresponds to a plausible heart rate for neonatal patients. This pulse curve can be interpreted by the pulse oximeter as a valid measurement, particularly when the interference already existed at the beginning of each measurement. The incorrect pulse frequency therefore does not represent a warning signal for an incorrect measurement." The instrument does not know it is wrong, the number it reports is clinically ordinary, and nothing on the monitor indicates an artifact.

In the event that prompted the study, the value was not merely being read. It was being acted on by a closed-loop controller raising the oxygen automatically. The consequence the authors identify follows from that: "Erroneously low saturation levels can lead to unnecessary increases in oxygen administration, which increases the risk of retinopathy in preterm infants", and in the abstract, that the effect "can lead to the risk of blindness in premature infants due to excessive oxygenation." The Foundation states what this is and is not. No infant is reported to have been harmed, and the Foundation asserts no injury. What is reported is a mechanism by which a modulated lamp can cause an automated system to administer more oxygen to a premature infant than the infant needs, and the harm at the end of that pathway is a recognized one.

What the Foundation does not take from this paper

The authors do not claim the interference is peculiar to this technology, and the Foundation will not claim it either. "It can therefore be assumed that such phantom signals can be caused by any flickering light source. Both incandescent bulbs and fluorescent tubes flicker during standard operation with alternating current. Consequently, these light sources can also cause the interference signal we have shown." The proposition the Foundation advances is the narrow one the paper supports: the lamp that produced this event is a light-emitting diode lamp driven by pulse-width modulation at 207 hertz and emitting for 37 percent of the time, and the authors attribute the interference to that modulation. Part V.D.1 sets out why full-depth modulation is a property of the dimming method in general use rather than a defect of a particular driver.

Nor does the paper establish how often this happens. It reports one event, one informal reproduction, one lamp and one instrument, and its mechanism is a model with limitations the authors state. The Foundation relies on it for the existence of the pathway and not for its frequency.

The exclusion, and the question it puts to this Department

The last finding is the one the Foundation asks the Department to weigh longest, because it is about regulatory design rather than about physics.

> "There are EU regulations in place for the use of indoor lighting, which prohibit strong flickering light at the frequency of the lamps we tested. However, medical lamps, with their specific requirements such as spot brightness and color fidelity as essential diagnostic features, are excluded from these regulations. This should be fundamentally questioned, as the technical effort to produce flicker-free LED lamps seems manageable."

The instrument referred to is Commission Regulation (EU) 2019/2020, which Part V.D.1 identifies as the source of the only binding numerical limit on temporal light modulation that this comment has found anywhere. A lamp flickering as this one does would not be permitted in a European office. It is permitted over a neonatal incubator, because medical lamps are carved out of the regulation on the ground that brightness and color fidelity are essential to their diagnostic function. The specialists who found the problem say that exclusion should be fundamentally questioned, and they say the remedy is not technically difficult.

The Foundation makes two observations and asks one question. The first observation is that the European exclusion was presumably drafted on the assumption that the only thing flicker does is annoy people who see it, so that a lamp used for a few minutes by a clinician was not worth constraining. This paper identifies a consequence the exclusion cannot have contemplated, because the people who built the instrument it interferes with could not explain the interference when it was reported to them. The second is that the United States has no corresponding limit at all, so it has no exclusion either, and the absence of a requirement is not an improvement on an imperfect one.

The question is one of jurisdiction, and the Foundation puts it plainly because the answer is within this Department. A pulse oximeter is a medical device, cleared by the Food and Drug Administration, and its performance is the subject of that agency's attention. An examination lamp is an electronic product that emits optical radiation, and 21 U.S.C. § 360ii directs the Secretary to establish and carry out an electronic product radiation control program, while 21 U.S.C. § 360kk provides the authority to prescribe performance standards for such products. Both products are therefore within one Department. No requirement known to the Foundation connects them. No performance standard limits the modulation of the lamp, and the Foundation has not established whether any standard requires the instrument to be immune to modulated light. The Department is better placed than this commenter to answer the second half of that, and the Foundation asks it to do so.

E. Neurological and Photosensitive Responses

This subsection concerns responses mediated by the nervous system rather than by photochemical or thermal injury to tissue. The distinction matters because the exposure limits described at Part V.C.2 are constructed for injury, and none of the responses described here is an injury in that sense. They are responses of an intact nervous system to a stimulus it processes as noxious.

The Foundation separates three classes of response, and states the separation before describing any of them, because they are not the same phenomenon and the comment does not treat them as one.

Photosensitive epilepsy, at paragraph 1 below. A seizure is a discrete pathological event, it occurs in a small and identifiable fraction of the population, and the flash rates and spatial conditions that provoke it have been characterized and are the subject of published guidance.

Light-induced pain and photophobia, at paragraphs 2 and 4 below. This is a nociceptive response conveyed by the trigeminal system. It is not a seizure, it does not become one, and the population in which it occurs is different in kind and far larger.

Sensory processing differences, at paragraph 3 below. These concern how a stimulus is integrated rather than whether it provokes pain or a seizure.

The Foundation does not contend that these are one phenomenon, does not contend that a product capable of provoking one is for that reason capable of provoking another, and does not use evidence drawn from one to support a proposition about another. Where this Part relies on a study, it states which of the three the study addressed. The Foundation asks the Department to hold it to that.

What the three have in common is narrower, and it is the only thing the comment draws from the grouping. None of them is a photochemical injury. None of them is reached by any exposure limit in the international guidance described at Part V.C.2, which is constructed to prevent retinal injury and makes no provision for pain, discomfort or seizure at exposures below the injury threshold. And none of them is addressed by any federal performance standard for any light-emitting product, as Part II establishes. A limit set to prevent injury does not become a limit against pain merely because pain occurs at lower exposures than injury does.

1. Photosensitive epilepsy and flash-rate thresholds

This subsection concerns the one effect of artificial light on the nervous system that is not in dispute. That flashing light can precipitate a seizure in a susceptible person is established, is quantified, and is already the subject of numerical limits in five sets of guidelines and in at least one federal regulation of the United States. The Foundation therefore does not argue in this subsection that a hazard exists. It argues about where the limits apply and where they do not.

The condition, and the population that has not been counted

The analysis at Appendix C.81, funded by two components of this Department and published in 2024, supplies the figures the Foundation relies on. Photosensitive epilepsy is estimated at one person in four thousand. The proportion of the general population who might exhibit a photoparoxysmal response on testing is estimated more widely, at between 0.3 and 8 percent, though not all of those people have the condition. Photosensitivity is one and a half to two times more common in females than in males. It is most common between the ages of eight and twenty-five, with a mean age of onset of fourteen and declining incidence after twenty. Most people do not outgrow it: one study found 70 percent still photosensitive at long-term follow-up.

One further statement in that analysis bears on the argument the Foundation makes elsewhere in this comment about the absence of reporting. Its authors observe that it is uncommon to screen for photosensitivity, and that there is therefore an unknown population of people at risk who have not yet had a seizure or received a diagnosis. They call it the latent population. That is the same structure as the objection at Part I.C.7: a harm is not counted where no mechanism exists to identify the people subject to it, and the absence of counted harm is then read as evidence of safety.

The mechanism, as that analysis describes it, engages two of the three emission characteristics set out at the opening of Part V.B simultaneously. To precipitate a seizure a critical population of neurons in the visual cortex must be stimulated, and the area of brain involved corresponds to the area of the visual field stimulated, so that a larger illuminated area recruits a larger area of cortex. That is the spatial characteristic. And the activity of those neurons must be sufficiently rhythmic and synchronized, which is set up by regular flashing, flicker, oscillation or phase reversal. That is the temporal characteristic. Neither alone is sufficient.

The thresholds, which exist and are numerical

Five sets of guidelines limit flashing content, developed since the mid-1990s: the United Kingdom guidance, the Japanese broadcasters' joint guidance, ISO 9241-391, the International Telecommunication Union guidance, and the World Wide Web Consortium's Web Content Accessibility Guidelines. Appendix D.2 catalogues them. The thresholds they apply are close to one another and, for standard dynamic range content, substantially the same.

A general flash, in which the two states differ by more than 20 candelas per square meter, is treated as potentially hazardous if the darker state is below 160 candelas per square meter.

The more conservative of the two Web Content Accessibility Guidelines criteria prohibits any flashing more than three times per second, without reference to luminance or area.

Of people who would respond to maximal black-to-white flashing, an estimated 7 percent may still be at risk at a luminance change of 20 candelas per square meter, which is why that figure rather than a larger one was chosen.

The Foundation draws attention to the form of those limits rather than to their values. A limit on the magnitude of a luminance change, a limit on the rate at which that change may repeat, and a limit on the proportion of the field of view it may occupy are precisely the three quantities a performance standard for a flashing light source would have to specify. They have been specified. The question Part IX.B.4 puts to the Department is not whether such limits can be written.

Where those limits apply, and where they do not

Every one of the five is a guideline for content presented on a display. The Foundation states that plainly because the distinction is the whole of the point and because nothing in this subsection should be read as evidence about light sources. The United Kingdom guidance arose from a television advertisement in 1993 that caused seizures in at least three people. The Japanese guidance arose from a cartoon broadcast in 1997 in which flashing sequences sent 685 children to hospital. ISO 9241-391 governs image content on display screens. The Web Content Accessibility Guidelines govern web content. They are addressed to broadcasters, advertisers, content creators, game developers and web authors.

And one of them has been made binding in the United States. The analysis at Appendix C.81 records that the Web Content Accessibility Guidelines, including the photosensitive epilepsy success criteria, have been applied through Section 508 of the Rehabilitation Act to non-web digital documents and software that are purchased, procured or created by government, and in the European Union through EN 301 549. The underlying guidelines were also adopted as ISO/IEC 40500:2012.

The Foundation asks the Department to hold those two facts together, because stated together they describe the gap this comment exists to identify.

A federal agency procuring a training video, a software application or an electronic document must ensure that it does not flash more than three times per second. That obligation arises under Section 508 of the Rehabilitation Act and is enforceable.

A manufacturer selling a rectangular rapid-flashing beacon, an emergency vehicle light bar, a flashing deterrent light or any other physical light source is subject to no federal limit on flash rate, on luminance change, or on the proportion of the field of view the flashing source occupies. Part VI.C and Part VI.I describe those products. Part II.E.4 establishes that no performance standard under 21 U.S.C. § 360kk applies to them.

The condition is the same. The susceptible population is the same. The triggering mechanism, as described above, is the same: a sufficiently large area of the visual field changing luminance at a sufficiently regular rate. What differs is only whether the flashing reaches the eye from a screen or from a lamp. A person with photosensitive epilepsy is protected by federal regulation from a flashing sequence in a government training video and is not protected by any federal regulation from a flashing beacon at a crosswalk, which they cannot close, cannot look away from while crossing, and did not choose to encounter.

The Foundation does not suggest that the authors of Section 508 or of the content guidelines were in error, or that their scope should have been wider. Each instrument addressed the technology domain its drafters were responsible for. The point is the one Part V.C.2.k makes about the classification of optical radiation products generally: when the instruments are organized by domain rather than by emission characteristic, a hazard that crosses domains is addressed in one and not the other, and nothing in the structure causes anyone to notice. Part V.B.3 makes the same observation about 21 C.F.R. § 1040.20, which has limited a spectral ratio for one light-emitting product since 1985 while no comparable limit exists for any other. Here the instrument is not merely available by analogy. It is in force, in the United States, for this condition, expressed in the units required, and it does not reach the products this comment is concerned with.

2. Migraine and photophobia

Photophobia is the clinical term for an abnormal, light-induced aversive or painful response. It is a recognized diagnostic feature of migraine and is reported in tension-type headache, in headache following traumatic brain injury, in cluster headache and the other trigeminal autonomic cephalalgias, and in a range of ophthalmological conditions. Where the response includes pain referred to the eye itself it carries its own name, photo-oculodynia.

The Foundation relies principally on one review and on two of the primary studies it synthesizes. The review is Noseda, Copenhagen and Burstein, Current understanding of photophobia, visual networks and headaches, published in Cephalalgia on June 25, 2018 and appearing at volume 39, issue 13, pages 1623 to 1634. Two of the three authors are at the Department of Anesthesia, Critical Care and Pain Medicine at Beth Israel Deaconess Medical Center and Harvard Medical School; the third is at the Department of Ophthalmology at the University of California, San Francisco School of Medicine. The work was supported by three grants of the National Institute of Neurological Disorders and Stroke: R21-NS090254, R01-NS104296 and R37-NS079678. The authors declared no conflicts of interest. Part II.E.6 addresses the significance of the funding source and the Foundation does not repeat it here.

a. The response is not a visual preference, and a natural experiment establishes it

The objection most readily made to the reports described at Part VII is that an aversive response to light is a matter of taste, comfort or habituation rather than of physiology. The Foundation addresses that objection here rather than in Part VII, because the answer is a question of mechanism and the mechanism has been identified in human beings.

Noseda, Kainz, Jakubowski and others, publishing in Nature Neuroscience in 2010, studied migraine patients who were blind. The review describes the result:

> "Accordingly, intensification of headache was perceived only by blind migraineurs with an intact optic nerve who were able to partially perceive ambient illumination but unable to form images due to degeneration of rod and cone photoreceptors (i.e. patients diagnosed with retinitis pigmentosa, retinal prematurity or cone/rod dystrophy). Conversely, totally blind migraineurs lacking any type of visual perception due to damage of the optic nerve (i.e. those with optic neuropathy, retinal cancer or enucleation), which translates to complete absence of photic information reaching their brain, testified that light does not hurt them during migraine."

The Foundation asks the Department to consider what that comparison excludes. The first group could not see images. They had no visual experience of the light, no aesthetic response to it and no opinion of its appearance, and light intensified their pain. The second group retained no photic input to the brain at all, and light did not. The variable that distinguished them was neither preference nor expectation nor the appearance of the source. It was whether photoreception reached the brain.

The Foundation accordingly does not advance light-induced pain as a matter of comfort, and asks that the reports at Part VII not be read as reports of discomfort. A response that occurs in people who cannot see the stimulus is not a preference about how the stimulus looks.

b. Wavelength governs the response at identical intensity

Noseda, Bernstein, Nir and others, publishing in Brain in 2016, tested the effect of the spectral composition of light on headache in migraineurs with normal eyesight. The design is the material feature and the review states it:

> "White, blue (447 ± 10 nm), green (530 ± 10 nm), amber (590 ± 10 nm) and red (627 ± 10 nm) lights were applied using a full-field Ganzfeld stimulator calibrated to deliver narrow bands of visible light at equal intensity to the human eye for 3 minutes."

> "Surprisingly, green light significantly attenuated the headache intensity, as opposed to the exacerbating effect of white, blue, amber and red lights."

Intensity was held equal and wavelength was varied. The direction of the effect reversed. One narrow band reduced the pain and four increased it. The authors obtained mechanistic corroboration from color-selective electroretinography and visual evoked potentials in the same patients and from recordings of dura-sensitive thalamic neurons in the rat, reporting that green

evoked the smallest electroretinographic a-wave and the smallest cortical P2 amplitude of the five conditions.

That result bears on this comment in two ways, and the Foundation separates them.

It is the human clinical instance of the proposition advanced throughout Part V.J.4: that a quantity of light is not a description of its biological effect. Two exposures identical in intensity produced opposite changes in a clinical endpoint. A standard expressed in illuminance, in luminous intensity or in any other photometric unit cannot distinguish between them, because the quantity in which it is expressed was equal in both.

The exacerbating blue band in that experiment was centered at 447 nanometers. Part V.J.4 records that the emission peak of a phosphor-converted white light-emitting diode lies between approximately 450 and 470 nanometers. The Foundation states as its own observation, and not as a finding of the authors, that the band found to exacerbate headache in that experiment is the band in which white light-emitting diode products emit their primary radiation. The authors studied migraine. They did not study any product, and the Foundation does not represent that they did.

c. The comfort of a healthy observer is not a criterion for this population

Part V.C.2 describes the international guidance on which the Department is asked to rely, and records the position taken in the 2020 statement of the International Commission on Non-Ionizing Radiation Protection that where a source is comfortable to view its levels should not be considered harmful. The Foundation offers two sentences from the headache literature against that criterion, and offers them because they are not its own.

> "The common notion is that exposure to light that is otherwise comfortable to healthy people exacerbates the intensity of the headache."

And on the question whether a level exists below which the response does not occur, the review states the position of the ophthalmological literature it cites, Katz and Digre in Survey of Ophthalmology in 2016:

> "For migraineurs with normal eyesight, virtually all luminous intensities can trigger uncomfortable features of photophobia"

The Foundation does not read the second sentence as establishing that no threshold exists, and does not advance it for that. It reads it as the state of the published description, which is that no threshold has been identified. The consequence for the guidance is the same either way. A criterion that takes the comfort of an unaffected observer as the test of safety excludes from consideration the population in which the response occurs, and does so by construction rather than by oversight.

The review also identifies a setting in which this bears on a product class already before the Department. Having described hypersensitivity across photopic, scotopic and mesopic conditions, the authors note the last of these arises "when driving at night using both photoreceptors (mesopic vision)", "which is a serious challenge for photophobic migraineurs." Part VI.B and the citizen petitions described at Part IV concern vehicle headlamps. The Foundation notes the convergence and draws no further inference from it here.

d. What this does not establish

Four limitations, and the Foundation states them at the length they deserve because the third is a result that runs against a mitigation the Foundation has elsewhere described.

None of this work concerns light-emitting diode products. No study described in this paragraph exposed a subject to a named product, measured what any product emits, or

reported a spectral power distribution of a lamp in commerce. The experimental sources were laboratory stimulators delivering calibrated narrow bands.

Migraine is a disease and migraineurs are a patient population. Nothing in this paragraph establishes that light-emitting diode products produce pain in people who do not have a photophobic condition, and the Foundation does not contend that they do. The proposition is the affected-population one: there exists a population, of substantial size, in which ordinary ambient light produces pain through a characterized non-visual mechanism, and no federal standard for any light-emitting product takes account of it.

The evidence that filtering the implicated wavelengths helps is weaker than it appears, and the Foundation reports the complication rather than omitting it. A proof-of-concept study of notch-filter spectacle coatings designed to block 480 nanometers in chronic migraineurs reported benefit on the headache impact test and on a photophobia questionnaire — but, in the review's words, "not only blue but also sham lenses filtering red light (620 nm) were beneficial for the headache and photophobia." The explanation offered for the sham result was the bistability of melanopsin, and the review records that direct recordings of the relevant retinal cells under red light failed to show a response, "thus opposing the bistability hypothesis." A trial in which the sham arm performs as well as the active arm does not establish that the active mechanism operates. The Foundation accordingly does not offer spectral filtering as a demonstrated remedy, and Part II.G.3 should be read with this paragraph: the techniques listed there are available and untested, which is the Foundation's point about them, and this is an instance of a technique that was tested and did not separate from its control.

The review is a review. For each of the two load-bearing findings the Foundation cites the primary study, and it relies on the review for the synthesis, for the state of the field and for the research-gap statement at paragraph e.

e. The field's own account of what has not been done

The Foundation has stated throughout this comment that the research bearing on these questions has not been performed. On this question the authors say it themselves, in the second sentence of their background:

> "Over the years, multiple mechanisms have been proposed to explain its causes; however, scarce research and lack of systematic assessment of photophobia in patients has made the search for answers quite challenging."

Two features of that sentence bear on the requests at Part IX. The first is scarce research, which is a statement about volume. The second is the lack of systematic assessment of photophobia in patients, which is a statement about surveillance, and it is the same absence the Foundation describes at Part V.J in respect of exposure and at Part IX.D in respect of adverse event reporting. Investigators funded by the National Institute of Neurological Disorders and Stroke report that the symptom is not systematically assessed in the patients who have it. The Foundation asks the Department to read that alongside the reliance placed on an absence of reported harm, which Part I.C.7 addresses.

3. Autism and sensory processing differences

This subsection concerns a population for which the question this comment asks is both more acute and less answerable than for any other it treats. The Foundation sets out what the literature contains, and then states plainly that it does not contain what would be needed, because the gap is the finding.

Why the question arises, and the form the Foundation gives it

Atypical reactivity to sensory input is not an incidental feature of autism. It is part of the diagnostic construct itself: the criteria include hyper-reactivity or hypo-reactivity to sensory input,

or unusual interest in sensory aspects of the environment, and the visual examples given in the criteria concern lights and movement. The Foundation states the criterion in that two-sided form because that is how it is written, and because a comment that converted it into a general proposition that autistic people are sensitive to light would be asserting something narrower than the criterion says and broader than the evidence shows.

What follows from the criterion is not a conclusion about harm. It is that a recognized population, identified in part by its reactivity to sensory input, is exposed to the emissions described throughout Part V, and that the Department has never asked what those emissions do to that population. The request at Part IX.C.6 follows from that and from nothing stronger.

The two studies, and what each of them lacks

The Foundation examined the two most directly relevant studies it could identify. They are set out at Appendix C.82 and Appendix C.83. Taken separately each is of modest value. Taken together they describe the condition of the field precisely, because their weaknesses are exact complements.

Appendix C.82 measures. It records the pupillary light reflex objectively, by eye tracker, and reports that in adults a higher score on the restricted and repetitive behavior subscale was associated with smaller relative pupil constriction and longer constriction latency, both surviving correction for multiple comparisons. It has no autistic participants. Its samples were non-autistic, and autistic traits were measured dimensionally by questionnaire.

Appendix C.83 has the population. Eighty-seven autistic children aged six to sixteen, clinically diagnosed. It measures nothing. Its instrument is a forty-question survey of the children and their parents, scored on a suitability ranking, and it reports no physiological or behavioral observation of any kind.

And neither characterizes the light. In Appendix C.82 the stimulus is described as a white flash of 120 milliseconds, with no wavelength, no luminance and no statement of the background adaptation level. In Appendix C.83 the position is more complete than that: the Foundation searched the full text of that paper for every photometric and radiometric term it could think of, and for the common lamp technologies, and found none of them. The result is recorded in the entry. A paper on the effect of light on behavior states no illuminance, no luminance, no correlated color temperature, no wavelength, no spectral power distribution, and does not identify what kind of lamp was in the rooms it concerns.

What that pattern is, and what it is not

At Part V.E.2 the Foundation drew a distinction, taken from the words of investigators in that field, between scarce research, which is a statement about volume, and the absence of systematic assessment, which is a statement about surveillance. The position on this question requires a third category, and the Foundation states it as the finding of this subsection.

The difficulty here is not only that there are few studies. It is that the studies which exist are not of a design that could answer the question, and they fail in a consistent way. The study with the right population does not measure. The study with the measurement does not have the population. Neither describes the exposure. A third study of either kind would not remedy that, because the deficiency is in the design rather than in the count. What is required is a single study holding three things at once: a diagnosed population, a physiological or behavioral measurement, and an exposure characterized in the units Part V.J.1 sets out. The Foundation is not aware of one.

The Foundation accordingly asserts no dose-response relation for this population and asks the Department to notice that it cannot. It does not claim that autistic people are injured by light-emitting diode products at any stated level, because no study in the record before it would support that claim, and a comment that made it on the strength of the two studies described above would deserve to be discounted. What it asks is set out at Part IX.C.6: that the study be performed.

The condition neither study reaches

One further gap is worth identifying with precision, because it is the condition most often described by the people who report difficulty and it is addressed by neither study. Appendix C.83 concerns static interior lighting. Appendix C.82 used a single brief flash, with intervals of ten to fifteen seconds between trials included deliberately to prevent retinal saturation, and it did not measure redilation at all. The design therefore excluded repeated exposure by construction.

Repeated and flashing sources, encountered in darkness, engage a different mechanism from the one either study examined. Constriction amplitude describes the response to an increase in light. Recovery between successive flashes is a function of redilation kinetics and of light and dark adaptation, and neither is measured in either paper. Part V.D concerns the temporal characteristic generally, Part V.E.1 concerns the one neurological response to flashing light for which numerical thresholds exist, and Part VI.C concerns the products that produce the condition. The Foundation records here that the intersection of those three with this population is, so far as it can establish, entirely unstudied.

4. Trigeminal and melanopsin-mediated pathways

This paragraph states the anatomical route by which the responses described at paragraph 2 are understood to arise. The Foundation sets it out because the route explains three features of those responses that would otherwise appear anomalous, and because it is the point at which the human and animal evidence in this comment meet.

The convergence is in the thalamus. The review describes the finding:

> "Experiments using in vivo electrophysiological recordings of dura-sensitive (trigeminovascular) neurons in the thalamus showed that shining light into the contralateral eye induces robust and sustained increase in their activity."
>
> "These light/dura-sensitive neurons, which are located in the lateral posterior (LP) and posterior (Po) nuclei, receive input from ipRGCs."

The abbreviation is for intrinsically photosensitive retinal ganglion cells, the melanopsin-expressing cells described at Part V.F as the conduit for circadian entrainment. The same cells supply the thalamic neurons that carry pain signals from the dura. Light and cranial pain therefore converge on single neurons, and a photic signal arriving at such a neuron adds to a nociceptive one.

Three features of the clinical picture follow from that arrangement, and the Foundation identifies them because each corresponds to something stated elsewhere in this Part.

The response does not require image formation, because the input is from a non-image-forming photoreceptor. That is the mechanism behind the blind-migraineur comparison at paragraph 2.a. The review notes that the melanopsin system is driven optimally by photons of approximately 480 nanometers, and records the finding of Zaidi and others in Current Biology in 2007 that subjects lacking an outer retina, nominally unaware of light perception, could nonetheless identify a 481-nanometer test light and failed to detect it at other wavelengths.

The response is to light as a quantity reaching a receptor rather than to a scene, which is why it is not governed by the appearance of the source and why Part V.B.2 is relevant to it. What determines the signal is the irradiance delivered to the retina, and Part V.B.2 sets out why that quantity does not fall with distance from a source the eye resolves.

The autonomic and affective accompaniments of the response are not incidental to it. The review describes photic signals transferred to brain regions involved in sensory, autonomic and emotional regulation, and reports the finding of Noseda and others in the Proceedings of the National Academy of Sciences in 2017 on hypothalamic-mediated autonomic

responses to light during migraine. Part V.E.5 addresses that literature. The Foundation notes here only that nausea, lacrimation and the affective quality of the experience are features of the pathway rather than reactions to the pain.

The animal evidence in Appendix C.51 corroborates the receptor identity by a different method, and the Foundation sets the two side by side because neither alone would be sufficient. In that study a melanopsin antagonist reduced blue-light aversion while a blocker of the visual photoreceptors did not, and the investigators recorded trigeminal activation markers together with corneal inflammation that persisted for three days after a three-hour exposure. The human comparison at paragraph 2.a establishes that the pathway operates in people and does not require image formation. The animal study identifies the receptor pharmacologically and shows that the response outlasts the stimulus. Neither establishes the other and the Foundation does not present either as doing so.

One historical point belongs here because it bears on the glare analysis at Part V.C. The review summarizes the earlier literature as proposing that migraine involves "a subcortical inability to suppress glare and light-induced pain, and that trigeminal-autonomic reflexes further contribute to pain by promoting vasodilatation in pain-sensitized extra/intracranial vessels." Part V.C.3 and Part V.C.4 treat disability and discomfort glare as visual and photometric phenomena, which is what they are. This sentence identifies a population for whom glare is additionally a nociceptive one. The Foundation does not merge the two accounts and asks that they be read as describing different things that the same installation can produce.

The Foundation closes this paragraph with the authors' own statement of what remains to be done, because it is a research agenda addressed to precisely the subject paragraph 360ii(a)(4) directs the Secretary to study:

> "Due to the many anatomical structures and medical conditions that are associated with photophobia, efforts to identify the underlying neurobiological mechanisms behind its different forms must continue to focus on the relationship between visual networks, trigeminal pain pathways and autonomic regulation at multiple levels, from the eye to the cerebral cortex, in a pathology-specific manner."

And the conclusion with which they qualify the whole of it, which the Foundation reproduces because it is a caution against the overreading this paragraph could otherwise invite: "Photophobia phenotype is diverse, and the relative contribution of visual, trigeminal and autonomic systems may depend on the disease it emerges from."

5. Autonomic and acute stress responses

This subsection concerns reported responses that are neither seizure nor pain: the acute autonomic and stress responses that Part VII.B.4 records in the incident material, including the panic reactions, nausea, lacrimation and the affective quality of the experience described there.

The Foundation states the condition of the evidence before anything else, because the honest answer is that it has not assembled it. Two leads have been identified and neither has been obtained and read. One is work on cardiac autonomic function under colored light-emitting diode illumination, identified through a reference list rather than read in the original. The other is work on hypothalamic-mediated autonomic responses to light during migraine, which Part V.E.2 notes in passing for the proposition that nausea and lacrimation accompany the migraine response. The Foundation does not rely on either and does not state their findings. Part V.A.2 sets out the standard of evidence this Part applies, and material identified but not read does not meet it.

What the Foundation does say is confined to the structure of the question. An autonomic response is a measurable physiological event rather than a report of discomfort, which places it among the effects a study under paragraph 360ii(a)(4) could measure directly. Part V.G.7 sets out where the Foundation places material that rests on report alone, and this subsection belongs there until the literature is obtained.

6. Deliberate induction of altered perception, and the frequencies at which it is done

This subsection concerns a fourth thing, distinct from the three the opening of this Part separates. It is not a seizure, it is not pain, and it is not a difference in sensory integration. It is the deliberate use of flashing light, in laboratories and in recreational settings, to alter visual perception in people who are not unusual in any respect. The Foundation raises it for two reasons, and neither is the one a reader might expect.

What this does not say, stated first

The study described at Appendix C.93 used flicker at 3 and 10 hertz. The modulation of light-emitting diode products treated at Part V.D lies between about 100 hertz and 10 kilohertz. These are different phenomena at different frequencies, and the Foundation does not contend that the modulation of a lamp or a display induces an altered state of consciousness. Nor are the exposures comparable: the participants sat at about half a meter from a purpose-built stroboscope, in a dark room, wearing earplugs, with their eyes closed, for twenty minutes. Nothing in this subsection is offered as evidence about ordinary lighting.

The first reason: the frequencies are those of devices in the public way

Part V.D.4 establishes by counting the pattern the governing manual prescribes that a rectangular rapid-flashing beacon delivers exactly 5.0 illuminations per second at each indication and 7.5 per second across the assembly. Those rates fall between the two frequencies this study used. They are not near them or comparable to them; they lie inside the interval.

The band is wider than the two frequencies tested. The discussion in the same paper collects the literature. One study reported "most radial illusory percepts at ~10 Hz and spiral percepts to be most pronounced at the slightly higher frequency of ~15Hz". Another found the phenomena "most strongly pronounced between 10–25 Hz". Two more place "the strongest illusory percepts in the range of 15 to 30 Hz". So the band within which flashing light is established to alter visual perception runs from about 3 to about 30 hertz, and the devices described at Part VI, including pedestrian beacons, emergency vehicle lamps and the flashing elements of dynamic signs, operate inside it. The Foundation states the limit of the point: identity of frequency is not identity of effect, and the exposures differ in eyelid, duration, distance and ambient light. What the identity of frequency establishes is that these devices are not operating in a band about which nothing is known. They are operating in the band that researchers select when they wish to alter perception.

The second reason, which the Foundation regards as the stronger: what was required before anyone was exposed

To expose twenty-four healthy adult volunteers to twenty minutes of flashing light at 3 and 10 hertz, a European university required all of the following. A semi-structured interview with a psychologist, conducted before the experiment, "to ensure that they were not affected by an acute mental or neurological disorder, were not currently or regularly taking any psychotropic medication or drugs and were not pregnant". An instrumented screen for susceptibility, namely "a screening for indications of photosensitive epilepsy based on electroencephalography (EEG)", which itself comprised four-second flicker episodes at 1, 3, 10, 20, 30 and 40 hertz, each presented twice, together with a resting record and a period of hyperventilation, the whole reviewed by a trained expert. Approval by a hospital ethics committee. Written consent after being informed of the risks. And a familiarization session under constant light before any flicker was applied.

Even with all of that, one participant withdrew: "One participant dropped out of the study due to self-reported migraine symptoms after the first experimental session with FLS of 10 Hz". A person who had been interviewed by a psychologist, screened by electroencephalography, and found suitable, was made unwell by a single session.

Now set that beside the position of a person crossing a street. A beacon operating at 5.0 flashes per second at each indication is installed in the public way. No one is interviewed. No one is

screened by electroencephalography or by any other means. Pregnancy is not asked about and does not matter. Psychotropic medication is not asked about and does not matter. No ethics committee has considered the exposure, because it is not research. No consent is sought, informed or otherwise, and none could meaningfully be given, because the only way to decline is not to use the street. There is no familiarization session. And there is no mechanism by which a person made unwell can withdraw, be replaced, or be counted.

The Foundation does not argue that a pedestrian beacon is a research instrument or that installing one requires ethical review. The argument is narrower and is about knowledge rather than about procedure. The safeguards that a research institution imposes are a statement of what that institution believes flashing light in this band can do to a person. They are the considered judgment of the people who study the stimulus, expressed in the one form that costs them something, which is the form of a protocol they must follow. A regulator deciding what is known about flashing light may read that protocol as evidence of the state of knowledge, and what it says is that exposure in this band is understood to warrant screening for epilepsy, exclusion of pregnancy, exclusion of psychotropic medication, and the opportunity to decline.

None of those four protections attaches to any device described at Part VI. That is the proposition this subsection establishes, and the Foundation asks the Department to notice that it does not depend on any finding about altered states being alarming, or on the frequencies of lighting-product modulation, or on anything contested. It depends only on what the researchers did before they turned the lamp on.

7. Effects that outlast the exposure

Every mechanism treated in this Part so far operates while the person is exposed. The seizure occurs during the flash, the migraine is triggered by it, the autonomic response accompanies it. This subsection concerns a different question, which the Foundation has found addressed in one place only: whether a flash leaves anything behind.

The study is described at Appendix C.100 and the Foundation states at the outset what it is. It is an experiment in mice, conducted under craniotomy with intracellular recording and two-photon imaging, and its purpose was methodological: its authors set out to develop flashing light as a tool for inducing plasticity in the adult brain. It is not a study of exposure to any product and the Foundation does not present it as one.

What it establishes about the response itself

A brief flash does not produce a brief cortical response. It produces a fast transient response followed by a long-delayed response that persists for seconds after the flash has ended. The authors state in their significance statement that this delayed response occurs in mice, rats and humans, citing their own earlier work for the human case. The flash used was modest: a hundred milliseconds of white screen at 240 candelas per square meter against a background of 60, which is about 65 lux at the eye.

The Foundation draws the Department's attention to that single fact before going further, because it bears on every criterion discussed in this Part and in Part V.D. Those criteria are expressed in the properties of the stimulus while it is present. If the cortical response to a flash outlasts the flash by seconds, then a device flashing more than twice a second, which is what Part VI.I reports measuring, is delivering its next flash into the response evoked by the last one. Whether that matters is not known. That it has not been asked is the point.

What the experiment did beyond that, and the protocol that limits it

The authors paired the flash with a visual feature. A grating drifting in one particular direction was presented four hundred milliseconds after each flash, at the onset of the delayed response, and the pairing was repeated thirty to fifty times. The consequence was a suppression of the cortical response to gratings drifting in that direction, and a measurable fall in the animals' ability

to detect motion in that direction. Both the neuronal and the behavioral change persisted for at least several hours, and both were abolished when an N-methyl-D-aspartate receptor antagonist was applied to the visual cortex, which identifies a mechanism rather than merely an association.

The Foundation now states the limitation, and states it in the authors' own words rather than its own, because it is decisive for how far this can be taken:

> "Although the intensity of the flashing stimulus employed here (Δluminance = ~60 lx) is comparable to that experienced in our daily lives, such as that of a camera strobe, we rarely encounter such repeated, specific exposures to visual stimuli."

Two things follow and the Foundation separates them. The intensity was ordinary. It was not the intensity of anything described in Part VI, and the authors compare it to a camera strobe. And the exposure pattern was a conditioning protocol: a flash, a fixed interval, one specific stimulus, repeated dozens of times, with the resulting deficit confined to that one stimulus. A person driving past a warning lamp is not in that protocol, and the Foundation does not suggest that the deficit demonstrated here occurs on a roadway.

What the Foundation asks the Department to take from it

Three things and no more. That a brief flash produces cortical activity outlasting it, in humans as well as in rodents. That in an animal model, repeated flashing coupled with a visual feature degrades the perception of that feature for hours afterward, through an identified receptor mechanism. And that whether environmental flashing light, at the intensities and repetition rates actually deployed in the products described in Part VI, engages that mechanism in people has not been studied by anyone.

The authors say that we rarely encounter repeated, specific exposures to visual stimuli. The Foundation records, without asserting that the two are equivalent, that the deterrent lamp measured at Part VI.I presents a five-pulse burst repeating more than twice a second, continuously, for as long as the unit is switched on, directed at a public sidewalk. Whether a repeated environmental exposure of that kind has any relationship to the repeated laboratory exposure these authors used is precisely the sort of question paragraph 360ii(a)(2) directs the Secretary to have answered, and it is open.

F. Circadian Disruption and Melatonin Suppression

The circadian pathway is the one effect family in this Part on which large-scale human outcome data now exist, and the most substantial study appeared in September 2026.

Dai, Dai, Heianza and Qi, publishing in the European Heart Journal, examined light exposure and cardiac outcomes in the UK Biobank cohort. Light exposure was measured rather than reported: each participant wore a wrist accelerometer with an integrated light sensor for seven days, and nighttime exposure above 3 lux was derived from calibrated measurements aligned to each individual's own circadian phase. Eleven thousand and seventy-one participants underwent cardiac magnetic resonance imaging about three years later. Between 71,077 and 73,286 were followed for incident disease over eight to ten years.

On imaging, high versus no nighttime light exposure was associated with left ventricular concentric hypertrophy and subclinical functional decline: 2.4 percent greater left ventricular mass indexed to height (95% CI 1.6, 3.1), 1.5 percent greater mean wall thickness (1.0, 2.0), and 1.9 percent lower myocardial contraction fraction (1.1, 2.7). Myocardial deformation was impaired in all three directions. Adverse associations were also seen in the right ventricle and the left atrium.

The incident disease findings are the ones the Foundation asks the Department to read directly. Over eight to ten years of follow-up, participants with high versus no nighttime light exposure had:

a 29 percent higher risk of heart failure (95% CI 12, 49);

a 33 percent higher risk of stroke (11, 59);

a 24 percent higher risk of myocardial infarction (7, 44);

a 15 percent higher risk of atrial fibrillation (4, 27); and

a 26 percent higher risk of cardiovascular mortality (5, 52).

All associations showed linear dose-response relationships, and 24 to 49 percent of each was mediated by shorter sleep duration on formal causal mediation analysis. The models adjusted for age, sex, ethnicity, deprivation, education, employment, urbanicity, physical activity, diet, smoking, alcohol, body mass index, hypertension, dyslipidemia, diabetes, kidney disease, vitamin D, air pollution, photoperiod, season and sleep duration — that is, including the confounders ordinarily raised against studies of artificial light at night. The authors conclude that the findings "highlight dark nights and adequate sleep for cardiovascular health."

Two features deserve emphasis. The first is the threshold. Three lux is not bright. It is the order of light that enters a bedroom from a street lamp through a curtain, and the study found a linear dose-response relationship above it. The second is that the exposure was measured by instrument at the wrist, which removes the recall bias that weakens much of the literature on artificial light at night.

The Foundation states the limit of this study as plainly as its findings. It is observational and establishes association, not causation, and the authors describe it in those terms. More important for this comment, it measured ambient light at night from whatever source produced it. It did not isolate light-emitting diode products, did not characterize the spectral content of the light, and makes no claim about lighting technology. It cannot be cited for the proposition that LED products cause cardiovascular disease, and the Foundation does not cite it for that.

What it supports is narrower and sufficient. Exposure to light at night at low levels is associated with serious cardiovascular outcomes in a large cohort with measured exposure. Light-emitting diode sources are now the predominant contributors to that exposure in the United States, for the reasons given at Part IV.G.3. And no federal body measures what any American actually receives at night, from any source. Appendix C.2 sets out the study in full.

A larger analysis of the same question, confined to clinical events, had been published a year earlier. Windred and others, in JAMA Network Open in October 2025, examined 88,905 UK Biobank participants over 9.5 years, deriving exposure from approximately 13 million hours of wrist-worn light sensor data and taking outcomes from National Health Service records. Comparing those with the brightest nights, the 91st to 100th percentile, against those with dark nights, the 0 to 50th:

coronary artery disease, adjusted hazard ratio 1.32 (95% CI 1.18 to 1.46);

myocardial infarction, 1.47 (1.26 to 1.71);

heart failure, 1.56 (1.34 to 1.81);

atrial fibrillation, 1.32 (1.18 to 1.46);

stroke, 1.28 (1.06 to 1.55).

The associations survived adjustment for physical activity, smoking, alcohol, diet, sleep duration, socioeconomic status and polygenic risk. That last adjustment is unusual and worth noting: the analysis controlled for genetic susceptibility directly rather than assuming it away. Associations were larger in women for heart failure and coronary artery disease, and larger in younger participants for heart failure and atrial fibrillation. The authors conclude that avoiding light at night may be a useful strategy for reducing cardiovascular risk.

A caution about reading these two studies together

The Foundation draws attention to the relationship between that study and the cardiac imaging study described above, because the two must not be read as independent confirmations of one another and a reader who assumed they were would be misled.

Both analyze the UK Biobank. Both derive exposure from the same wrist-worn light sensors. The participants substantially overlap. Two analyses of one cohort using one instrument are not two studies in the sense that matters for replication, and the Foundation does not present them as such. What they jointly establish about generalizability is limited to that population.

What they do establish within it is of a different kind, and the Foundation submits that it is more interesting than replication would have been. The imaging analysis found structural and functional change in the heart: concentric hypertrophy, greater wall thickness, reduced myocardial contraction fraction, impaired deformation in all three directions. The incidence analysis found the clinical events that such changes characteristically precede: coronary disease, infarction, heart failure, atrial fibrillation, stroke. The subclinical finding and the clinical finding are mechanistically consistent with one another, in one population, measured by one instrument. That is coherence rather than replication. The Foundation presents it as coherence and asks the Department to weigh it as such. Appendices C.2 and C.8.

A smaller study published in May 2026 bears on the same pathway in a clinical population, and the Foundation includes it with its limitations stated rather than omitting it. Li and others followed 454 patients with hepatocellular carcinoma and compensated cirrhosis in a single Chinese city for twelve months, measuring light in each patient's bedroom with a handheld illuminometer between 23:00 and 04:30 on three occasions. Mean bedroom light above 50 lux was associated with increased risk of overt and minimal hepatic encephalopathy, with deterioration of liver function, with esophagogastric variceal rupture, and with disease-related mortality.

The Foundation does not place weight on that study for the proposition that light at night causes disease in the general population, and the reasons are set out at Appendix C.4. The population is narrow and seriously ill, the threshold of 50 lux is far above the level at which the cohort study described above found effects, and there is a plausible reverse-causation pathway that the authors do not address: hepatic encephalopathy disturbs the sleep-wake cycle, so a patient developing it may come to have more light in the bedroom at night rather than less. The Foundation identifies that difficulty itself because a reader who found it unaided would discount everything adjacent to it.

What the study does contribute is methodological, and it belongs with Part V.J. The investigators measured each participant's actual nighttime light exposure in the room where that person slept, repeatedly, with an inexpensive handheld instrument.

A third outcome study, published in January 2026, examined a different disease in the same cohort used by the cardiac study above. Chen and others followed 346,163 UK Biobank participants for a mean of 13.71 years, assigning outdoor artificial light at night from satellite data matched to each participant's residential address. Each standard deviation increment of exposure was associated with an 8 percent higher risk of incident ulcerative colitis (hazard ratio 1.084, 95% CI 1.023 to 1.149, $p < 0.001$), and the highest exposure level carried a 31 percent higher risk than the lowest (HR 1.309, 95% CI 1.12 to 1.529, $p < 0.001$). The association was non-linear on restricted cubic spline analysis and was stronger in women.

One feature of that result is worth noting for a reason unrelated to inflammatory bowel disease. No association was found with Crohn's disease (HR 1.044, 95% CI 0.83 to 1.308, $p = 0.71$), although the two conditions share the urban distribution and the socioeconomic gradient that make confounding the standard objection to studies of this kind. A confounder operating through

urbanicity or deprivation would be expected to move both. That it moved only one is some evidence, though not proof, that the association is not simply a map of where cities are.

The exposure measure is nonetheless the weakest element of that study and the Foundation says so. Satellite radiance at a residential address describes light leaving a neighborhood, not light reaching a person. The effect sizes are modest, and modest hazard ratios in observational work are the ones most vulnerable to residual confounding. Appendix C.5.

The melatonin pathway is also the hypothesized mechanism for the longest-standing question in this literature, which concerns breast cancer. The study described at Part V.J.4 and Appendix C.7 bears on it. Among 24,793 women followed in two pooled cohorts, outdoor light at night measured conventionally as brightness showed no significant association with breast cancer. A measure weighted by the capacity of the light to suppress melatonin, among women who reported light entering their rooms at night, was associated with a 1.53-fold hazard in the highest tertile against the lowest (95% CI 1.18 to 1.98). The Foundation presents that finding with the cautions set out at Appendix C.7, which are substantial, and relies on it principally for what it shows about measurement rather than for what it shows about risk.

The origin of that question should be identified, because this comment has described the literature on light at night without naming where it began. The hypothesis was advanced in 1987 by Richard G. Stevens, in a paper in the American Journal of Epidemiology titled Electric power use and breast cancer: a hypothesis. It proposed that the use of electric light at night, by suppressing nocturnal melatonin, might bear on breast cancer incidence. The Foundation identifies it for two reasons and neither is that the hypothesis has been established.

The first is chronological. The proposition that artificial light at night might have consequences for human health is not a recent contention, and it is not the Foundation’s. It was advanced in the peer-reviewed epidemiological literature thirty-nine years ago, and it has been under investigation continuously since. Part II.A records the agency’s determination of May 24, 2024 and the reliance it placed on a history of safety. The Foundation asks the Department to note that the question has had a published literature for the whole of the period in which light-emitting diode products were introduced and became dominant.

The second is that the hypothesis has since been tested at scale, and Appendix C.53 describes the test: a prospective cohort of 109,672 American women followed for twenty-four years, funded by three components of this Department and published in the journal of a fourth. The Foundation does not adopt the melatonin mechanism, for the reasons given above and at Appendix C.44, and does not need it. What it draws from the sequence is narrower: a hypothesis was published in 1987, it was investigated for three decades, the investigation produced results that the investigators themselves describe as requiring confirmation, and paragraph 360ii(a)(2) directs the Secretary to support exactly the research that would supply it.

One further study bears on mechanism rather than on risk, and the Foundation includes it for the mechanism alone. Yang and others, publishing in Clinical Epigenetics in July 2025, combined an observational analysis in 1,010 patients with an animal experiment. The human arm is weak and Appendix C.9 says so: it rests on 32 outcome events and returns an odds ratio whose confidence interval reaches down to 1.00. The Foundation does not rely on it.

The animal arm is a different matter. Dim light at night in mice produced global hypomethylation of DNA, and treatment with melatonin partially counteracted that effect. Metabolic profiling implicated ATP-binding cassette transporter proteins in the regulation of lipid metabolism under the same exposure.

The Foundation draws attention to the character of that finding rather than to its magnitude. The effects of optical radiation set out elsewhere in this Part are physiological: a retinal response, a hormonal response, a change in mitochondrial respiration. This one is epigenetic. It reports a change in the methylation state of the genome of an exposed animal, and a partial reversal of that

change by administering the hormone whose secretion light at night suppresses. Whether anything comparable occurs in humans at the exposures people actually receive is unknown, and the Foundation asserts nothing about it. That it is unknown is the point. Part V.L.

The studies set out above concern adults. One recent study measured the light exposure of children, and the Foundation brings it forward for the exposure data rather than for the association it reports.

Ding and others, publishing in Environmental Research in 2025, fitted 831 school-aged children in Chuzhou, Anhui Province, with personal light sensors for five days. The children averaged 8.53 years of age. The measured exposure was as follows: 490.1 minutes per day above 100 lux in daytime, and 311.2 minutes per night at or above 1 lux.

The Foundation asks the Department to hold that second figure against the recommendation described at Part V.J.4. The published guidance is that the sleep environment should be below 1 lux of melanopic equivalent daylight illuminance. These children were at or above 1 lux for an average of more than five hours every night. The measures are not identical, since the study reports illuminance and the recommendation is melanopic, and the Foundation does not treat them as interchangeable. The order of magnitude of the gap is nonetheless what the Department should notice, and it was measured on children rather than modeled.

The study also reports associations with body composition: a one percent increase in the proportion of time in daytime light at or above 100 lux, which is 14.4 minutes, was associated with a 3.10 percent decline in percentage body fat, while an additional 14.4 minutes above 1 lux at night was associated with a 3.49 percent increase, both at p less than 0.01. The Foundation places little weight on those associations and Appendix C.10 explains why: the design is cross-sectional, so exposure and outcome were measured at the same time, and a child who is heavier may plausibly spend less time outdoors and more time indoors at night. The direction of causation is not established by this design and the authors do not claim that it is.

What the study does establish is that the nocturnal light exposure of children can be measured directly, that it has been, and that in the population measured it stood far above the level the field recommends. No comparable measurement exists for children in the United States. Parts V.J, V.K and VII.

This subsection concerns the suppression of nocturnal melatonin and the disruption of circadian timing by light exposure, and in particular by the short-wavelength content described at Part V.B.1. The Foundation treats one document first, not because it is the most important in the literature, but because of what its date and its sponsorship establish.

1. The 2010 analysis prepared for ASSIST

Mark S. Rea, Aaron Smith, Andrew Bierman and Mariana G. Figueiro of the Lighting Research Center at Rensselaer Polytechnic Institute prepared for the Alliance for Solid-State Illumination Systems and Technologies a technical paper titled The potential of outdoor lighting for stimulating the human circadian system, dated May 13, 2010 and revised December 11, 2012. Part II.E.4 describes the consortium for which it was prepared.

The paper applied a published model of human circadian phototransduction to estimate melatonin suppression from four typical outdoor light sources under what it described as realistic exposure scenarios. Its result was that three of the four "would not meaningfully stimulate the human circadian system after one hour of exposure," while the fourth, identified as a 6900 K LED, was:

> "predicted to have a modest stimulating effect after a one–hour exposure (corresponding to 12 – 15% nocturnal melatonin suppression)."

The paper was candid about what it could not establish. In its own words, "there are several limitations to this analysis due to the uncertain causal relationship between retinal light exposure at night and human health."

The Foundation relies on that document for three propositions and for no more. It does not present a modest effect as a finding of injury, and it adopts the paper's own characterization of the effect and of its limits.

A quantitative estimate of nocturnal melatonin suppression attributable to a particular LED street lighting spectrum was available in 2010 and was revised in 2012.

It was produced for an industry consortium by a university research center. It was not produced by this Department, and the Foundation has found no federal counterpart to it.

Its authors identified the unresolved question as the causal relationship between nocturnal retinal exposure and human health. That is the question 21 U.S.C. § 360ii(a)(4) directs the Secretary to study and evaluate, and § 360ii(a)(2) directs the Secretary to plan, conduct, coordinate and support research upon.

Fourteen years separate that paper from the determination of May 24, 2024 that no performance standard was necessary because of a long history of safety with respect to the visible wavelengths being emitted. The intervening period is the period in which the conversion of American street lighting to light-emitting diodes took place. Part IV.G.

G. Affective and Psychological Response

1. Scope of this subsection

This subsection concerns the affective and emotional responses described in Part I.G: wellbeing, agitation, fear, panic, and hopelessness. It does not concern the autonomic component of an acute stress response, which is addressed at subsection E.5, nor the circadian and hormonal mechanisms addressed at subsection F.

2. Light, circadian disruption, and mood — the established pathway

The route from light exposure to mood is not a conjecture of the Foundation's. It is a recognized area of inquiry with an identified mechanism, and it runs through the circadian system described at Part V.F rather than directly.

Stewart and Albrecht reviewed it in npj Biological Timing and Sleep in March 2025. The Foundation identifies the article as a review rather than as primary research, in accordance with the rule stated at Part V.A.1, and relies on it for what a review can establish: the state of expert synthesis. The authors summarize the position as follows:

> "Importantly, light affects our internal time-keeping system, the circadian clock, which regulates daily rhythms of biochemical and physiological processes, ultimately impacting mood and behaviour. The 24-h availability of light can have profound effects on our well-being, both physically and mentally, as seen in cases of jet lag and shift work."

The Foundation draws a narrow and specific use from that. This subsection is the one on which the comment must be most careful, because the evidence available to it in this domain is weaker than elsewhere in Part V, and because Part VII contains first-hand reports describing distress, agitation and worse. Those reports cannot establish causation. Part V.A.2 says so, and the Foundation does not retreat from it.

What this literature supplies is the thing those reports lack on their own: a biologically plausible route by which an affective response to light exposure could arise. Light reaches a non-visual pathway; that pathway sets circadian timing; circadian timing bears on mood. Each step is established independently of anything the Foundation says. Plausibility is not demonstration and the Foundation claims no more than plausibility here.

That is enough for the purpose this comment has. A recognized mechanism together with an accumulation of reports is the classic occasion for investigation, and 21 U.S.C. § 360ii(a)(4) directs the Secretary to study and evaluate conditions of exposure to electronic product radiation. It is not an occasion for a conclusion, and the Foundation asks the Department to reach none. Appendix C.12.

3. Discomfort, aversion, and the experience of glare

Discomfort glare is studied as a subjective response and is measured by rating scales. Part V.C.4 sets out that literature and its instruments.

The Foundation draws attention to what that establishes about method, because it answers an objection this Part attracts. Where a reported experience is said to be merely subjective and therefore outside the reach of a technical criterion, the answer is that the lighting field has treated exactly this class of effect by subjective report for decades, has built rating scales for it, and has accepted them as the recognized instrument. The literature at Part V.C.4 is therefore directly on point in two ways: it is evidence about discomfort, and it is evidence that subjective report is how discomfort is properly measured.

4. Sensory environments, distress, and sensory processing differences

Part V.E.3 sets out the neurological account of sensory processing differences and this subsection does not restate it. What it adds is the unit of analysis. The literature at Part V.E.3 concerns a response to an emission. The accounts at Appendix A frequently concern a response to an environment: a store, a classroom, a corridor, in which the lighting is one element of a setting that also contains sound, reflection, movement and crowding.

The distinction matters to this comment for a single reason, and the Foundation puts it as a limitation rather than as an argument. An emission criterion addresses one element of such a setting. It would not make a sensory environment tolerable to a person for whom the aggregate is the difficulty, and the Foundation does not suggest that it would. What a criterion would do is remove from the aggregate the one component that is a product characteristic, measurable, and within the authority of this Department. Part III.G sets out the techniques of minimization, of which shielding and diffusion address the character of the light in a space rather than its quantity.

The Foundation does not reproduce or cite individual accounts in this subsection. Some reports in this group contain material about the reporter's own distress that the Foundation has determined should not be quoted anywhere in this comment, and Part V.G.6 sets out separately, and with the care the subject requires, the one category of report the Foundation does address. Part VII.A.6 records the screening applied to the whole set.

5. What the incident reports describe [RFI Q3]

Part VII.B sets out what the reports describe, by category, and this subsection does not reproduce it. Its function is to place those accounts against whatever literature exists rather than to present them a second time.

The placement is this. For the ocular and glare responses at Part VII.B.1 there is an established literature, set out at Part V.C.3 and Part V.C.4. For headache and migraine at Part VII.B.2 there is an established literature at Part V.E.2. For photosensitive response at Part VII.B.3 there is an established literature at Part V.E.1 and a threshold framework. For the acute autonomic and panic responses at Part VII.B.4 the position is the one Part V.E.5 states: the Foundation has identified leads it has not obtained, and the accounts rest on report alone. Part V.G.7 states the three-way classification this Part applies.

6. Reports of hopelessness and suicidal ideation

Three of the accounts reproduced at Appendix A describe suicidal ideation, and two describe hopelessness. They describe more than one route by which it arose.

Some describe an accumulation: repeated seizures triggered by flashing or flickering sources, chronic ocular pain, or the progressive loss of the ability to drive after dark, to work, to shop, or to leave home, with no prospect of relief. Others describe something immediate. In those accounts an encounter with strobing or flashing sources, by day or at night and often without warning, produces an acute and overwhelming aversive state, and the thought of ending one's life presents itself as a means of escaping a stimulus from which there is no other escape.

Both routes are recognized in the medical literature in other contexts. Recurrent seizures are associated with elevated risk of depression and of suicide. Chronic pain is associated with both. So are loss of occupational function, loss of mobility, and exclusion from ordinary public life. And suicidal ideation arising as escape from an acute, overwhelming, and inescapable aversive state is a described clinical pattern, studied in connection with other sources of overwhelming distress. The accounts here do not describe a novel phenomenon. They describe known phenomena arising from a stimulus that has not been studied.

What distinguishes these accounts is not that the stimulus is light. It is the particular combination of spatial, spectral, and temporal characteristics set out at Part I.G: the radiance of the emitting surface, the number and arrangement of emitters in the field of view, the short-wavelength content, the modulation waveform and flash rate. No published work establishes which combinations of those characteristics are tolerable and which are not, because the parameter space has not been examined. That absence is the gap this comment asks the Department to address under 21 U.S.C. § 360ii(a)(4). It is not evidence that the combinations are benign.

What the Foundation asks the Department to take from these accounts is that they were made, that they were transmitted to the Center for Devices and Radiological Health, that the routes they describe are recognized routes, and that no federal body has examined either the reports or the stimulus characteristics that produced them.

7. What is established, what is plausible, and what rests on report alone

The notice asks that established evidence be distinguished from emerging findings and from areas of uncertainty. The Foundation closes this subsection by doing that for the affective and psychological material, in three statements.

Established. Light influences circadian regulation, and circadian disruption is associated with affective change. Part V.F sets out the circadian literature and Part V.G.2 the pathway.

Plausible and unstudied. That the acute responses described in this record follow from the spectral, spatial and temporal characteristics identified at Part I.G and treated at Part V.B. The mechanism is describable and the Foundation has located no study of it.

Resting on report alone. The specific acute experiences described at Part VII. The Foundation says so plainly, in the same terms it uses at Part V.A.3 for the literature as a whole, and Part VII.A.5 states the limitations of the reports before any use is made of them.

H. Occupational and Educational Exposure Settings

Two settings in which a person is present by necessity, for a fixed period, under lighting selected by somebody else. The Foundation treats them together because the feature they share is the one that matters: the exposure is compulsory and its duration is not the exposed person's to choose.

Occupational

Part II.H.10 sets out the position of the agency that administers occupational safety and health, and Part VII.J.3 sets out that nothing in the occupational framework requires any optical quantity to be monitored or any exposure record to be kept. A workplace may be measured for illuminance to establish that there is enough light; nothing requires it to be measured to establish that there is not too much.

What the record contains is reported rather than measured. Part VIII.B.6 records that thirty-two of the 593 accounts at Appendix A describe work or employment, and sets out the employment provision that reaches the setting. Part VI.E treats interior lighting in workplaces as a product class and Part VI.K records that a person employed at an entertainment venue is exposed for a shift, repeatedly, by occupational necessity, and does not choose the programming.

The characteristic that distinguishes occupational exposure from the rest of this Part is duration. Part III.E.3 treats cumulative exposure as a characteristic requiring a boundary, and the occupational case is where it bites: an exposure that would be unremarkable for ten minutes is a different quantity over two thousand hours a year. No federal instrument expresses an optical exposure in those terms, and Part V.J.5 treats the question of expressing optical exposure in the units used for radiofrequency exposure, where time-averaging is routine.

Educational

Part VI.E treats school lighting as a product class and Part VI.E.2 sets out the three features that distinguish a child's exposure to it: the longest compulsory exposure of any setting, the least lenticular filtering, as Part V.C.2.g records from the measured age-dependence of ocular transmission, and no capacity to consent or to avoid. Part VI.C.3 adds the school bus warning lamp, which the same children meet at close range twice a day. Part IX.L asks that this population be addressed expressly.

The Foundation identifies one gap specific to the educational setting. A school district procuring lighting specifies it by illuminance, efficacy, correlated color temperature and cost, which are the quantities the product literature carries, and Part VI.E.1 records that a district wishing to specify by source luminance or short-wavelength content could not, because the information is not published. Part IX.F.3 asks for the disclosure that would change that.

I. Environmental and Ecological Effects [RFI Q14]

This subsection answers question 14, and states its scope at the outset because the question invites a literature far larger than the comment can carry and the Foundation will not pretend to survey it. It addresses two characteristics of artificial light and not the whole of the question. The first is temporal modulation, the characteristic treated throughout Part V.D. The second is the presence of artificial light at night at all, taken up at the end of this subsection through ten studies: one of a disease vector, one of wild mammals, one of an amphibian, three of nocturnal moths, one of urban vegetation across four hundred and twenty-eight cities, one of a seabird, and two that are not about a species at all but about a mechanism and a product. Two of the moth studies are a matched pair from the same laboratory which reach opposite conclusions about the same proposed remedy. The third measured how much of its own subject the standard method of observation cannot see, and the answer was ninety-six percent. The study of urban vegetation is the only one in the comment that weighs this exposure against another environmental stressor. The study of the seabird is the only one whose exposure was specified in the subject's own visual terms as well as in human ones. The last two are placed last and read together: the ninth establishes the mechanism by which artificial light disrupts insect flight, and the tenth, which does not cite it, built a luminaire that removes the condition the mechanism requires and measured the result. Between them they bear more directly than anything else in this Part on what a performance standard would prescribe. The subsection then ends with a note on scope, stating that everything in it is terrestrial and setting out three things taken from a review of the marine literature. A final paper is not used as a study at all: the Foundation declines its findings, for reasons it states, and takes from it only the lighting recommendations its authors make and one error in its units. The large bodies of work on the intensity, the timing and the spectral content of artificial light at night are not surveyed here, and their absence is not a view about their weight.

Why modulation is the part of this question the Foundation can speak to

The reason is that the subject was identified as a gap by the people who study artificial light at night. The study described at Appendix C.94, published in 2014 by a group at the University of Exeter, states that research on the ecological effects of artificial light has "concentrated almost exclusively on the biological effects of the intensity, duration and, to a lesser extent, spectral signature of artificial light", and that another characteristic "has largely been overlooked", namely that the output of electric lamps flickers. The Foundation accordingly offers this subsection as an answer to the narrow part of question 14 on which a peer-reviewed primary source exists.

The measure, and what the collation found

Whether an animal perceives a modulated lamp as flashing or as steady is governed by its critical fusion frequency, which is the frequency at which a series of pulses ceases to be resolved as separate and is seen as a continuous stream. The authors assembled what they describe as the largest collation of such values to that date: 56 studies yielding 93 measurements for 81 species in 66 genera and 9 classes, admitting only peer-reviewed determinations accompanied by a full statement of method.

The range is wide. The lowest value was 6.7 hertz, for the cane toad. The highest was 400 hertz, for a fire beetle, which the Foundation presents as the extreme of the dataset rather than as a representative figure. The proportion above the frequency of a lamp on a 50 hertz supply is reported four ways: "16.1% of measurements, 13.5% of species, 16.6% of genera and 44.4% of classes". And the authors supply the conversion that matters to this Department: "It should be noted that a number of countries utilise a 60 Hz electrical supply and hence the flicker frequency with be higher at 120 Hz". The United States is such a country.

Two particulars bear on the urban and roadway environment. The pigeon, which the authors describe as "a very common urban bird that is likely to encounter high levels of artificial light", has "the highest CFF values recorded (143 Hz) of any vertebrate species and will easily be able to perceive flicker from artificial lights". And of insects, for which values exist for only twelve species, the range runs from 42.5 to 400 hertz, of which the authors say that "Given the vital role insects play in ecosystem functioning (e.g. pollination, decomposition), and as nutrition for other organisms, this depauperate knowledge base should give cause for concern".

What the Foundation does not take from this, which is most of what a reader might expect

The Foundation states the authors' own assessment of their evidence before drawing anything from it, and quotes it in full.

> "The evidence presented here suggests that impacts from the perception of the flicker of artificial light may be rather limited for most species studied thus far. There remains, however, a scarcity of data on CFFs for many taxa that are most likely to be affected, hence we suggest that the potential ecological effects should not be wholly dismissed".

Three further limits are the authors' and the Foundation adopts them without softening. The animals able to resolve this flicker are diurnal, so only species for which artificial light extends the day, or which are facultatively nocturnal, are candidates. Resolution falls with light intensity, which falls with distance, so perceptibility is a function of how close the animal is to the lamp: tsetse flies would resolve a flickering street lamp at 3 lux, which the authors describe as about the dimmest point between neighboring lamps, but honeybees and domestic chickens would need to be "closer than three metres to the light source in order to perceive the flicker", and chickens "will only be able to perceive flicker at light intensities exceeding the range likely to be produced by artificial lamps". And the evidence of effect, as distinct from perception, is thin: "Explicit studies of the biological effects of light flicker on animals remain scarce, and have focused on the efficacy of trapping devices for insects and on welfare issues for captive vertebrates".

The Foundation also states a distinction the paper does not need to make but a regulator does. Resolving a flicker is not being harmed by it. That a pigeon sees a street lamp as flashing rather

than steady is a fact about pigeon vision, and nothing in this literature converts it into an injury. The Foundation asserts no ecological harm and asks the Department to find none on this record.

What the Foundation does ask

Two things, both narrow. The first is that the Department record what the question's answer presently is, which is that the modulation of these products has not been studied as an ecological variable, that the measured temporal resolution of a substantial minority of species and of nearly half the classes examined exceeds the frequency at which mains-driven lamps modulate, and that the taxa the specialists identify as most likely to be affected are among those for which no measurements exist. The authors put that last point as a knowledge problem rather than as a finding, and so does the Foundation.

The second is that the Department notice the form of the authors' recommendation, which is the same form the Foundation urges throughout this comment: "Given the precautionary principle and that it is likely that in the future an increasing level of artificial light will come from lamps with a high flicker index, as incandescent bulbs are phased out, and replaced with fluorescent … and LED lamps, we suggest the impacts of flickering light on natural systems are given urgent attention". The authors do not claim to have shown harm. They identify a characteristic that is increasing, a mechanism by which it could matter, a set of species that could be affected, and an absence of data, and they ask that the question be studied. That is a request for study and not for restriction, and 21 U.S.C. § 360ii(a) directs this Secretary to conduct exactly such study.

A second characteristic, and the one place where this question reaches a human disease

Everything above concerns whether an animal can resolve a modulated lamp. The Foundation adds one study on a different characteristic, which is the presence of artificial light at night at all, and adds it for a reason of statutory relevance rather than ecological interest. Its subject is the principal mosquito vector of West Nile virus in the northern United States.

Fyie L.R., Meuti M.E., Sivakoff F., Fiorta M.A. and Gardiner M.M., Artificial light at night (ALAN) is a stronger inhibitor of overwintering dormancy than urban warming in mosquitoes, Journal of Applied Ecology, first published 18 May 2026, doi:10.1111/1365-2664.70407. Described at Appendix C.125.

What was done, and what was found

Culex pipiens f. pipiens females normally enter diapause in autumn in response to shortening day length. A female in diapause halts reproductive development, stops seeking hosts and ceases blood-feeding, and therefore cannot transmit a pathogen. The question the authors asked is whether ordinary residential lighting prevents that from happening.

Mosquito larvae were reared to adulthood in enclosures placed in the yards of private properties, schools and churches in Columbus, Ohio, across the autumns of 2022 and 2023. Each property carried two enclosures, one beneath a light fixture the owner had already installed and one in a dark spot on the same property. Temperature and illuminance were logged every thirty minutes in each enclosure. Diapause was then assessed in the laboratory by egg follicle length, by whether the female would take a blood meal, and by whether she produced offspring.

The central result is a contrast between two enclosures a few meters apart on the same property. Across both Octobers, every mosquito reared in the dark enclosures entered diapause. Of those reared beneath a porch or garage light, 41 percent did. In the dark enclosures in October not one female took a blood meal; beneath the lights, 29 percent did, and of those, nearly three quarters laid eggs and more than half produced living larvae. In September the ALAN-exposed females were roughly twice as likely to blood-feed as those in the dark, 70 percent against 37 percent.

The authors also report what the title states: the effect of the light exceeded the effect of urban warming, and in September overrode it. Temperature predicted diapause in the dark enclosures and

predicted nothing in the lit ones. Whatever the urban heat island was doing to these mosquitoes, the porch light was doing more.

The finding that corrects a proposition elsewhere in this comment

The Foundation places this next because it cuts against a line of argument that appears in this comment and in the Foundation's own advocacy, and because a comment that reported the convenient half of this paper would deserve to be discounted.

The lights in this study were the ones the property owners had already installed, and most of them were warm white at roughly 2,700 to 3,000 kelvin. The intensities were very low: a mean of 4.93 lux, a maximum of 19.07, and at some sites as little as 0.87 lux. Warm white light at under one lux was sufficient to prevent diapause. The authors state the consequence in their policy implications and the Foundation quotes it rather than softening it:

> "Low intensities of warm white ALAN were a stronger inhibitor of diapause initiation than urban warming, indicating that changes in brightness or light colour may not be sufficient to mitigate ecological impacts"

Two qualifications keep that from being the end of the spectral question, and the Foundation states both. The first is that these authors did not test spectrum. They deliberately excluded light color from their analyses, because the only relationship they detected between color and brightness was driven by a single unusually bright site. What they establish is that warm white light sufficed, not that spectrum is irrelevant. The second is that the authors themselves distinguish broad-spectrum warm white from narrow-band emission, and suggest that phosphor-converted amber or monochromatic sources may yet mitigate the effect, noting that moths and spider mites exposed to pure red light did enter diapause.

The distinction matters and the Foundation adopts it. A lamp of low correlated color temperature is not a narrow-band lamp. Warm white light is broad-spectrum light with a reduced blue fraction, and it retains blue content; the authors note that some warm white diodes carry distinct blue peaks absent from non-diode lamps of the same nominal color. So this study does not show that reducing short-wavelength content is pointless. It shows that reducing correlated color temperature and reducing brightness, which are the two mitigations most often proposed and the two most often conflated with reducing blue content, were together insufficient here. The Foundation will not again present a warmer correlated color temperature as an answer to a biological question without saying what spectrum the warmer lamp actually emits. Part V.B.3 and Part V.J.4 make the same point about metrics; this is the same error in the language of product specification.

What the study does not establish, stated before the use made of it

It establishes nothing about human health directly, and no part of the Foundation's submission requires that it should. The outcome measured is mosquito reproductive physiology. No human case was counted, no infection was measured, and vector competence was not tested. The step from a longer biting season to a greater incidence of West Nile virus in people is an inference, and the authors mark it as one: their paper reveals, in their words, a potential explanation for higher mosquito-borne disease risk in cities. The further proposition that light-exposed females may also be more susceptible to infection rests on three separate findings of other groups, one of which was obtained in males of a different ecotype. The Foundation does not assemble those into a chain and does not ask the Department to.

The study is also small in the places that matter most. Diapause was assessed across five to sixteen sites; blood-feeding and fecundity across five to seven. In September only two dark-treatment cages yielded blood-fed females, too few for the model, so a chi-square was used instead. Enclosures were lost to light malfunctions, animal interference and a logger failure, the enclosure design changed between the two years, and year was itself a significant predictor of blood-feeding. The mosquitoes came from a laboratory colony. It is one species in one city.

Why it is in a comment to this Department

For two reasons, neither of which is the one a reader might expect.

The first is statutory and narrow. Paragraph 360ii(a)(2) directs the Secretary to minimize two things, as Part II.D.4 sets out: the emissions of, and the exposure of people to, unnecessary electronic product radiation. The two objects are coordinate, and the first does not require a human receptor. This study is evidence about an emission. A porch light that prevents the principal West Nile vector in the northern United States from entering dormancy is emitting radiation that is doing work in the world beyond the visual task it was installed to serve, and the mitigations these authors recommend are shielding against light trespass and limiting duration by timer or motion sensor. Light trespass is one of the four categories Part II.D.3 identifies as instances of what the statute calls unnecessary. The Foundation offers this study as evidence bearing on that category, measured in a biological endpoint, and not as evidence of a human health effect.

The second is institutional, and it is a fact rather than an argument. This research was supported in part by a grant of the National Institutes of Health, numbered R01AI188567, together with a grant of the National Science Foundation and institutional funds. Part II.E records two other grants of this Department supporting research into the health effects of artificial light at night, and makes the observation that of the four verbs in paragraph (a)(2), the one being performed is the one requiring only money. This is a third grant and it is the most pointed of the three, because of what the research it paid for recommends. The authors' closing recommendation is addressed to bodies of a particular kind:

> "We recommend that mosquito control districts and public health departments consider extending mosquito surveillance and control efforts in the fall, especially in areas with significant light pollution and higher temperatures."

The Department of Health and Human Services is a public health department. It funded the research, the research recommends that public health departments account for light pollution, and the Foundation is aware of no action by any component of the Department in response. That is the same shape Part V.M describes three times in another country and Part II.E describes twice in this one: the question is reached, the money is spent, the recommendation is published, and nothing follows.

One further matter the Foundation records because its practice throughout this comment requires it. The authors note, on the authority of four other studies, that lower-income neighborhoods are more exposed to light pollution and to urban heat. Nothing in this comment should be capable of being read as an argument for reducing lighting in those neighborhoods without regard to what the residents want, and Part V.M states that position in terms. The Foundation records the distributional finding because it bears on where a federal characterization of this exposure would matter most, not because it supports any particular lighting decision.

The study that answers an objection this comment raised against itself

The second study is the one the Foundation regards as the most useful animal work in this comment, and the reason is methodological rather than ecological. Part V.A.3 sets out, from a review by investigators who conduct rodent studies of this exposure themselves, three grounds on which rodent evidence is indirect for a human. The first and largest is phase inversion: most laboratory rodents are nocturnal, so light at night falls in their active phase, while in a person it falls in the rest phase. That paragraph also recorded that no entry in this comment's appendix used a diurnal model, and called it a gap in the collection. This study closes it.

Vardi-Naim H., Janovsky G., Kronfeld-Schor N. and Wine Y., Artificial light at night disrupts immune rhythms in wild rodents under semi-natural conditions, Environmental Pollution, doi:10.1016/j.envpol.2026.127774. Described at Appendix C.126.

The design, and why its design is the point

Two closely related species of spiny mouse share rocky desert habitat in Israel and divide it by time: Acomys dimidiatus is nocturnal and Acomys russatus is diurnal. The investigators placed 160 animals, eighty of each species, in sixteen outdoor enclosures of one and a half by three meters, ten animals to an enclosure at an even sex ratio, where they could roam, interact and breed through the natural cycle of daylight, weather and season. Eight enclosures received artificial light at night and eight did not. The experiment ran about eight months, from December 2021 to August 2022, after an eight-week acclimation.

The exposure was characterized, which is why the Foundation can use it. It was a white light-emitting diode of approximately 6,000 kelvin correlated color temperature at an illuminance of 10 to 15 lux, measured at the entrances of the nesting shelters, with lower levels inside the shelters so that illumination across an enclosure was deliberately uneven. That is a blue-rich white diode at an illuminance of the same order as what a street lamp or a neighbor’s security lamp delivers to a bedroom window.

The Foundation notes the contrast with the mosquito study above, because the two together bracket the variable at issue. That study used warm white light of 2,700 to 3,000 kelvin at under one lux to nineteen lux. This one used cool white light of about 6,000 kelvin at 10 to 15 lux. Different spectra, overlapping intensities, effects in both.

What was found, reported in full because it is mixed

The cleanest result, and the one that holds in both species, concerns the timing of an immune response. Animals were immunized with keyhole limpet hemocyanin twice, fourteen days apart, some during their rest phase and some during their active phase. Under natural light, the ratio of the secondary to the primary antibody response was significantly higher in animals immunized during their rest phase, in both species. Under artificial light at night that difference disappeared in both species.

The Foundation asks the Department to notice the form of that result and not only its direction. The advantage attached to the rest phase, and it attached to the rest phase in the diurnal animal and in the nocturnal animal alike. It was therefore a property of circadian phase rather than of nocturnality. That is the finding that bears on Part V.A.3, because the standing objection to rodent evidence in this field is that light at night means something different to a nocturnal animal than to a person. Where an effect is indexed to the rest phase in both temporal niches, that objection does not apply to it.

The remaining rhythm results are split, and the Foundation sets out all four combinations rather than the two that are favorable.

- Circulating lymphocyte frequency in the diurnal species: a twenty-four-hour rhythm in the control animals and none detectable under artificial light at night. Disruption shown.
- Circulating lymphocyte frequency in the nocturnal species: a rhythm in both groups, and a formal comparison of models found no difference between them. No disruption shown.
- Fecal cortisol in the nocturnal species: a rhythm in both groups, but a significant treatment interaction, with reduced amplitude and a small phase shift. Disruption shown.
- Fecal cortisol in the diurnal species: no significant daily rhythm detected at all, in either group. Nothing to disrupt, and the authors note that this is contrary to earlier evidence of daily glucocorticoid variation in this species.

So of the four, two showed disruption, one showed none and one failed to detect the underlying rhythm. The paper’s title is supported by the antibody result and by two of the four rhythm comparisons, and the Foundation will not report it as though all four had run the same way.

A further complication the authors raise against their own mechanism deserves recording. Lymphocyte frequency peaked during the daytime in both species, which is the rest phase for only one of them, yet the antibody advantage followed the rest phase in both. The authors conclude that the trafficking of lymphocytes cannot by itself explain the antibody result, and hypothesize instead that lymphocytes may be more permissive to activation during the rest phase. They offer that as a hypothesis and the Foundation repeats it as one.

The survival result, and the weight it can carry

Animals exposed to artificial light at night died sooner. The Kaplan-Meier comparison gives a log-rank probability of 0.035 and the proportional hazards model gives a hazard ratio of 2.35, with an interval from 1.03 to 5.38 and a probability of 0.042, across eighty animals with twenty-four deaths and no difference between species or sexes.

The Foundation states what that figure will and will not bear, because a doubled hazard of death is the most arresting number in this subsection and the most easily overstated. The lower bound of the interval is 1.03, so the result is barely distinguishable from no effect. The authors could not determine any cause of death and say the result should be read as a fitness-related association and not as evidence of a pathological mechanism; in their earlier work in the same enclosures a subset of animals was examined and no clear pathological cause was identified. They attempted to model the enclosure as a random effect and the model would not converge, so the analysis treats eighty animals housed ten to an enclosure as independent, which overstates the precision of the interval rather than the direction of the effect. Their own retrospective sensitivity analysis puts the power to detect a hazard ratio of this size at about seventy-two percent. And the survival analysis was confined to the animals for whom a complete set of immune measurements existed, which is a restriction decided after the fact.

One further qualification matters more than any of those. The Foundation had taken this survival finding for a replication, and it is one, but not an independent one. The authors describe it as consistent with their own previous work in the same enclosure system with the same species. It is the same group confirming its own earlier result, which is worth considerably less than a second laboratory obtaining it, and the comment says so.

What it does not establish

No human effect. The animals are wild rodents and every endpoint is theirs. Melatonin, which is the mediator the mechanism is usually attributed to and the subject of Part V.F, was not measured, and the authors state that direct inference about melatonin-dependent mechanisms is therefore limited. Lymphocytes were identified by light-scatter morphology alone, because species-specific reagents do not exist for these animals, and the authors acknowledge that the gate may include other leukocytes. The physiological sampling was cross-sectional, each animal bled once, so the daily curves are assembled across animals rather than followed within them. And the enclosures are not the desert: the authors say so, noting that they limit pathogen diversity, predation and the unpredictability of resources, and call their approach a deliberate compromise.

The Foundation also records an analytical choice that bears on every result above. Values more than two standard deviations from their group mean were excluded as outliers. That is an aggressive rule, it was applied group by group, and in a study with these sample sizes it can affect which comparisons reach significance. The Foundation does not suggest it was applied in order to obtain the results, and notes that the authors disclosed it. It is recorded because a reader entitled to weigh the findings is entitled to know it.

Why it is in a comment to this Department

On the same narrow ground as the study before it, and on one further ground that this study supplies and the other does not.

The narrow ground is the emissions limb of paragraph 360ii(a)(2), set out at Part II.D.4, which directs the minimization of emissions of unnecessary electronic product radiation and does not require a human receptor. This is a characterized emission, a blue-rich white diode at a stated illuminance, producing measurable biological effect in a mammal. The Foundation offers it as evidence about the emission.

The further ground is mechanistic, and it is the reason this entry earns space in a comment about human health. The architecture through which the effect is proposed to run — retinal photoreception, the suprachiasmatic nucleus, melatonin and glucocorticoid output, and peripheral clocks in immune tissue — is the architecture Part V.F describes in human beings. The authors chose these species for that reason and say so, offering them as a model for the study of biological rhythms and of this exposure in diurnal mammals, including humans. Appendix C.84 records that photopigments of the opsin family are expressed in human B-cells and T-cells, which is a second and separate route by which light and immune function might be connected and which this study does not test.

The Foundation therefore does not ask the Department to find that artificial light at night impairs human immunity. It asks the Department to notice that a quantified dose of the emission at issue, in a mammal, measurably disorganized the timing of an adaptive immune response, and that the advantage lost was indexed to the rest phase in a diurnal animal as well as a nocturnal one. Whether the same holds in a person is a question for research, and paragraph 360ii(a)(2) directs the Secretary to plan, conduct, coordinate and support it.

One line of work the Foundation flags for the Department rather than relying on. Both this study and the mosquito study above cite, at second hand, findings by Kernbach and colleagues that artificial light at night raises the competence of a wild bird reservoir for West Nile virus and lengthens its infectious period. If those findings hold, then two halves of one transmission cycle have been separately associated with this exposure by independent groups: the vector's season at one end and the reservoir's infectiousness at the other. One of those two papers has since been obtained and is at Appendix C.145, and the Foundation reports at once that it does not run in the direction the sentence above invites. The other has not been obtained. The convergence is still stated as a reason for the Department to look and not as a finding.

The one of the two that has been obtained, and why it complicates rather than completes the picture

Kernbach, Martin, Unnasch, Hall, Jiang and Francis published in Proceedings of the Royal Society B in 2021 an analysis of the Florida Department of Health sentinel chicken surveillance program, which maintains caged flocks across the state and tests them monthly for antibodies to West Nile virus. Described at Appendix C.145. The analysis covered the months of June to December across four years, drawing on more than a thousand surveillance events at eighty sites and a hundred and five distinct coordinates.

Two findings, and the Foundation takes them in the order that is least comfortable for it. The first is the one that helps. Artificial light at night was the only one of the urbanization variables in the model with a strong effect. Impervious surface showed none. Human footprint showed none. Human population density was mixed and small. The second standing objection recorded at Part V.A.2 — that outdoor light at night is among the closest available proxies for urbanization and that the urbanization is doing the work — was tested here against three separate measures of urbanization entered in one model, and the light survived and they did not.

The Foundation states at once what that is not. It is not a second instance of the thing relied on at Part V.A.2, because the study relied on there is a human cohort of twenty-eight thousand people in which air pollution was measured and adjusted for, and this is a caged bird. An objection answered in a sentinel species is answered for that species. What it shows is that the objection is answerable, that it has now been answered twice in two literatures by two methods, and that the answer did not come out the way the objection predicts.

The second is the one that does not help, and the Foundation states it plainly because a comment that reported the first without the second would be doing the thing it criticizes. The relationship was not a straight line. Light was modeled as a second-order polynomial, and both the log and the squared terms carried the effect. Exposure risk was greatest at the lowest levels of artificial light, at radiance intensities below one in the units used, and declined toward the intermediately lit sites. The headline of the university press release that brought this study to the Foundation says light pollution drives increased risk. The curve in the paper says risk peaks in the faintly lit places and falls where the light is brighter.

Three things follow and the Foundation separates them. The first is that the proposition more light means more harm is false for this endpoint, and the comment does not advance it for any endpoint; Part V.A.2 has said throughout that a limit is a point chosen on a curve and that the curve has to be established rather than assumed. The second is that a standard which reduced intensity without knowing the shape of the curve could, for an endpoint of this kind, move an exposure toward the peak rather than away from it. The Foundation does not know whether that is a real risk here and neither does anybody else, which is the point. The third is the use the Foundation does make of it, and it is the strongest illustration in this comment of an argument made at Part V.A.2 from the other direction entirely: this shape could not have been found by comparing a lit place with an unlit one. It was found because somebody fitted a curve. A literature built from presence-and-absence comparisons would have reported either an effect or no effect and would have been wrong either way.

And the exposure variable belongs with the rest. It is not a measurement at the coop. It is the published world atlas of artificial night sky brightness at one-kilometer resolution, which is a modeled product derived from the same satellite radiometer whose limitations Part V.J.4 collects. The Foundation has added this entry to the census of entries at Part V.J.4 that take a satellite product as their own exposure variable, and notes that this is the first in which the outcome is a human notifiable disease in a sentinel species rather than a biological measure in a wild one.

A third study, on an endocrine organ this comment has already reached from the human end

The last of the three is the weakest and the Foundation says so before describing it. Its quantitative measures found nothing, its groups are of six animals and four, and it measured no hormone. It is here for one reason, which is the organ.

Ajduković M., Drobnjaković M., Šošić-Jurjević B., Vučić T., Petrović T. and Prokić M., Influence of Artificial Light at Night on Thyroid Gland Histology in Triturus Newts (Urodela, Salamandridae), Animals, volume 16, issue 3 (2026), article 483, doi:10.3390/ani16030483. Described at Appendix C.127.

Metamorphosed juvenile crested newts, bred in the laboratory from eggs of nine females taken from a wild population in Serbia, were divided into a group kept in natural darkness at night, below one tenth of a lux, and a group exposed at night to a white light-emitting diode of 6,000 kelvin at 30 lux, for sixty days. Both groups received about 450 lux of the same diode light by day, and the day length was adjusted weekly to follow the natural photoperiod from early September to late October. The thyroid glands were then examined by stereology and by immunohistochemical staining for thyroglobulin, the protein in which the gland stores its hormone precursor.

The authors state why they chose that exposure, and the Foundation notes it because this is now the third study in this subsection to characterize its light. They selected a diode source as the predominant outdoor light, an intensity of 30 lux as corresponding to what is perceived in public gardens and emitted by street lights, and a correlated color temperature of 6,000 kelvin as the one mostly used outdoors. Appendix C.126 used 6,000 kelvin at 10 to 15 lux and Appendix C.125 used 2,700 to 3,000 kelvin at under one lux to nineteen lux. Three independent groups, three stated exposures, all of them within the range a person encounters at a bedroom window.

What was found, with the nulls first

The stereological measurements, which are the quantitative part of the study, found no difference between the groups in anything. Not in the absolute volume of the gland, at a probability of 0.873. Not in the volume of the follicular epithelium, at 0.689. Not in the volume of the colloid, at 0.749. Not in the volume of the interstitium, at 0.936. Those are four null results and the Foundation reports them before the one positive result because that is the order in which the paper obtained them.

One measurement differed. The optical density of thyroglobulin immunostaining was higher in the light-exposed animals, at a probability of 0.030, which the authors read as accumulation of the protein at the apical surface of the follicular cells and therefore as a gland releasing less of it into circulation. Alongside that they describe, from representative micrographs, large colloid-filled follicles, a flattened epithelium and an absence of the resorption vacuoles that indicate active secretion. Those morphological observations were not quantified or counted. So the measures that were quantified were null, and the observations that carry the paper's interpretation were not quantified.

Three limits, one of which the Foundation regards as unresolved

First, the numbers. Six animals in each group for the stereology and four in each group for the immunohistochemistry. The authors explain that six is the minimum required for histological analysis and that Triturus ivanbureschi is strictly protected in Serbia under a named regulation, so the smallest possible number was used. The Foundation accepts that explanation entirely and does not accept that it changes what four animals per group can support.

Second, and this is the unresolved point. Ten images were analyzed for each of the eight animals in the immunohistochemical comparison. The methods do not state whether the significance test was performed across the eight animals or across the eighty images. The difference matters and is not a technicality: images taken from the same animal are not independent observations of the effect of a treatment applied to animals, and a test that treats them as independent will report a probability smaller than the design supports. The Foundation cannot tell from the paper which was done, and the single positive result in this study depends on the answer. Until it is resolved the comment states the result and does not rely on it.

Third, no hormone was measured. The authors say so themselves and give the reason: a juvenile newt is too small to yield enough blood for a reliable assay without pooling or a species-specific validated method. Thyroxine, triiodothyronine, thyroid-stimulating hormone and melatonin were all unmeasured. The hypofunctional state the paper describes is therefore an inference from the appearance of tissue, and the two mechanisms the authors propose, melatonin suppression and corticosterone, are offered as plausible pathways and not as findings. They also note that in amphibians the effect of light at night on circadian regulators is poorly understood, and cite work finding only slight effects on the melatonin signaling pathway in two frog species.

The authors are candid about magnitude in a way that cuts against any use of this paper for alarm, and the Foundation repeats it. They compare their findings to the same laboratory's earlier work exposing these newts to thiourea, a recognized endocrine disruptor, and state that the changes they saw from light are relatively subtle by comparison. Their own ranking places this exposure below a chemical disruptor in effect.

Why it is here, which is the pairing and not the finding

Appendix C.44 of this comment is a prospective cohort of 464,371 American adults in which the highest quintile of satellite-estimated light at night was associated with a 55 percent higher incidence of thyroid cancer, a hazard ratio of 1.55 with an interval of 1.18 to 2.02. That entry records two things about itself. The exposure is spectrally blind, for the reasons Part V.J.4 gives. And the mechanism the authors propose, running through melatonin, was hypothesized and not measured.

The entry also sets out at length the overdiagnosis objection that governs any thyroid cancer finding, and the Foundation does not withdraw it.

This newt study is the mirror image of that one. Its exposure is characterized to a stated spectrum and a stated illuminance. It measured a marker in the tissue of the organ itself. And it is six animals, with no hormone assay, in a species no part of this comment claims is a model for a person.

The Foundation submits the pairing and nothing more. The same endocrine organ is under investigation at both ends of this literature. At the human end there is a cohort large enough to detect an association and an exposure measurement that cannot say what the light was made of. At the animal end there is a characterized emission and a tissue measurement in a sample too small to settle anything. Neither end has what the other lacks, and no study the Foundation has found has both. That is a description of a research gap, and paragraph 360ii(a)(2) directs the Secretary to plan, conduct, coordinate and support the research that would close it, while paragraph 360ii(a)(4) directs the study and evaluation of emissions and conditions of exposure. The Foundation asks for nothing in this passage beyond that.

What this study does not establish should be said plainly, because the subject invites more than it supports. It establishes nothing about human thyroid function, nothing about human thyroid disease, and nothing about hormone concentrations in any animal. It does not establish that artificial light at night is an endocrine disruptor, a term the authors use as a category for what they are investigating rather than as a conclusion. And on its own quantified measures it established no difference at all.

The study that tests the remedies, and finds each of them wanting

The subsection ends with the strongest study in it. Everything before asks whether artificial light at night does something. This one asks the question a regulator has to answer, which is whether any of the things proposed to fix it work.

Briolat E.S., Galloway J.A.M., Cornelius E., Wright C.J., Bennie J., Gaston K.J. and Troscianko J., Severe and widespread reductions in night-time activity of nocturnal moths under modern artificial lighting spectra, Proceedings of the Royal Society B, volume 293, issue 2063 (2026), article 20252704, doi:10.1098/rspb.2025.2704, open access. Described at Appendix C.128.

The Foundation discloses a relationship before using the paper. Two of its authors, Jonathan Bennie and Kevin Gaston, are authors of the collation at Appendix C.94 on which the first half of this subsection rests, and both are co-authors of the satellite instrument paper relied on at Part V.J.4. The two halves of this subsection are therefore not independent of each other in authorship, and the same University of Exeter group appears three times in this comment. The Foundation states that here rather than leaving a reviewer to find it, and does not present the flicker material and the moth material as independent corroboration.

The design, which is why the result carries weight

Eight hundred and forty-three moths, of twenty-three species in three families, were tested individually over a hundred and twenty-four nights across two summers in Cornwall. Each animal spent a night in a small chamber, outdoors, under one of eight lighting conditions, filmed from above by infrared at one frame every ten seconds from the end of twilight until sunrise. Activity was scored as the proportion of frames in which the animal had moved. Moths were taken both by light trap and by hand net, deliberately, so that species with different attraction to light were represented. The analysis was run twice, once with species and family as random effects and once as a phylogenetic mixed model built on a tree inferred from nearly five thousand single-copy orthologous proteins from published genomes, and the two analyses agreed.

The lighting was characterized rather than described. Every treatment was set to ten lux at the chamber lid and calibrated with a spectroradiometer, and the composite treatments were matched to their broadband equivalents in human color space to a Euclidean distance below one. The eight

conditions were a dark control under the open sky; a white diode at a correlated color temperature of 5,986 kelvin; a narrowband amber diode at 1,621 kelvin; a broadband phosphor-converted amber diode at 1,743 kelvin; two composite lights made by combining three narrowband red, green and blue diodes to match the white and the broadband amber for a human observer; and the broadband amber at one lux and at a tenth of a lux.

One number in the methods is worth more to this comment than any other in the paper. The authors measured the natural night at their sites, a hundred and eleven times, and report a median illuminance of 0.0168 lux, with an interquartile range of 0.0102 to 0.0332 lux. That is the condition under which these animals evolved, measured with an instrument. The lowest treatment was about six times brighter than it and the standard treatment about six hundred times brighter. Part V.B.5 asks what the sources were under which human visual and circadian physiology developed; this is the same question answered for another taxon, with a figure attached.

What was found

Light suppressed activity, severely, and the median reduction per species at ten lux was as follows.

- Composite white, from red, green and blue diodes: 93 percent.
- Broad-spectrum white diode: 85 percent.
- Composite amber, from red, green and blue diodes: 82 percent.
- Broadband phosphor-converted amber diode: 73 percent.
- Narrowband amber diode: 57 percent.
- Broadband amber at one lux: 24 percent.

Every one of those except the broadband amber at a tenth of a lux differed significantly from the dark control, in both analyses. Depending on the treatment, between sixty-five and one hundred percent of the species tested were less active under light than in darkness.

The amber result, which corrects this comment for the third time

Part V.M records that the Foundation has twice had to amend its own framing of the amber question, once because a study it relied on had not analyzed spectrum at all and once because warm white light at under one lux was sufficient to prevent diapause in a mosquito. This study requires the third amendment, and it is the one that should settle the matter, because it is the only test the Foundation has found in which the candidate remedies were run against each other at a fixed intensity.

The result is neither of the two simple answers. Amber is not a solution: narrowband amber, which is the longest-wavelength and most spectrally restricted outdoor light anyone proposes, still cut activity by 57 percent at an intensity found beneath an ordinary street light. The authors put it plainly, that switching to amber lights would not mitigate the impacts of lighting on activity in many areas. But amber is not useless either, and a comment that reported only the first half would be doing what this one criticizes. Narrowband amber at 57 percent and broadband amber at 73 percent are meaningfully better than white at 85 percent and composite white at 93 percent, and the authors' own conclusion is that amber lighting deployed at the lowest possible intensity may have the least impact for nocturnal moths.

What this study establishes about spectral mitigation is two-sided, and the Foundation states both sides. Reducing short-wavelength content reduces the effect. It does not remove it. Two further studies in this subsection qualify that result in ways this one could not reach, the first by testing the same remedy against a different exposure regime and the second by testing the warmest lamp in general service. The Foundation therefore states its settled position once, at the end of the three moth studies, rather than here. What can be said here is that the remedy this study tested was tested properly and was found to be partial, and that the submission resting on it is about the structure of a standard rather than about any lamp.

A consequence for the instrument described at Part V.B.3

The Foundation draws one inference against material it has itself just put before the Department. Part V.B.3 sets out the Andalusian regulation now in force, which for the protected surroundings of astronomical observatories requires an amber source with an effective wavelength between 585 and 605 nanometers and a spectral width not exceeding 25 nanometers. That is a narrowband amber specification, and it is the most spectrally restrictive requirement the Foundation has located in any law.

The narrowband amber diode tested in this study is a lamp of that character, and at ten lux it suppressed moth activity by 57 percent. So the strictest spectral limit in force anywhere, applied at street-light intensity, would still be expected to produce a substantial biological effect in this taxon. The Foundation does not offer that as a criticism of the Andalusian rule, which was written to protect astronomical observation and achieves it. It offers it as the reason a spectral limit cannot stand alone: the quantity and the duration of the emission have to be limited too, and Part V.B.3 records that the same decree limits both. A standard that addressed spectrum only would, on this evidence, leave most of the effect in place.

The composite-light result, which is a proposed remedy failing

A specific mitigation has been proposed in the literature: that white light assembled from three narrowband diodes, red, green and blue, should be less harmful than broad-spectrum white light that looks identical to a person, because its emission overlaps less with the sensitivities of other animals. This study tested it directly and found no benefit. The composite white and the broadband white did not differ significantly, at a probability of 0.580, nor did the composite amber and the broadband amber, at 0.917. The composite white produced the largest suppression of any treatment.

The authors record that this contradicts recent findings in moths and in mosquitoes, and offer an explanation the Foundation regards as the most useful general proposition in the paper: that the earlier work measured attraction to light or flight past pulses of light, while this work measured continuous exposure, and that the attractiveness of a light is not a good proxy for its other effects. A lamp may draw fewer insects and still immobilize the ones that are near it. The Foundation asks the Department to carry that distinction into any assessment it commissions, because the same error is available in the human case: a lamp that is judged acceptable on one endpoint has not been assessed on the others.

Intensity, skyglow, and a result that runs the other way

Lowering the intensity helped but did not reliably clear the effect. In the main experiment the broadband amber at one lux and below was not significantly different from natural darkness once phylogeny was accounted for. But a second experiment on five species found significant suppression under white light at one lux and under broadband amber at one lux, and species-level comparisons showed many species still affected at these levels, including under white light at a tenth of a lux, which the authors describe as similar to skyglow. Since skyglow is far more widespread than direct lighting, that is the finding with the largest geographic reach and the least evidence behind it, and the Foundation reports it as the authors do, as a reason for further investigation.

One set of results runs clearly against the general picture and the Foundation reports it because candor requires it and because it bears on how confidently anyone should legislate from this. Several species became markedly more active under the dimmest amber light, not less. Under broadband amber at a tenth of a lux the peppered moth increased its activity by 618 percent relative to darkness, and three other species by between 119 and 166 percent. Under broadband amber at one lux the peppered moth increased by 240 percent. The direction of effect at low intensities is therefore not uniform across species, and a mitigation that suppresses activity in most species while greatly increasing it in others is not obviously benign. Nothing in this comment should be read as asserting that the biological consequences of these lamps are understood.

Two findings that bear on other parts of this comment

The first concerns part-night lighting, which Part V.M examines at length because three British jurisdictions switched their street lights off at or around midnight and the Foundation relies on what followed. These authors observe that most insects reach lights within three hours after sunset, that the same is true of early-emerging bats, and conclude that switch-offs would need to be earlier than midnight to provide effective mitigation. That is the second independent arrival at the same point in this comment: Appendix C.124 records that the household survey in the largest part-night lighting study found no measurable change in residents' self-reported sleep, and the Foundation noted there that a midnight switch-off leaves the evening exposure window, which is the biologically consequential one, untouched. Two literatures, two taxa, one conclusion about timing.

The second is methodological and the Foundation flags it because it bears on the reliability of a whole literature. Moths caught in light traps were less active than moths caught by hand net, and in one species the control activity of trap-caught animals was 89 percent lower than that of net-caught animals, which would make the apparent effect of light smaller than it is. The authors state the consequence: using artificial light to collect the animals whose response to artificial light is then measured can mask the effect being studied. Part V.A.2 sets out how this comment grades evidence; this is a selection mechanism of a kind that grading does not capture, and the Foundation records it as a caution applying to the insect literature generally and not to this paper, which tested for it.

What it does not establish

The authors state the governing limitation themselves and the Foundation adopts it without softening: the moths could not escape the light or seek refuge from it. An animal in a chamber of a few centimeters under a lamp has nowhere dark to go, and a moth in a hedgerow may. The authors offer in support only the observation that moths are known to remain at lights for long periods, sometimes through the following day, and call that anecdotal. Until the experiment is done where the animal can leave, the magnitude of these figures belongs to the apparatus as well as to the light.

Three further limits. Activity is a proxy and not a fitness endpoint: nothing in this study measures reproduction, feeding, predation or survival, and the link to the population declines the paper invokes is an inference the authors mark as one. The animals were introduced after twilight had ended, so the paper cannot say whether light delays the onset of activity, which may be where the effect matters most. And these are twenty-three common and widespread British species in three families of larger moths, not a sample of Lepidoptera.

And it establishes nothing whatever about human health. No part of the Foundation's submission requires that it should. Its place in this comment is as evidence about an emission and about the adequacy of proposed remedies, which is the subject of Part IX.

Why it is here

On the emissions limb of paragraph 360ii(a)(2), as Part II.D.4 construes it, and for one thing more. The Foundation has asked the Department throughout this comment to characterize four properties of these products: their spectral content, their quantity, their geometry and their duration. The usual objection is that the first of those is the one that matters and that a shift to warmer or narrower spectra disposes of the question. This study is the most direct evidence the Foundation has found that it does not. At a fixed intensity, every spectrum tested produced a large effect, the best of them leaving more than half of it in place, and a composite spectrum engineered for the purpose produced no benefit at all. Spectrum, intensity and duration each mattered and none was sufficient alone. That is an argument for characterizing all four, which is what paragraph 360ii(a)(4) directs and what Part IX requests.

A fifth study, on headlamps, and the pair it forms with the fourth

This study is here for two reasons. It is the only study in this comment that applies an ecological method to the product class on which the Foundation has done the most work, which is vehicle lighting. And read against the moth study at Appendix C.128, which immediately precedes it, it

yields the opposite answer on the same proposed remedy, which required the Foundation to refine for a fourth time what it says about spectral mitigation.

Fabusova M., Gaston K.J. and Troscianko J., Pulsed artificial light at night alters moth flight behaviour, Biology Letters, volume 20, issue 11 (2024), article 20240403, open access. Described at Appendix C.132. Two of its three authors are authors of the study at Appendix C.128, and the disclosure made there about the recurrence of this group applies here.

The exposure, which is larger than anything else in this subsection

Four hundred and twenty-eight wild-caught moths of sixty-four species in seven families were each dark-adapted for at least ten minutes, then released while exposed to a single ten-second pulse of light at one meter, and their first behavior recorded. Four light treatments were used, matched in correlated color temperature and in intensity to human vision by finding metameric pairs: a cool phosphor-converted diode at 5,664 kelvin, a warm phosphor-converted diode at 3,102 kelvin, a cool composite diode of red, green and blue at 5,661 kelvin, and a warm composite at 3,222 kelvin. A dark control was also run.

The illuminance of each treatment was between about 430 and 465 lux. The Foundation draws attention to that figure because it is of a different order from everything else in this subsection. The other four studies used light at under one lux, at ten to fifteen lux, at ten lux and at thirty lux. This one used something near four hundred and fifty. The reason is the subject: the authors state that vehicle headlamps form horizontally focused beams typically an order of magnitude more intense than static street lighting, and they cite an estimate that seventy percent or more of the land area of Great Britain may be affected to some degree by light from road vehicles.

The authors also took their animals by hand net under a red headtorch, expressly to avoid the sampling bias that light traps introduce. The study at Appendix C.128 later measured that bias and found it substantial. The Foundation notes the precaution because it was taken before the problem was quantified.

The mechanism, which is the same mechanism this comment argues about human drivers

The authors set out why a pulse should matter more to an insect than to a person, and the Foundation records it because Part V.C makes the human half of the same argument. A vertebrate pupil constricts in about a second. Insects have no pupil of that kind; they adapt by migrating screening pigment within the optical units, a process that can take over thirty minutes to reverse, and which has been found to operate more slowly at night than by day. An animal with a thirty-minute recovery constant, struck by a beam of several hundred lux for ten seconds, is in a different position from a driver whose pupil closes in a second and whose recovery Part V.C.3 measures in seconds.

The Foundation does not offer the insect case as evidence about human recovery, which Part V.C treats on its own evidence. It offers the parallel as the reason a single exposure metric cannot serve both, and as the reason the duration of a pulse is a characteristic of the emission that paragraph 360ii(a)(4) directs the Secretary to evaluate.

What was found

The clearest result is the comparison with darkness. Released in the dark, 86 percent of moths flew directly upward, which the authors read as the normal escape response. Released into a pulse of light, an average of 37 percent did. The pulse replaced the ordinary response with a range of others.

On which light was worst, the Foundation reports the three tests separately because they do not all point the same way.

- Erratic flight alone was most frequent under the cool phosphor-converted diode but the effect was not significant on any test: neither color temperature, nor spectrum, nor their interaction, each at a probability of 0.350.
- Flight into the light was significantly predicted by color temperature, being more frequent under cool lights of either spectrum, at a probability of 0.002. Spectrum alone did not predict it.
- The two combined, which the authors treat as the harmful class, showed a significant interaction between color temperature and spectrum at a probability of 0.006, and were most pronounced under the cool phosphor-converted diode. The authors give the effect sizes: harmful responses were 1.8 times more likely under that lamp than under the other three, and 25.5 times more likely than in darkness.

Moths also responded fastest under the cool phosphor-converted diode, about twelve seconds faster than under the others, against a mean latency across treatments of 21.45 seconds. And there was no detectable difference between taxonomic families, which the authors note is contrary to studies of attraction to static lights and suggests the result may extend beyond the sixty-four species tested.

The pair, and the fourth refinement of what this comment says about spectrum

Part V.I has already recorded that the Foundation's position on spectral mitigation has been corrected three times. This study requires a fourth correction, and it is the most useful of the four because it does not subtract from the position but qualifies the circumstances in which it holds.

The study at Appendix C.128 tested composite lights made from three narrowband diodes against broad-spectrum lights matched to them for human vision, under continuous exposure at ten lux, and found no benefit whatever: probabilities of 0.580 and 0.917, with the composite white in fact the worst treatment of all. This study tested the same proposed remedy, against a single intense pulse, and found that it helped: the harmful class of responses turned on an interaction in which the cool phosphor-converted lamp was worst, and the authors conclude that lower color temperature or composite alternatives are likely to provide benefits.

Two studies, the same laboratory, two of the same authors, the same county, the same proposed remedy, opposite answers. The later study names this one as the contrasting finding and supplies the explanation, which the Foundation adopts: the earlier work measured a response to a brief pulse while the later measured continuous exposure through a whole night, and the attractiveness or immediate effect of a light is not a good proxy for what it does over hours.

The refinement this pair supplies is therefore about exposure regimes and not about amber. Whether a spectral change helps at all depends on the regime against which it is tested: against a brief intense pulse a composite or warmer spectrum reduced the most harmful immediate responses, and against continuous exposure at street-lighting intensity it did not measurably help at all. A mitigation validated against one regime therefore cannot be assumed to work against another, and a standard that prescribes a spectrum without specifying the exposure regime it is meant to address has not said enough to be assessed. The Foundation carries that refinement forward into the settled position stated at the end of the next study and states no separate position here.

What the authors say about human beings, which the Foundation records with care

The paper closes on a proposition about people, and the Foundation reports it as the authors framed it rather than as it would prefer. Noting that the blue peak of phosphor-converted diodes has been associated with decreasing alertness in older drivers, they write that they "can speculate that changing the spectral composition of car headlights by reducing the blue peak will likely be associated with beneficial changes to road safety for moths and humans alike."

Three ecologists, in a conservation collection of a biology journal, writing about insects, reach a conclusion about the spectral composition of motor vehicle headlamps and human road safety. The Foundation notes the convergence with its own position at Part VI.B and then states plainly what the

sentence is and is not. It is speculation, and the authors label it so. It is outside their field. It rests on two cited studies of human pupillary response and alertness which the Foundation has not read. It is not evidence of anything about human drivers and the Foundation does not offer it as such. What it is worth is this: the proposition that the blue content of headlamps is worth reducing is now reached independently by investigators with no interest in the Foundation's position and no connection to the American regulatory dispute, on their way to a different conclusion about a different taxon.

What it does not establish

The light did not move. The authors say so: the source was static and the pulses were intended to simulate a passing headlamp encountered at close range. A real headlamp approaches, brightens, sweeps and recedes, and arrives with noise and moving air. The exposure was a single pulse, where a moth beside a road receives many at traffic frequency. Only the first behavior within two minutes was recorded: nothing about survival, reproduction, collision or energy expenditure was measured, and the harm is inferred from the character of the response rather than observed. The animals were handled and released from a pot, and the authors list an escape response to handling among the mechanisms that could confound or supersede the others. The mechanism was not determined and the authors say it cannot be from behavioral data alone. The control arm was forty-two animals and was not balanced across treatments. And the erratic flight result, which the abstract leads with, was not statistically significant on its own; the significant findings are flight into the light and the combined class.

It establishes nothing about human health. Its place in this comment is as evidence about an emission of a product class, and about the inadequacy of a spectral prescription that does not specify the exposure regime.

A sixth study, which measured how much of the problem the instrument cannot see

The Foundation asks the Department to read this study before the others in this subsection if it reads only one. Its subject is moths, and it is the third and last of the moth studies. Its importance is that it quantified the blindness of the method by which almost everything known about this exposure has been learned.

Degen J., Storms M., Lee C.B. and nine co-authors, the last being Degen T., Shedding light with harmonic radar: Unveiling the hidden impacts of streetlights on moth flight behavior, Proceedings of the National Academy of Sciences, volume 121, number 42 (8 October 2024), article e2401215121. Described at Appendix C.135.

The design, which is the reason the finding was available to be made

Ninety-five flights of ninety-four individual moths were tracked by harmonic radar on an open pasture near Großseelheim, Germany, in June and July 2018. A transponder weighing 10.5 milligrams was fixed to the thorax; it carries no battery, being powered by the radar beam, and returns the beam at twice the transmitted frequency, which permits a position fix every three seconds out to a kilometer. Six high-pressure sodium streetlights on three-and-a-half-meter poles were arranged in a circle of eighty-five meter radius with the release point at the center, their light cones not overlapping. Moths were released one at a time, with the lights on or off on alternating nights, and tracked until the signal was lost for ten minutes.

What that apparatus permits is the observation of the whole flight, inside and outside the lit area. Every previous method — the light trap, the capture and recapture, the observation of the lamp itself — can only record an animal that came to a light. The radar records the animals that did not.

The finding

Every moth tested had been caught using light, which is to say every moth tested was known in advance to respond to light by approaching it. The authors state the consequence for their sample plainly: it "might not be representative for the whole population." They expected most of these animals to fly to a streetlight.

Of the fifty released with the lights on, two flew to a streetlight. Four percent. Those two showed the behavior the literature describes, circling the lamp and falling to the ground. Twenty-eight individuals entered the twenty-three meter radius within which a lamp of this type is believed to capture a moth; twenty-four of them flew out again and continued. Six individuals, twelve percent, passed within ten meters of a burning streetlight without interrupting their flight — a distance at which the authors had separately confirmed, by releasing seven privet hawk moths ten meters from a lamp, that every animal circles and crashes.

And yet the lights changed the flights. Turning them on significantly increased the tortuosity of flight in both groups studied, which is to say the flights became less efficient: in hawk moths when the moon was above the horizon, in lappet moths when it was below. In lappet moths the circle of six lamps acted as a barrier the animals were significantly prevented from crossing when the lights were on and the moon was not visible, at a probability of 0.039.

Why this is the most useful study in this Part

Because the effect was in the ninety-six percent. The animals that arrive at the lamp are the ones the method sees, and they were a twenty-fifth of the animals affected. The authors draw the conclusion themselves, and the Foundation adopts it without enlargement: "light-trap catches might underestimate the impact of ALAN since only individuals that fly toward the light source are sampled," and the observation of moths at streetlights "might only concern a small fraction of individuals that pass a streetlight in free-flight." Their own framing of the question is the one the Foundation would put to the Department: how well can light traps placed at the lamp post reflect the real impact of streetlights?

This is the seventh time in this comment that the Foundation has had to report that the instrument used to observe this exposure cannot see it. The first six concern the satellite radiometers whose spectral band begins at five hundred nanometers and which are therefore blind to the emission that has grown fastest; those are collected at Part V.J.4. This one concerns a different instrument, in a different discipline, measuring a different subject. The Foundation draws attention to the pattern rather than to any single instance of it, because the pattern is the answer to question 7 and question 8. The methods by which this exposure has been observed were not built to measure it, and in the one case where somebody built an instrument that could and then compared the two, the established method was shown to be recording four percent of what was happening.

The Foundation asks the Department to take the specific consequence rather than the general sentiment. A performance standard under section 360kk must prescribe an emission characteristic, and an emission characteristic must be measured. Where the Department finds the published literature reporting an effect, it must ask what instrument produced the observation and what that instrument is capable of recording, because the answer in this field has repeatedly been that the instrument records a fraction. That is a reason to measure, which is what paragraph 360ii(a)(4) directs, and it is a reason not to treat the absence of a recorded effect as evidence of absence.

The lamp, which is the fifth and strongest demonstration of the spectral point

The lamps were high-pressure sodium at 2,000 kelvin. The authors note that lamps of this type "are considered to be 'insect-friendly' because of the spectral composition of their light emissions."

Two thousand kelvin is warmer than any white diode sold as a mitigation and warmer than the three thousand kelvin ceiling the ecological literature recommends, including the recommendation the Foundation reproduces from the paper that closes this subsection. Sodium light is close to monochromatic and is the lamp the field itself nominates as the least harmful in general service. It fragmented the landscape. It made the flights of two families of moths measurably less efficient.

The Foundation accordingly states its position on spectral mitigation here, once, and asks that this paragraph govern every place in this comment where the subject arises. Eight studies in this subsection bear on it and they are consistent with one another once two qualifications are stated. First, reducing short-wavelength content reduces some effects and not others. In one study collected

here a warmer source was statistically indistinguishable from darkness on the two endpoints it measured, in a living animal; that is the fifth occasion on which this position has had to be amended, the study is set out below, and three features of it govern how much it can carry. In every other study a reduction in short-wavelength content left an effect in place. A modeling study is the second qualification and is set out below also: under a near-monochromatic sodium source the modeled chromatic contrast between a camouflaged snail and its background fell below the threshold at which any of three modeled predators could discriminate it, and those authors record that in the absence of color a predator uses luminance contrast, which they did not model. Second, whether it helps at all depends on the exposure regime against which it is tested, a composite spectrum having helped against a brief intense pulse and not against continuous exposure at street-lighting intensity, so that a mitigation validated against one regime cannot be assumed to work against another. Third, a lamp of low correlated color temperature is not a narrow-band lamp: warm white is broad-spectrum light with a reduced blue fraction and it retains a blue peak, measured at 455 nanometers in a lamp sold as 3,000 kelvin, and Part V.B.3 sets that point out at length. Fourth, the lamp at the amber end of the range actually deployed — sodium at 2,000 kelvin, nominated by the field itself as insect-friendly — still produced a barrier across a landscape. Fifth, it follows that a spectral change is a mitigation and not an answer, and that anyone who offers one as a reason not to limit the quantity, the direction or the duration of an emission offers a partial measure as a complete one.

The consequence for a performance standard is specific, and the Foundation asks the Department to take the consequence rather than the sentiment. A standard under section 360kk that prescribed a correlated color temperature would prescribe a quantity that does not determine the emission it is being used to control, and a standard that prescribed a spectrum without specifying the exposure regime it addresses would not have said enough to be assessed. If the Department intends to regulate spectral content, it should prescribe the spectral content: a limit on radiant power within a stated wavelength interval, or an index computed from the spectral power distribution of the kind the Andalusian instrument described at Appendix D.2 employs. Part IX.G.1 already lists those quantities and Part IX.J already asks the Department to state that lumens, watts and correlated color temperature do not describe the spectral content of a source. This subsection is the evidentiary basis for requests the comment has already made, and it does not enlarge them.

The authors place one limit on this which the Foundation reports and does not evade. They expressly decline to generalize to light-emitting diodes: sodium lamps are being replaced worldwide, diodes “can vary considerably in spectrum and intensity,” and the authors write that the repeatability of their results “will need to be specifically investigated for the different LEDs in the future.” So this study does not establish that a diode fragments a landscape. It establishes that the lamp nominated as insect-friendly does. The Foundation observes, marking the inference as its own, that the direction of that result is unfavorable to the lamp that replaced it rather than favorable, and that the burden of showing otherwise lies with whoever proposes the replacement.

The question the settled position invites, which is whether to go further and use red

If moving a lamp toward the long-wavelength end reduces the effect without removing it, the obvious question is what happens at the end of the range. Several European authorities have begun requiring red light in or near protected areas, principally to protect bats. The Foundation does not ask this Department to prescribe red light anywhere, and sets out here why it does not.

Durmus D., Jägerbrand A.K. and Tengelin M.N., Research note: Red light to mitigate light pollution: Is it possible to balance functionality and ecological impact?, Lighting Research and Technology, volume 56, issue 3 (2024). Described at Appendix D.7. The Foundation identifies what this document is before using it: a research note and mini review, which its authors describe as a qualitative synthesis of pertinent literature. It reports no original measurement and no original experiment, and every empirical claim in it is taken from a source the Foundation cites to that source or records as an acquisition. It is used here as a statement of informed opinion from within lighting engineering, and the comment does not treat it as evidence.

What the ordering in the record actually is

On insect attraction, and only on that, the ordering follows wavelength and the studies collected in this subsection agree on it. White is worst, amber is better, and red is better still. At Appendix C.128 narrowband amber suppressed moth activity by 57 percent against 85 and 93 percent for the two white treatments. At Appendix C.136 bringing a tailored luminaire from 2,700 to 2,000 kelvin took the catch from half the conventional figure to a third. At Appendix C.133 shearwaters offered blue against red at matched brightness chose red, at probabilities of 0.003 and 0.00052. And in three separate studies the investigators handled their animals under red light precisely because they regarded it as close to darkness for the taxon in hand.

So the answer to the narrow question is yes. The answer to the question that matters is no, and the Foundation sets out four reasons, three of them the authors' and one its own.

Why red is not the answer

- The bat evidence, which is the reason red is being required, does not support a general rule. The authors report that two species of pipistrelle show increased activity under red light during migration, which is a positive phototactic response, while light-averse species of Rhinolophus, Myotis and Plecotus may avoid it. In the one controlled experiment they cite, activity fell under every color tested and fell least under red. The responses are, in their words, species-specific and shaped by ecological context.
- A spectrum chosen because a species cannot see it may make that species easier to eat. The authors put the point as the creation of unintentional ecological traps for animals unable to detect the light, raising their vulnerability to predation and so potentially raising mortality in the very populations the measure was meant to protect. The Foundation has not seen that consideration anywhere else in this literature and regards it as the most important sentence in the document.
- Red is not neutral for animals whose peak sensitivity lies elsewhere, because they can still detect it. The authors report that red light can disrupt the magnetic orientation of migratory birds, producing disorientation and circling at the source with a consequent collision risk, and that in one controlled experiment red and white light advanced the onset of activity in blue tits to a greater extent than green did. On that endpoint red behaved like white.
- And the Foundation adds the point that follows from the study described immediately above. A red luminaire that is unshielded still sends light where it is not wanted. Nothing about the spectrum of an emission constrains its direction, and the direction was the characteristic that brought insect attraction to the level of darkness while a fivefold reduction in quantity did not. Substituting red for white is a change in the characteristic that mattered least of the ones tested.

The two human costs, which bear on parts of this comment already written

The Foundation reports these because they are the reasons it will not ask for red light, and because each lands on an argument the comment makes elsewhere.

The first is visual function. Narrowband red gives poor color rendering, which the authors say can hinder accurate identification of objects including faces, compromise visual acuity and color discrimination, and reduce local contrast; they add that under extremely chromatic sources chromatic adaptation breaks down, so that a person cannot fully adapt to the lighting at all, and that red light reduces subjective ratings of visual comfort. Part V.M records that where the public has been asked, the preference is not for amber but for a warm correlated color temperature combined with good color rendering, which narrow-band sources do not provide. Red is worse on that axis than amber, and the Foundation will not ask this Department to recommend a lamp under which a pedestrian cannot identify a face.

The second is power. Red sits far down the photopic and scotopic sensitivity functions, so a red source needs more radiant power for the same visual effect. The authors give a figure from a

commercially available streetlight marketed for light pollution mitigation: it delivers about 50 percent less luminous flux than a white luminaire drawing comparable power. Part IV.G sets out the federal lamp efficiency framework administered under the Energy Policy and Conservation Act, and the Foundation notes the collision plainly. A spectral requirement that halves luminous efficacy runs against a federal efficiency standard, and a shielding requirement does so too, since the authors of Appendix C.136 state that they sacrificed efficiency to their shielding. The Department should expect that conflict and should raise it with the Department of Energy under the liaison duty of paragraph 360ii(a)(3) and (a)(6) rather than discover it later.

What the Foundation takes from it

The authors conclude that advocating red light is well-intentioned, that its effectiveness in mitigating ecological impacts remains uncertain, and that caution is warranted against its use as a universal solution. They then write the sentence the Foundation adopts: it is also possible that very little or no light is more beneficial than red light outdoors.

That is the position of this comment, reached independently by three lighting researchers, and it is why the Foundation asks for limits on quantity, direction and duration rather than for a color. A change of color moves the harm between species and imposes costs on the people using the road. Less light, aimed where it is needed, for as long as it is needed, does not. The request Part IX makes is accordingly a request about the quantity, the geometry and the timing of an emission, and it does not ask the Department to prescribe a spectrum at all; where the comment discusses spectral content it asks only that it be measured and disclosed, which is the request at Part IX.F.

Two further results, one of which does not help the Foundation

First, the geometry understated the real case, and the authors say so. Their lamps stood eighty-five meters apart, which is much farther than ordinary street lighting; they give European pole spacing for roads as twenty-five to forty-five meters, and conclude that the barrier effect "would be even stronger with the typical streetlight design." An experiment that understates its exposure and still finds an effect is the useful kind.

Second, and against the Foundation's interest: the authors looked for an effect of skyglow on flight direction and did not find one. The brightest sectors of their sky were the ones carrying skyglow from named towns, and the moths did not fly toward them; nor did they fly toward the moon when the moon was brightest. The Foundation reports this because it has elsewhere in this comment treated diffuse sky brightness as an exposure, and this study found that the diffuse component did not steer these animals while the local point source changed their flights. Two qualifications keep that from being more than it is. Failing to find a directional preference is not the same as finding no effect, and the authors tested direction only. And the result sits comfortably with the comment's own emphasis, since the thing that mattered here was the emission of a product at close range rather than the diffuse sum of many products at a distance. Part V.J.4 should be conformed to this rather than left to imply more than the record carries.

What it does not establish

Every tested animal was male; the authors caught almost no females, so nothing here speaks to the sex that lays the eggs, which matters because the inference the authors draw is about reproductive success. Every tested animal was caught using light, so the behavioral results describe a phototactic subsample even though that selection makes the four percent figure stronger rather than weaker. The radar cannot resolve altitude, and altitude is the authors' own explanation both for the twelve percent who passed close by and for the difference between the two families; they call for three-dimensional tracking and state that the proof is not available with present methods. The tortuosity analyses rest on thirty-one hawk moths and thirty-two lappet moths after exclusions, with cells the authors describe as small and unbalanced. The choice of which tortuosity index to use for each family depends on an assumption about which family was native to the field, which the authors support but do not test. The twenty-three meter attraction radius is taken from earlier work and was not measured here. A flight ended where the signal was lost, which may mean the animal landed,

flew too high, shed the transponder or was eaten. And the one individual flown twice is an anecdote in which both variables changed at once.

It establishes nothing about human health and the Foundation does not offer it for that. Its place is on the emissions limb of paragraph 360ii(a)(2) as Part II.D.4 construes it, in the measurement argument at Part V.J, and in the spectral position above.

A seventh study, which weighs this exposure against one the Government already takes seriously

This study is the only one in the comment that puts artificial light at night beside another environmental stressor and asks which matters more. The stressor it chose for the comparison is the urban heat island, and the answer it reports is the reason the Foundation includes it.

Wang L., Meng L., Richardson A.D., Hölker F., Li H., Mao J., Longcore T., Xia J. and She D., Artificial light at night outweighs temperature in lengthening urban growing seasons, Nature Cities, volume 2 (2025), pages 506 to 517, open access. Described at Appendix C.131.

What was done

Four hundred and twenty-eight cities of the Northern Hemisphere, from 2014 to 2020. For each city the authors divided the area into ten concentric bands by the proportion of impervious surface, from the outermost rural band to the urban center, and then measured four things in each band: satellite light at night, near-surface air temperature, the date on which vegetation greenness began to increase in spring, and the date on which it began to decrease in autumn. The separation of the two drivers was attempted by partial correlation, each computed while holding the other constant, with the difference between the two coefficients tested for each city. The spatial pattern was then checked against a thirty-meter phenology product for sixty-two cities in the continental United States, including a version with lawns and other developed open space excluded.

The gradient itself is the first result and it bears on everything after. Across the ten bands, light at night rose from 3.1 to 53.3 nanowatts per square centimeter per steradian, an increase of roughly seventeen times, and the rise was exponential, most of it concentrated in the last three bands. Air temperature over the same gradient rose from 10.7 to 11.5 degrees Celsius, which is eight tenths of a degree, and most of that occurred between the first band and the second. The two stressors have very different shapes across a city.

What was found

In 378 of the 428 cities, the growing season lengthened toward the center: spring onset advanced and autumn senescence was delayed. Averaged across all cities, spring onset was 6.4 days earlier and autumn senescence 7.1 days later in the urban half of the gradient than the rural half.

On which driver accounts for it, the answer differs between the two ends of the season and the Foundation states both rather than the title.

- For spring onset the two are comparable. The partial correlation with light was minus 0.37 and with temperature minus 0.33. Where the two differed significantly, light was dominant in 135 cities and temperature in 144. Neither wins.
- For autumn senescence the two are not comparable. The partial correlation with light was plus 0.38 and with temperature minus 0.03. Senescence was positively correlated with light in 310 cities, while its relationship with temperature was inconsistent in direction, negative in 134 cities and positive in 118. Across the seven climate zones examined, the light coefficient averaged 0.49 and the temperature coefficient 0.003, and light outweighed temperature in every zone.

So the finding in the title holds for the end of the growing season, where it is emphatic, and does not hold for the beginning, where the two drivers are of similar strength. The Foundation reports it that way and asks that it not be cited more broadly than that.

One further figure the Foundation notes because of who is reading. Of the three continents examined, North American cities were the brightest, at 30.1 nanowatts per square centimeter per steradian in spring against 23.6 for Europe and 20.8 for Asia.

The comparison the Foundation asks the Department to draw, which is not about plants

The urban heat island is a recognized environmental health hazard in the United States. It has federal attention, interagency programs, surveillance, heat action plans and public guidance addressed to it. The Foundation makes no criticism of any of that and does not suggest that heat deserves less.

What it asks the Department to notice is the comparison. In four hundred and twenty-eight cities, measured over seven years with the same satellites and the same method, the environmental variable with the larger and more consistent effect on the measured outcome was not the heat. It was the light. And of the two, the one with a federal program is the heat.

The Foundation states the limits of that comparison immediately, because it is rhetorically attractive and could be overdrawn. The outcome measured is the timing of vegetation growth, not a human outcome, and nothing follows from it about the relative importance of heat and light to human health, where the evidence on heat is incomparably stronger. The two variables have very different ranges across the gradient the study uses, light varying seventeenfold and temperature by less than a degree, and the Foundation's own view is that a comparison of correlation magnitudes between variables of such unequal range is not straightforwardly a comparison of importance; that criticism is the Foundation's and is not addressed by the authors. And a single observational study does not settle anything.

What survives is narrower and still useful. It is no longer open to say that artificial light at night is too small a variable to warrant federal attention when a peer-reviewed study of four hundred and twenty-eight cities finds it outweighing the urban heat island on the outcome it measured. Paragraph 360ii(a)(2) directs the Secretary to plan, conduct, coordinate and support research. The comparison is a reason to begin.

The pathway to a human outcome, which the Foundation records as a lead and not a finding

The authors identify consequences of the shift they measured, and one of them is the first route from this exposure to a clinical endpoint that the Foundation has encountered in this subsection. They write that earlier leaf-out and later senescence driven by light may increase the risk of frost damage, disrupt plant and pollinator interactions, and lead to an earlier occurrence of pollen allergy symptoms. For the last of these they cite a study in a journal of the American Medical Association association reporting an association between changes in the timing of spring onset and asthma hospitalization in Maryland.

The Foundation sets out the chain and then says what is missing from it. Light at night is associated with an advance in the start of the growing season of about six days. The start of the growing season is when wind-pollinated trees release pollen. And a change in the timing of spring onset has been associated with asthma hospitalization in one American state. Each link is measured, which distinguishes this from the chains the Foundation declined earlier in this comment. What is missing is any study joining them: no one has measured whether light at night is associated with pollen season timing, or with allergy or asthma presentations, and the Foundation does not assert that it is.

It submits instead that this is precisely the research paragraph 360ii(a)(2) directs the Secretary to plan, conduct, coordinate and support, and that it is unusually tractable. The exposure is already measured by satellite for the whole country. Pollen counts are already collected. Asthma presentations are already recorded. The question is whether anyone has put the three series beside each other, and so far as the Foundation can establish, no one has.

The Foundation adds one qualification to the scope of that request, because the chain described above concerns one pollen season and there are two. The study the authors cite concerns the onset of spring and the wind-pollinated trees that release pollen when the growing season begins. A second and independent route runs through the late-summer weed pollens, of which common ragweed is the principal allergen in North America and whose season does not overlap the tree season at all. Whether artificial light at night bears on the second route is not something the Foundation asserts, and it has examined one study on the question and declined to rely on it. The point here is narrower and concerns the design of the research rather than its result: a study scoped to spring phenology would not detect an effect on the late-summer season, and the two seasons are monitored separately by the same networks. The Foundation asks that any study undertaken under paragraph 360ii(a)(2) cover both rather than one.

What it does not establish, and the measurement problem it shares

It is observational and spatial. Light and temperature both rise toward a city center, and so do many things the model does not contain: carbon dioxide, ozone, nitrogen oxides, particulate deposition, soil compaction, irrigation and drainage. The authors address species composition, noting that cities carry more non-native plantings and validating their result against a thirty-meter dataset with lawns excluded, but they do not address the atmospheric or soil variables. Partial correlation separates light from temperature. It does not separate either from anything absent.

And the exposure is the same instrument this comment has criticized five times. The authors state the limitation themselves, and add a refinement that is specific to plants and that the Foundation had not previously seen. Plants sense light through several photoreceptor families: phytochrome responds to red and far-red light between roughly 620 and 1,000 nanometers, while phototropins and cryptochromes respond mainly to blue. The satellite band runs from 500 to 900 nanometers. It therefore covers much of the range to which one photoreceptor family responds and is blind to the range to which the others do. The authors call for a sensor capable of capturing a broader spectrum, particularly in the blue. Their defense of their own result is that the conversion to light-emitting diodes probably occurred at about the same time across each urban region, so that the spectral change is roughly common to all bands of their gradient. The Foundation records that this is an assumption which the authors state as one and do not test.

It establishes nothing about human health. The outcome is the greenness of vegetation observed from orbit.

An eighth study, which specified its exposure in the subject's visual system and in a human's, and in which the two did not agree

This is the last of the studies the Foundation relies on in this subsection, and it is here for a reason that has nothing to do with its subject. Its investigators characterized their light twice: once in the photometric unit a person would use, and once in the receptor space of the animal they were testing. The two characterizations do not describe the same stimulus. That is the central proposition of Part V.J.4, demonstrated by investigators who were not arguing for it.

Atchoi E., Mitkus M., Machado B., Medeiros V., Garcia S., Juliano M., Bried J. and Rodríguez A., Do seabirds dream of artificial lights? Understanding light preferences of Procellariiformes, Journal of Experimental Biology, volume 227, issue 19 (2024), article jeb247665. Described at Appendix C.133.

The design

The subject is the Cory's shearwater, Calonectris borealis, whose largest population breeds in the Azores and whose fledglings leave the burrow at night in late October and early November. About six percent of fledglings are grounded each year in what the literature calls fallout events, in which birds come down in lit urban areas and cannot resume flight; a rescue campaign on Faial has collected them every year since 1995.

One hundred and thirty-one rescued fledglings and eighty-four adults from a colony were each given a single trial in a plywood maze, 100 by 50 by 40 centimeters, painted matte black and divided into two arms with a light above each. A bird was held under a dark box for one minute, then released, and its arm entry, choice and latency recorded; a trial ended after ten minutes if the bird did not move. Three treatments: one arm white and one dark; one arm blue and one red; and a control with both arms dark.

The exposure, which is the part that matters

The white arm was a named commercial product, a warm-white diode strip at 3,000 kelvin, with measured spectral peaks at 455 and 625.2 nanometers, delivering 175 lux at the bird's starting position. The dark arms measured below 0.1 lux. The Foundation notes in passing that 0.1 lux is a ceiling and not a measurement, and that the moth study at Appendix C.128 measured the natural night sky at a median of 0.0168 lux, so a dark arm specified as below 0.1 lux is specified loosely by the standard this appendix now has available.

The blue and red arms were single-peak diodes at approximately 450 and 620 nanometers. Here the investigators did something no other study in this appendix did. Rather than matching the two stimuli in human photometric terms, they modeled the visual system of a shearwater and matched them in it: the two arms were set to differ by about four percent in achromatic contrast, which is to say they were very nearly equally bright to the bird, while differing by about 60.7 just-noticeable differences in chromatic contrast, which is to say they were about as distinguishable in color as two stimuli can be. The investigators also report what those same two stimuli measure in human photopic units: 75 lux for the blue arm and 120 lux for the red.

The Foundation asks the Department to hold those two statements together. Two light sources that are within four percent of each other in the brightness channel of the animal being tested differ by a factor of 1.6 when measured in lux. The discrepancy is not an error by anyone. It is what the photopic luminosity function is: a weighting derived from human observers, which assigns to each wavelength the value it has for human vision and no other. Applied to a bird it returns a number, and the number is not about the bird.

Part V.J.4 makes this argument and supports it by showing what is lost when the spectrum is discarded. This study supplies the demonstration directly, and in the direction that matters for a performance standard. A limit expressed in lux is a limit expressed in a human weighting. For the purposes of section 360kk that is not a defect, because the statute is concerned with people and the Foundation has said throughout that the Department should regulate in the units in which human exposure is assessed. The point is narrower and it cuts the other way: the Department cannot read the ecological literature, or answer question 14, by converting its exposures into lux and comparing them, because lux is not the quantity those studies are about. Any synthesis of this literature that proceeds by reducing every exposure to illuminance will produce comparisons that are arithmetically sound and biologically empty.

What was found

The birds avoided the light, and avoided the shorter wavelength.

- Fledglings entered an arm in 101 of 131 trials, 77 percent, against 45 of 84 for adults, 54 percent; Fisher exact probability below 0.001, odds ratio 2.88. In the control both arms being dark, every fledgling made a choice; adults did in 70 percent of trials.
- Offered white against dark, fledglings chose the dark arm in 77 percent of the trials in which they chose, binomial probability 0.009. Adults chose dark in 66 percent, which was not significant at 0.3; the authors calculate that between 176 and 305 adults would have been needed to resolve it.
- Offered blue against red at equal brightness to the bird, both ages chose red: fledglings at a probability of 0.003, adults at 0.00052. Only one adult chose blue.

- In the control there was no side bias in either age group, at 0.627 and 0.115, which is the check that makes the other two results interpretable.
- Fledglings took longer than adults to choose, probability below 0.01, and both groups were fastest in the control. Within each treatment, however, the latency comparisons between the two arms were all null.

What the authors concluded, and what they expressly did not

The authors do not claim that these birds were attracted to the light. They claim the opposite, and the distinction is theirs: at close range the birds were "apparently disoriented by the stimuli rather than being behaviourally attracted to them." Their summary of the white treatment is that "artificial light appears to impair the fledglings' ability to exit the unknown lit environment," and of the whole experiment that "the presence of a close-range artificial light can be disruptive to Cory's shearwater fledglings."

They also report a negative result against their own hypothesis, which the Foundation records because it is the kind of reporting that makes the rest credible. Fallout falls overwhelmingly on fledglings rather than adults, and the obvious explanation would be that the two ages behave differently toward light. They do not: the choices did not differ significantly between ages, and the authors therefore write that "behavioural differences cannot account for the age bias observed in fallouts." Their alternative, that the fledgling visual system is still immature, is offered as a hypothesis and the Foundation reports it as one.

What it does not establish

It is not a model of fallout and the authors say so: a two-armed maze at close range is not the circumstance in which a bird flying at night encounters a lit town. The samples within treatments are small, the choice results resting on roughly two to four dozen birds each, and the adult arm is underpowered by the authors' own calculation. The white stimulus was not isoluminant with the blue and red pair, so the two experiments cannot be compared to each other on intensity. The visual model was built on the spectral sensitivities of a different species, the wedge-tailed shearwater, and not on the species tested. The fledglings had already been grounded by urban light, handled, ringed, measured and held in boxes before testing, so they were not naive to the exposure; the authors raise this themselves, argue from earlier work that it is unlikely to have skewed the result, and recommend testing unexposed birds. And the tested fledglings were selected for mass at or above 660 grams and averaged 820 grams against 766 for the rescued population as a whole, so they were the fitter part of a group that had already been injured by the exposure.

It establishes nothing about human health, and the Foundation does not offer it for that. Its place is on the emissions limb of paragraph 360ii(a)(2) as Part II.D.4 construes it, and in the measurement argument above.

One further bearing, on the spectral question settled earlier in this subsection

The white lamp here was 3,000 kelvin, which is at the warm end of what is sold as a mitigation. It has a measured peak at 455 nanometers. The fledglings avoided it. Taken with the mosquito study at Appendix C.125, where lamps at 2,700 to 3,000 kelvin and under one lux did not prevent the effect, and with the two moth studies at Appendices C.128 and C.132, this is the fourth independent demonstration in this subsection that a low correlated color temperature is not a narrow spectrum. Warm white is broad-spectrum light with a reduced blue fraction, and it retains a blue peak. The Foundation repeats the position stated at the end of the moth pair and does not restate it here.

A ninth study, which found that insects are not attracted to light at all

Fabian S.T., Sondhi Y., Allen P.E., Theobald J.C. and Lin H.-T., Why flying insects gather at artificial light, Nature Communications, volume 15 (2024), article 689, open access. Described at Appendix C.137.

This study and the one that follows it are placed last and should be read together. This one establishes why artificial light disrupts insect flight. The next one, whose authors cite this work, built a luminaire that removes the condition this mechanism requires, and measured what happened. The Foundation knows of no other pair in this literature in which the mechanism and the remedy were established independently and agree.

What was done

Four hundred and seventy-seven stereo-videographic recordings of wild insects flying near artificial light were made in Costa Rica at 500 frames per second under infrared illumination, which the investigators took to be invisible to the subjects. In the laboratory, eight infrared motion-capture cameras tracked a three-marker frame glued to the thorax of individual insects flying freely in a two-meter tent around a light source, resolving the orientation of the animal's back as well as its position, to a marker residual of about a quarter of a millimeter. Five hundred and thirty-eight continuous flight trajectories were recorded across four species: two dragonflies, which are diurnal and not associated with light trapping, and three moths. Separate experiments reversed the direction of the light, tested insects under two centimeters in length, switched between two lights while an insect was circling one of them, and simulated the proposed mechanism in an agent-based model.

What was found, which displaces the standard account

The insects did not fly toward the light. Their velocity vectors concentrated at right angles to the direction of the source, in every species tested, at probabilities below 0.001. In darkness and under a diffuse overhead light the same effect was absent, at probabilities of 0.36 and 0.65, which establishes that it was the point source and not the enclosure.

What the insects did instead was tilt their backs toward the light. The investigators measured this as the alignment between the animal's dorsal axis and the direction of the source, on a scale running from minus one to one. With the light on the values were 0.84, 0.79, 0.82 and 0.82 across the four species. With the light off, 0.17. Body bank angles rose correspondingly, median values moving from between about 9 and 20 degrees under control conditions to between about 29 and 48 degrees near a point source, all at probabilities below 0.001.

That behavior is the dorsal light response, a conserved reflex by which a flying insect keeps its back to the brightest part of its visual field. Throughout the evolutionary history of insect flight the brightest region has been the sky, so the reflex is a reliable way of determining which way is up. Most small insects cannot glide and have no passive stability, and the mechanosensory systems available to them measure rates of rotation rather than absolute attitude. The brightest region of the visual field is how they know where up is.

A bright lamp at close range is therefore not an attraction. It is a false vertical. An insect obeying the reflex banks toward it, and because flying animals accelerate in a direction fixed relative to the body, banking turns the flight path. The result is continuous steering around the source. The three behaviors the investigators recorded in the field follow from it: orbiting at a stable bank, stalling into a climb when the animal faces away from the lamp, and inverting into a dive when it passes over the lamp. All three appeared in ten orders of insect and in under two percent of recordings made in the dark.

The decisive experiment, which concerns direction and not quantity

The investigators shone an ultraviolet lamp downward onto a white sheet laid on the ground, which is the classical method of trapping insects. The insects inverted, tumbled and crashed. They then took the same lamp and shone it upward onto a sheet stretched overhead, producing a diffuse canopy resembling the sky. The insects flew normally beneath it, on various paths, and did not cluster. The same lamp, the same intensity, the same spectrum: reversing the direction from which the light arrived was the difference between normal flight and crashing.

The effect held for small insects. From thirteen families in six orders, every taxon tested except one flew upward stably under a diffuse ultraviolet ceiling and none could maintain flight with the same light coming from below, tilting and inverting shortly after takeoff. Measured across trajectories, path tortuosity near a point source had a median of 3.21 against 1.21 under the diffuse canopy, and insects turned preferentially toward the light near a point source at a probability below 0.001 and not at all under the canopy.

The Foundation asks the Department to hold that result beside the request Part IX makes. The variable that determined whether these animals could fly was the direction of the emission. Not its quantity, which was unchanged, and not its spectrum, which was unchanged.

The four explanations this displaces

- Escape to the light, in which the insect flies at the lamp as it would at a gap in foliage. Refuted: the animals flew orthogonally to the source and rarely toward it.
- A corrupted celestial compass, in which the insect mistakes the lamp for the moon. Refuted by an experiment the Foundation regards as elegant. An animal holding a compass bearing must keep the light on the same side of its body. When the investigators switched between two lamps while an insect was circling one, the insect changed the side it presented to the light in 25 of 37 trials, and three animals reversed direction on the same lamp with no switch at all. The simulated compass model also failed quantitatively: its agents escaped the light, at a median range change of 1.75 meters per second away from the source, where the real animals and the dorsal-tilting agents did not escape.
- Thermal radiation. Already refuted, and refuted again by the observation that diodes emit negligible infrared and trap insects in vast numbers.
- Blinding by a light brighter than a dark-adapted eye can handle. Refuted by the regularity of the behavior: a blinded animal does not produce three reproducible motifs that a four-parameter controller reproduces in simulation.

On the last of those the Foundation enters a caution of its own, because the comment relies at Part V.C on the proposition that a high-luminance source impairs human vision and recovery. Nothing here bears on that. What these investigators refuted is blinding as the explanation of a particular insect behavior in the immediate vicinity of a lamp. The mechanism they propose is a visual reflex that requires the animal to see the light rather than to be blinded by it, and it is specific to flight attitude in a taxon with no pupil. It is not evidence about people, and the comment does not offer it as any.

Why this bears on a performance standard, and the three entries it ties together

The authors state the mitigation their mechanism implies in one sentence, and the Foundation quotes it because of the words in it: “reducing unnecessary, unshielded, upward-facing lights and ground reflections can mitigate the impact on flying insects at night, when skylight cannot compete with artificial sources.”

Four things in that sentence. Unnecessary. Unshielded. Upward-facing. Ground reflections. The first is a judgment about quantity, the second and third about direction, and the fourth about a characteristic of the installation rather than of the lamp. The Foundation observes, marking the observation as its own, that the adjective these authors reached for first is the adjective Congress used in paragraph 360ii(a)(2). They are not invoking the statute and do not know of it. They arrived at the word because it is the right word for light that is emitted without a purpose that requires it.

The mechanism also explains three results the comment already carries, and the Foundation sets out the connections because each was previously recorded as a finding without an explanation.

- It explains why the luminaire described in the next study worked. Confining the emission to the target area and shielding the aperture removes the bright point above the horizontal that subverts the reflex. It also explains why dimming that luminaire fivefold did not work:

reducing the quantity of a point source leaves it a point source, and the reflex responds to the brightest direction rather than to an absolute level.

- It explains the figure at Appendix C.135, where radar tracking found that four percent of light-caught moths terminated their flights at a streetlight while the lights significantly altered the paths of the rest. Insects steering around a lamp are not arriving at it. A trap at the lamp post records the small fraction whose steering ends there. These authors reach the same conclusion from the other direction, observing that only two of fifty moths released eighty-five meters from a light ended their flights there, and inferring that artificial lights may trap passing insects rather than draw them from a distance.
- It supplies the mechanism for a recommendation the comment reproduced at Appendix C.134 and expressly said it did not address: that coastal construction use non-reflective, dark-colored materials. A reflective surface under a luminaire returns light upward from below the animal, which is the configuration these investigators showed to be the most disruptive of all. Reflectance is therefore not a refinement of the direction variable but part of it, and the Foundation now has a reason to say so.

One further matter, which the Foundation records without argument. This work was funded in part by two agencies of the United States: the National Science Foundation and the Air Force Office of Scientific Research, together with the European Research Council and several private foundations. The mechanism by which artificial light at night disrupts the flight of insects was therefore established with American federal money, in the same years in which the agency holding the electronic product radiation authority declined to evaluate the emission on the ground that existing mitigations are effective. The Foundation draws no inference about any individual and makes no complaint about the funding, which was well spent. It asks the Department to notice where the work is being done and under whose appropriations, and to treat that as a matter for the liaison duty of paragraph 360ii(a)(3) and (a)(6) rather than as a coincidence.

What it does not establish

It establishes nothing about human health and the Foundation does not offer it for that. Within its own subject the limits are these. The field classification of the three motifs was made by eye and the authors call it somewhat subjective, providing the original videos for verification. The field dataset is biased toward large insects by the requirement that a subject reflect enough infrared to be tracked: the authors state that most insects present at their light were under a centimeter while the mean size in their data was 29 millimeters, and that clear-winged butterflies showed the response but could not be digitized at all. Wind could not be excluded and true airspeed could not be estimated. The laboratory work rests on four species with between two and twelve individuals each, with markers glued to the thorax after immobilization on ice and no formal control for the marker beyond the absence of visible difference. Wavelength was not systematically studied and the authors say so, although the flies they tested tipped and crashed over ultraviolet light and not over white. Range was not tested at all, which is the most important limit: the mechanism is established at close range and the authors expressly do not claim it explains arrival from a distance. Two taxa were immune, three oleander hawkmoths across seventy-one trajectories and wild vinegar flies, and the authors cannot say why, noting the oddity that oleander hawkmoths are readily trapped by lights in the field. And the authors state plainly that they do not understand why insects do not tilt toward the moon or toward a low sun, which is an unexplained gap at the center of their own account.

No fitness, reproductive or population endpoint was measured. The Foundation offers the study on the emissions limb of paragraph 360ii(a)(2) as Part II.D.4 construes it, and for the proposition that among the characteristics of an emission, the direction is the one that governed this effect.

A tenth study, which changed the product rather than the practice, and which is the closest thing in this Part to the evidence a performance standard would rest on

Dietenberger M., Jechow A., Kalinkat G., Schroer S., Saathoff B. and Hölker F., Reducing the fatal attraction of nocturnal insects using tailored and shielded road lights, Communications Biology, volume 7 (2024), article 671, open access. Described at Appendix C.136.

The Foundation places this study last and asks the Department to read it with Part II.G rather than only with this subsection. Everything else in Part V.I reports that an exposure produced an effect. This one took a product, changed one characteristic of its emission, held the others fixed, installed it on real streets, and measured whether the effect went away. That is the form of evidence on which a performance standard rests, and it is the only study in this comment that has it.

What was changed, and what was held constant

The characteristic changed was the spatial distribution of the emission. Working with a manufacturer, the investigators designed luminaires whose optics confine the light to the target area and whose added shielding suppresses emission at high angles at the point where the radiation leaves the fixture, so that the luminaire is close to invisible from outside the lit area. Each was designed for its own site from the measured geometry of that site — road width, mounting height, pole spacing — then validated after installation and dimmed to match the illuminance of the fixture it replaced.

What was held constant is what makes the study usable. The illuminance on the ground was matched. The correlated color temperature was matched at the site where the comparison was like for like. And compliance with the European road lighting standard was maintained throughout, which the authors state in terms: the light field was tailored "without compromising human safety standards." The Foundation draws attention to that because the objection it most often meets is that any limit on an outdoor luminaire trades against the safety of the people using the road. Here the limit was imposed and the road lighting standard was still met.

The result, which establishes a hierarchy among the four characteristics this comment asks the Department to regulate

At the controlled site in a dark-sky reserve, twelve lit luminaires were compared with twelve permanently unlit ones six hundred meters away, with flight interception traps on all twenty-four, monthly from March to October for four years. Three lit configurations ran in succession.

- Conventional diodes at 30.6 lux attracted 7.7 times as many insects as the unlit controls.
- The same luminaires dimmed by 82 percent, to 5.6 lux, attracted 5.4 times as many. Against the high-illuminance treatment the reduction was not statistically significant, at a probability of 0.812.
- The tailored and shielded luminaires, at essentially the same illuminance as the dimmed ones, 5.2 lux, attracted 1.3 times as many as the unlit controls. The reduction was significant below 0.001, and in pairwise comparison the tailored luminaires were not significantly different from any dark control.

A fivefold reduction in quantity did not measurably help. Confining the same quantity to where it was wanted brought the catch to the level of no lighting at all. The Foundation states the proposition that follows, and states its limits in the next paragraph but one. On this evidence the direction of an emission is not one mitigation among four. For this endpoint it was the one that worked, and the quantity reduction that is ordinarily offered first did not.

The result then survived transfer out of the experimental field. At three municipal sites beside nature reserves — urban, suburban and rural, spanning a wide range of sky brightness — the replacement luminaires attracted roughly half as many insects as the existing street lighting, at probabilities below 0.001, below 0.001, and 0.005. These were ordinary streets under real traffic.

Three findings on spectrum, which confirm the position settled earlier in this subsection

The design separated the spatial question from the spectral one, and the Foundation reports all three results because together they are the cleanest confirmation of the settled position in this comment.

- At the urban site the correlated color temperature was held at 4,000 kelvin on both sides of the comparison. The reduction still occurred. So the benefit was spatial and not spectral.
- At the other two sites the replacement raised the color temperature, from sodium at 2,000 kelvin to diodes at 2,700 kelvin. The reduction still occurred, which the authors note is "not a matter of course, because a higher CCT is expected to increase insect attraction." A geometry change overcame a spectral change in the wrong direction.
- A further control fitted amber film inside the tailored luminaires to bring them to 2,000 kelvin at the same illuminance. The catch fell further, to a third of the conventional figure against a half at 2,700 kelvin. So the spectral change did add a benefit, on top of the spatial one, and the authors say it "could constitute an additional optimization."

That is the settled position of this comment, demonstrated within a single experiment: a spectral change is a real mitigation and it is not the mitigation that did the work. The Foundation asks the Department to note the order in which the two appear here. The geometry change moved the catch from seven-and-a-half times the dark control to one-and-a-third. The spectral change then improved a figure that was already near the floor.

Why this belongs with Part II.G, and what it shows about a duty not discharged

Part II.G sets out paragraph 360ii(a)(5), which directs the Secretary to develop, test, and evaluate the effectiveness of procedures and techniques for minimizing exposure to electronic product radiation. Part II.G.3 lists the techniques that exist for roadway lighting and includes full-cutoff optics and shielding among them, and Part II.G.3 then states the position this comment takes: the techniques have been developed, and what is absent is the federal development, testing and evaluation of their effectiveness.

This study is that evaluation, performed for one technique on that list, and it was paid for by a government. The work was funded by the German Federal Agency for Nature Conservation with resources from the federal environment ministry, and at the municipal sites by a regional council. A national conservation agency commissioned the design of a luminaire, had prototypes manufactured, installed them on public streets in three municipalities and in a dark-sky reserve, measured the emission with a goniophotometer and a spectroradiometer, ran flight interception traps for four years, and published the result with its data and code.

The Foundation offers that as the answer to question 5.0, which repeats the language of paragraph (a)(5) almost verbatim. The Department has asked what procedures and techniques for minimizing exposure exist and how effective they are. Here is what the exercise looks like when it is carried out. It is not expensive by the standards of federal research, it does not require any contested finding about injury, and it produces a number that purchasers and specifiers can act on without any standard being prescribed at all, which is what Part II.G.4 and Part IX.J ask for. The Foundation does not suggest that this Department should have studied German insects. It asks the Department to notice that the method is available, that another government used it, and that the quantity it isolated — the spatial distribution of a luminaire's emission — is an emission characteristic within the meaning of section 360kk and a characteristic of the product rather than of its operation by anyone.

That last point is the one the Foundation most wants the Department to take. Part IX has been careful throughout to ask for what this chapter reaches and not more: the Foundation does not ask the Department to tell a city when to switch off a streetlight, because that is the city's decision about operating a product it owns. Shielding is different in kind. A cutoff is manufactured into the

luminaire. It is present when the fixture leaves the factory, it is testable on a goniophotometer before anything is installed, and it does not depend on anyone's subsequent conduct. Of everything in Part V, this is the characteristic that sits most squarely within what a performance standard can prescribe, and this study is the evidence that prescribing it would do something.

What it does not establish, including the part that limits the use the Foundation can make of it

The most important limit is that the study does not say what to prescribe. The luminaires were tailored individually to each site and the shielding was fine-tuned until it met the criteria, and the published text gives no cutoff angle, no upward light output ratio and no luminous intensity distribution. Goniophotometric measurements were made and sit in a supplementary table the Foundation has not obtained. So this study establishes that confining an emission works; it does not supply the number that a standard would have to state. The Foundation records that gap rather than passing over it, because the whole of its submission is that a performance standard must prescribe a measurable characteristic, and a comment cannot demand a number while relying on a study that does not contain one.

The dimming null must not be overread, and the authors say so themselves: a further reduction of intensity, they write, could have produced a measurable effect, and a threshold is hard to predict because it will vary between taxa. The null is a null for 5.6 lux against 30.6 lux in this setting. It is not a finding that quantity does not matter, and this comment continues to ask for limits on quantity. What it supports is an order of priority, not an exemption.

Three further limits. At the controlled site the three lit treatments ran in successive years rather than simultaneously, so treatment is confounded with year; the authors address this with mixed models carrying temperature, wind and precipitation, and with the fact that the unlit controls caught almost exactly the same number of insects in each period, 430, 397 and 421, which is the strongest internal evidence in the study. At the municipal sites there were no dark controls at all, because the authorities would not permit the street lighting to be switched off under real traffic; the authors state that limitation and state that the community-dispersion results would probably have reached significance at all three sites had a dark control been available. And insects were identified only to order or suborder.

Finally, two things the Foundation records because they cut in opposite directions. The prototypes were not optimized for energy efficiency, which the authors say was sacrificed to the shielding — a trade the Department should expect to meet, given the federal lamp efficiency framework described at Part IV.G. And the catch in a trap at a luminaire measures the insects that came to the luminaire; citing the radar study at Appendix C.135, these authors write that the number caught "represents only a fraction of the insects affected." That is the eighth attestation in this comment that the instrument cannot see the whole of the exposure, and here it means the reductions reported are more likely to understate the benefit of the shielding than to overstate it.

It establishes nothing about human health. The Foundation offers it on the emissions limb of paragraph 360ii(a)(2) as Part II.D.4 construes it, as an evaluation of a technique under paragraph (a)(5), and as evidence that the characteristic Part IX asks to have prescribed is the characteristic that governs.

The strongest population evidence in this subsection, and the one study that counted the animals where they live

Every study in this subsection so far measures what an individual animal does: where it flies, how it banks, whether it feeds, how it orients, whether it can be seen. One measures how many there are. It is the strongest evidence in this collection that this emission reduces a wild population, and it was designed around the measurement problem that Part V.J.4 collects rather than inheriting it.

Boyes D.H., Evans D.M., Fox R., Parsons M.S. and Pocock M.J.O., Street lighting has detrimental impacts on local insect populations, Science Advances, volume 7, issue 35 (2021), article eabi8322,

doi 10.1126/sciadv.abi8322, open access. Described at Appendix C.142. The authors declare no competing interests. The work was funded by the Natural Environment Research Council through a doctoral training partnership and by an industrial studentship with Butterfly Conservation, a conservation charity of which two of the five authors are staff; the Foundation records that in the same spirit in which it records every other interest in this comment.

The design decision, which is why the Foundation leads with it

The standard way to sample moths is a light trap. These investigators did not use one, and they say in terms why: light traps, in their words, "lead to biases when comparing assemblages from lit and unlit areas." They sampled caterpillars instead, by beating hedgerows in daylight and sweeping grass margins at night. A caterpillar does not fly to anything. It is where it hatched, so counting caterpillars counts the population rather than the population's response to the person counting it. Part V.J.4 collects two papers that disclosed the light-trap bias while using the method. This is the first group in this comment that designed it out.

The sites were twenty-six matched pairs and one triplet in Oxfordshire, Buckinghamshire and Berkshire. Street-lighting datasets obtained from nine local authorities and a national highways body by freedom of information request were overlaid on satellite imagery; more than five hundred candidate locations were examined by street view, one hundred and fifty-three were visited in person, and the survivors were pairs in which the lit and unlit sections "appeared identical, except for the presence of ALAN." Lit and unlit transects were at least sixty meters apart, median one hundred and eighteen. According to the authorities' own records the lit sections had carried the same lamp type for at least five years and often for decades. Every site was visited between two and four in the morning to confirm that no part-night lighting or dimming was in operation.

Three independent measures, and the same ordering in each

Abundance first. In hedgerows, from 1,656 caterpillars beaten over twenty-five visits to thirteen matched pairs, there were fewer caterpillars on the lit side at every site, an overall reduction of 47 percent. In grass margins, from 822 caterpillars collected over sixty-four visits to fifteen sites, the overall reduction was 33 percent.

Then the same figures by lamp, which is the cleanest spectral comparison in this subsection:

- Hedgerows: 52 percent fewer under light-emitting diodes and 41 percent fewer under high-pressure sodium, both at a probability below 0.001.
- Grass margins: 43 percent fewer under light-emitting diodes at a probability of 0.02; 24 percent fewer under high-pressure sodium, not significant at 0.20; and 11 percent fewer under low-pressure sodium, not significant at 0.78.

And the reason that ordering is not an artifact of brightness: the mean illuminance of the sodium transects and the diode transects did not differ statistically, in either habitat, at probabilities of 0.34 and 0.85. The lamps differed in composition and not in measured quantity. That is a controlled spectral comparison in the field, at matched illuminance, on a population endpoint, and the Foundation has no other.

The second measure is mass. Caterpillars on lit transects were heavier. The effect was significant under diodes in both habitats, at probabilities below 0.001 and of 0.04; mixed under high-pressure sodium, at 0.007 and 0.10; and absent under low-pressure sodium, at 0.60. The authors read it as accelerated development under stress, consistent with laboratory work on two noctuid species, and note that earlier pupation is predicted to be deleterious to adult fitness. The Foundation reports that reading as the authors' own and returns to its ambiguity below.

The third is a manipulative experiment, and it is separate from the rest. Lighting rigs four meters high carrying either diodes or high-pressure sodium were erected in grass margins with no history of lighting, switched on an hour before sunset, with sampling between one and two hours after dusk, across nine visits. Nocturnal caterpillars normally climb grass stems at night to feed. Fewer were

found under the diode light than under no light, at a probability of 0.03. Under high-pressure sodium the difference was not significant, at 0.58. Generators were placed fifty meters away so that noise, vibration and fumes could not account for it.

The finding that bears most on the structure of this comment

The authors then say something that unsettles the way this field has measured its own subject, and the Foundation quotes it rather than paraphrasing:

> "Our findings also reveal that the number of adult insects attracted to different lighting technologies may not serve as a suitable proxy for their ecological impact, as has often been previously assumed."

The reasoning is set out immediately after it. A published meta-analysis reports that light-emitting diodes attract similar numbers of moths to sodium lamps, or slightly fewer, from which diodes would be expected to be the less damaging. At these sites the diodes were the more damaging, on every one of the three measures above. The authors draw the inference carefully and the Foundation adopts it at the same strength: this "could suggest that flight-to-light behavior is not the principal mechanism via which moth populations are negatively affected by ALAN," a hypothesis they say requires further confirmation.

Read with three studies already in this subsection, that proposition closes a circle. Appendix C.135 tracked individual moths by radar and found that four percent of those already selected for flying toward light terminated their flights at a lamp. Appendix C.136 states that the number caught in a trap at a light source represents only a fraction of the insects affected. Appendix C.137 supplies the mechanism of the flight itself. This study adds the last step: the quantity the field has been measuring for decades, moths at a lamp, may not rank lighting technologies in the order of their effect on moth populations, and at these sites it ranked them backwards. A mitigation chosen on the attraction evidence is a mitigation chosen on a proxy that the people who measured the population say may not be one.

The admission about the unit, which Part V.J.4 takes as its tenth

The exposure here is better characterized than in most of this subsection. Illuminance was measured with a named hand-held meter of stated resolution, at five points along each transect, on overcast nights or at the new moon, pointed upward at the height the caterpillar occupies: one and a quarter meters in hedgerows and a quarter of a meter in grass. Lit hedgerows averaged 5.7 lux and lit grass margins 2.2 lux; unlit transects were estimated below 0.01 lux and every one of them read the meter's minimum. And then the authors say this:

> "An important caveat is that lux is based on human vision, and thus potentially ecologically relevant spectral information can be omitted when using this unit. Identical measurements of lux may not correspond to the same illumination as perceived by a caterpillar. Despite these shortcomings, lux is the SI unit for light intensity and continues to be used by ecologists and urban planners alike due to its convenience."

Part V.J.4 adds that to the instances it collects and explains why it matters that this one concerns a meter in a hedge rather than a radiometer in orbit. The short point here is that the investigators who produced the strongest population result in this comment state in their methods section that the unit in which they expressed the exposure cannot carry the information the result is about, and that they used it because it is the convenient one.

What it does not establish, including the part that runs against this comment

The Foundation reports the authors' own scaling conclusion before anything else, because it is the opposite of the inference a reader might draw from the effect sizes. Using the actual distribution of streetlights rather than an assumption about major roads, they estimate that 1.1 percent of the land area of their study region is directly lit above one lux once road surfaces and urban land are excluded: 15.5 percent of suburban land, 0.23 percent of arable land and 0.68 percent of

broadleaved woodland. From that they conclude that direct illumination by streetlights "has probably been a minor contributor to long-term national moth declines to date; however, our results show that it can be a very substantial local factor." The Foundation adopts that sentence whole. Nothing in this comment asserts that this emission is a principal cause of insect decline, and this study, which is the best evidence it has, says it is not.

Five further limits. The design is not randomized: the treatments are existing streetlights, and the authors say so. Lit transects were often at junctions and may have had more traffic noise, nitrogen oxides or headlight glare; the authors expect the influence of those factors to have been minor, which is an expectation rather than a measurement, although they did test and exclude differences in botanical composition, verge management and surrounding urbanization. The low-pressure sodium figures rest on two transects and establish nothing. The mass finding is ambiguous even on the authors' account, who offer accelerated development under stress and local acclimation as competing explanations and note that it sits awkwardly with their own short-term result. And the short-term experiment used a brighter and bluer lamp than the field sites, 25.3 lux at about 5,000 kelvin against 2.2 lux at 2,700 to 4,000 kelvin, so the two arms are not matched and the authors identify that as one explanation for the apparent conflict between them.

It establishes nothing about human health and is not offered for any. The Foundation offers it on the emissions limb of paragraph 360ii(a)(2) as Part II.D.4 construes it, and as the clearest demonstration available to this comment that the spectral composition of a lamp changes what it does to a population at a quantity of light that is held constant.

The one study in which a spectral change did remove the effect, and why the position above stands

The position stated earlier in this subsection records that in no study collected here did a reduction in short-wavelength content remove an effect. One study qualifies that. The Foundation places it here, before the last two papers, and states the qualification precisely, because a careless reading of this study would overstate the comment's own case in the one direction in which it has been most careful.

McMahon O., Smyth T. and Davies T.W., Broad spectrum artificial light at night increases the conspicuousness of camouflaged prey, Journal of Applied Ecology (2022), doi 10.1111/1365-2664.14146, first published 25 March 2022. Described at Appendix C.141. The authors declare no conflict of interest. The work was supported by the Natural Environment Research Council under grant NE/S003533/2. Smyth and Davies are two of the ten authors of the marine review described at Appendix D.7, and the handling editor of this paper is a co-author of the other marine review there. The Foundation records the overlap rather than leaving it to be found.

What was done, and the first thing to say is that no animal was exposed to anything. Sixty-seven littorinid snails of two species were collected from bladder wrack at Whitsand Bay in southwest England in May 2020 and the reflectance of their shells was measured with a spectrometer between 350 and 750 nanometers; two measurements of the seaweed were averaged to give a background. Published photoreceptor peak sensitivities were taken for three predators: the herring gull, tetrachromatic, hunting from the air; the common blenny, trichromatic, in water; and the green shore crab, dichromatic, in water. Hyperspectral irradiance measured at ground level under real urban installations in Cornwall supplied the illuminants for four lamp types, with sunlight and full moonlight as natural references. For the two aquatic predators the light was carried through three meters of seawater by a radiative transfer model. A standard receptor-noise model of chromatic discrimination then computed, for each of thirty-six combinations, the color distance between snail and background in units of just noticeable difference.

The result in one sentence. Under low-pressure sodium all three color morphs fell below one just noticeable difference for all three predators, which is the threshold below which prey cannot be told from its background at all; under high-pressure sodium, metal halide and light-emitting diode

lighting the threshold was exceeded. Yellow morphs were affected most, which the authors attribute to the greater difference between their reflectance and that of the seaweed.

The mechanism, which this comment did not previously have

Everything else in this subsection concerns light that attracts, suppresses, disorients or shifts a clock. This concerns light that supplies information. Color vision requires more than one wavelength. A near-monochromatic lamp cannot support it and a broad-spectrum lamp can, so replacing the first with the second returns to the night a sensory channel that belonged to the day. The injury, if it is one, is not that there is more light. It is that the light carries information that was not available at that hour, and the organism on the losing side of the exchange is the one whose defense was its appearance. The authors put it as the encroachment of light that enables color-guided behaviors previously possible only during the daytime.

The qualification, stated before any use is made of the study

The model computes chromatic contrast and nothing else. The authors state what follows from that, and the Foundation quotes them because the sentence is the whole of the limitation:

> "In the absence of colour however, nocturnal predators will use luminance contrast perception."

Under the narrow-band lamp the prey became indiscriminable by color. It did not become invisible, and this study did not model whether it became harder to see. The authors go on to recommend, as their own next step, a review of the color vision systems of the nocturnal predators in a given ecosystem in order to identify the wavelengths that minimize luminance contrast between prey and background — which is to say that they treat the question their model leaves open as the operative one.

The position stated earlier therefore stands, and the Foundation amends only the first of its five propositions. A reduction in short-wavelength content removed a modeled effect, in a model of one mechanism, with the authors recording that a second mechanism remains and was not modeled. For the separate question whether any study has removed an effect measured in a living animal, see the movement immediately following.

The one study in which a warmer lamp was indistinguishable from darkness, and the three reasons it cannot carry what it appears to

Alaasam V.J., Duncan R., Casagrande S., Davies S., Sidher A., Seymoure B., Shen Y., Zhang Y. and Ouyang J.Q., Light at night disrupts nocturnal rest and elevates glucocorticoids at cool color temperatures, Journal of Experimental Zoology Part A, volume 329 (2018), pages 465 to 472. Described at Appendix C.148. Twenty-four captive zebra finches, eight to a group, exposed for about two weeks at night to a commercial diode strip sold as 5,000 kelvin, to one sold as 3,000 kelvin, or to no light at all. Birds under the cooler lamp became more active at night, peaking after about nine days, and showed a within-individual rise in corticosterone. Birds under the warmer lamp differed from the unlit controls on neither measure.

That is the first result in this appendix in which reducing short-wavelength content removed an effect in a living animal, and the Foundation states it as such and amends its settled position accordingly. It then states three features of the study which bear on how much the result can carry, and the second of them changes what the result is about.

The first is sample size. Eight animals a group, with no power calculation reported. A failure to distinguish the warmer lamp from darkness in groups of eight is weak evidence that no difference exists, and the Foundation does not convert it into one.

The second is the unit in which the two lamps were equalized, and it is the reason this study belongs as much to Part I.G as to this subsection. The two treatments were standardized to 0.3 lux, measured at perch height with a handheld consumer light meter. Lux is weighted to human photopic vision.

Two lamps set to the same lux therefore do not deliver the same radiant energy, and the cooler lamp at 0.3 lux necessarily delivered more energy at short wavelengths than the warmer lamp at 0.3 lux. The exposure contrast in this experiment was in that sense produced by the choice of standardizing quantity. The authors read the result as an effect of color temperature and recommend 3,000 kelvin over 5,000 kelvin. The more exact reading is that at equal human-perceived brightness the source with more short-wavelength content produced the effect, which is what the authors themselves propose as the mechanism when they attribute it to non-visual photoreceptors more sensitive to short wavelengths. The Foundation is not criticizing the inference. It is observing that the study does not show a 3,000 kelvin lamp to be safe at an exposure matched in any radiometric quantity, and that nothing in it rehabilitates correlated color temperature as a descriptor.

The third is what was measured and for how long. Two endpoints, nocturnal activity and a glucocorticoid, over about two weeks, in birds bred in captivity which the authors state had presumably never experienced light at night of any kind. Body condition and food intake did not change in any group, so the difference that was found is a difference in behavior and in a hormone and not in any fitness measure. The authors add two cautions of their own against their own recommendation: that a longer exposure might produce pathology, and that the activity peak had begun to decline, which they say may indicate acclimation. They add two more about the warmer lamp itself, that light at 3,000 kelvin may still attract insects and that long-wavelength light at higher intensities may have other consequences.

Taken together, the proposition the Foundation can state is this. In one experiment, on two non-fitness endpoints, in eight captive birds a group, at an illuminance of three tenths of a lux, a warmer commercial lamp was indistinguishable from darkness. That is a real qualification to the first of the five propositions above and the Foundation has amended it. It is not a demonstration that warmer lamps are safe, it is not a demonstration about color temperature as distinct from spectral content, and it sits beside the moth experiment at Appendix C.128, in which every spectrum tested at a fixed intensity produced a large effect, and the rodent study at Appendix C.146, in which a lamp emitting only between 550 and 650 nanometers suppressed foraging out to forty meters.

And one fact about this paper that belongs to Part II rather than to Part V

The copy the Foundation read is an author manuscript bearing the heading HHS Public Access, deposited in PubMed Central under the public access policy of the Department of Health and Human Services because the work was funded by the National Institute of General Medical Sciences of the National Institutes of Health under grant P20 GM103650. One co-author was supported by a National Park Service Natural Sounds and Night Skies Division postdoctoral fellowship. The Foundation sets that out plainly and without complaint. An operating division of this Department funded an experiment on whether the color temperature of a commercial light-emitting diode alters nocturnal rest and glucocorticoid output in a vertebrate; the resulting manuscript is held in the Department's own repository; and the authors concluded with a lighting recommendation. The Department is therefore not approaching this subject without a record of its own. Part II.H records federal engagement with this exposure largely as absence, and this is engagement.

A second qualification, which the Foundation regards as the more useful of the two

The threshold of detectability was also exceeded under sunlight and under a full moon. These snails are discriminable in nature. Low-pressure sodium is therefore the outlier in the set and not the natural baseline, and the proposition this study establishes is not that broad-spectrum lighting creates a condition unknown to the organism. It is that broad-spectrum lighting reproduces, on every night and across the whole of a lit shore, a condition that nature produces on a few nights a month and in no fixed place.

That is a claim about the duration and the extent of an exposure rather than about its kind, and it is a better claim for this comment than the headline suggests, because duration and extent are among the characteristics Part IX asks the Department to characterize. It is also the same shape as the finding at Appendix C.128, where the measured natural night sky was a median of 0.0168 lux and

more than half of the measured change occurred below full-moon illuminance. In both cases the relevant comparison is not between light and darkness. It is between the lit night and the range the organism evolved in, which includes a bright phase it gets for a few nights and then loses again.

What the Foundation does not take, and four features of the modeling that bear on its weight

It takes no assertion that predation increased, that any snail was eaten, or that any population changed in structure. Nothing was observed. The authors are explicit that conspicuousness does not necessarily scale linearly with color distance and that behavioral work is needed to establish the level of just noticeable difference at which prey actually become conspicuous, which they place beyond the scope of the paper. The passages about selective predation, altered population structure and the genetic composition of polymorphic populations are the authors' inference from the model and the Foundation does not adopt them.

Four features of the modeling belong with any use of it, and Appendix C.141 sets them out at length. No spectral sensitivity measured in a herring gull was available, and the authors assembled that visual model from published sensitivities within its family, describing it as the best possible approximation. The shore crab's photoreceptor proportions were unavailable and were set to the value that maximizes its ability to discriminate color. The authors state that statistical comparison between the three predators cannot be made. And the two darker morphs may not be two: the ordination showed no clear separation between olive and brown, and the authors write that these may in fact be a single dark morph.

One convergence of vocabulary is recorded and no authority is claimed from it. The authors close by asking that habitats be protected from "unnecessary exposure to artificial light." That is the phrase paragraph 360ii(a)(2) uses, arrived at independently, in a journal of applied ecology, by authors with no interest in this proceeding.

A diurnal animal, and the one study in this subsection whose emitter was not a light-emitting diode

Every animal in this subsection so far is active at night or at twilight, and every lamp in it is one that is sold for outdoor lighting now. One study is different on both counts. The Foundation states the second difference before the finding, because it governs what the study may be used for.

Parlin A.F., Stratton S.M. and Guerra P.A., Oriented migratory flight at night: consequences of nighttime light pollution for monarch butterflies, iScience, volume 25, issue 5 (2022), article 104310, open access. Described at Appendix C.140. The authors declare no competing interests. The animals were wild monarch butterflies caught during the fall migrations of 2019 and 2020 at a field station of the University of Cincinnati in southwest Ohio.

The emitter was a full-spectrum halogen bulb of 250 watts and 4,000 lumens, with ultraviolet A and B content, in a work light on a tripod. That is not a light-emitting diode, and the Foundation does not offer this study as evidence about light-emitting diode products. What the investigators did was tie their source to the deployed stock by intensity rather than by composition: using a manufacturer's own floodlight tool they computed the illuminance their source produced at four distances against three named light-emitting diode floodlights at 3,000 kelvin, and they state that their source is orders of magnitude less bright than much of the lighting found outdoors at night. So the exposure is realistic in quantity and is not a diode in spectrum. This is evidence about light at night. It is not evidence about one lamp technology against another and nothing below should be read as though it were.

What was done. Monarchs navigate by a time-compensated sun compass: they hold the sun at a bearing and correct for its movement across the sky using timing information from a circadian clock in their antennae. Wild fall monarchs were tethered in a flight simulator in a dark room and the lamp was placed where the sun would have been. In daytime trials the lamp substituted for the sun completely. Given a morning lamp position the animals oriented southwest at 231 degrees (Rayleigh

r 0.725, p 0.0012, n 13); given an afternoon position, at 217 degrees (r 0.747, p below 0.001, n 13). The two did not differ from each other, and neither differed from previously published observations of free-flying fall monarchs outdoors under clear skies. Animals held on a light-dark cycle delayed by six hours shifted their heading by 97 degrees, which is what a clock-driven compass predicts and what a compass without a clock would not do.

Then the night trials, which are the point. Seventy-eight monarchs were placed in the simulator in darkness at three times in their night cycle. In the dark they were quiescent, as monarchs are at night in the laboratory and in the wild. When the lamp was switched on, 96 percent of them — 75 of 78 — flew immediately. Forty-seven of those sustained flight long enough to meet the analysis criterion and 42 of the 47 flew directionally.

The direction is what told the investigators what the light had done. Light early in the night, at the fifteenth hour of the cycle, produced a group heading of 15 degrees with the lamp held to the right: afternoon behavior, which is a phase delay. Light in the middle and at the end of the night, at the eighteenth and twenty-first hours, produced headings of 233 and 232 degrees with the lamp held to the left: morning behavior, which is a phase advance. A fourth condition at the eighteenth hour with the lamp moved to an afternoon position gave 296 degrees, the animals still holding it to their left. All four group vectors were significant at or below 0.01.

Four things the Foundation takes, the weakest stated first

The weakest is the clock. No molecular measurement was made. The investigators read the phase shift off the flight direction and matched the pattern across the night to a published mathematical model of the antennal clock. That is a legitimate inference and it is not a measurement, and the Foundation does not describe this study as having measured a circadian perturbation. What it measured is flight direction, and the direction behaved as a shifted clock would require.

The second is the immediacy, and it is what the Foundation most wants the Department to notice. There was no acclimation period, no accumulating dose and no gradient. Animals quiescent in darkness flew within the time it took to switch on a lamp, and nineteen of every twenty did. Everything else in this subsection is a change in a rate, a count, a tortuosity or a proportion, measured across nights or across a season. This is a switch. The Foundation does not generalize from one insect to any other organism and does not need to. It records that the dose-response relationships Part V.A.2 says this field has not built will not all be the same shape, and that at least one endpoint in at least one species responds to a lamp of ordinary outdoor intensity as a step rather than as a gradient.

The third is the mechanism, and it is a short-wavelength mechanism that the study did not test. In the monarch antennal clock the absence of light drives transcription of cryptochrome 2, timeless and period; in the presence of light, cryptochrome 1 — which these authors describe as a blue-light circadian photoreceptor — degrades the timeless protein and allows the other two to enter the nucleus and repress transcription. The light-sensitive step in this animal’s clock is mediated by a receptor the authors identify as blue-sensitive. The Foundation states clearly that the study did not vary wavelength and tested nothing about it: the lamp was broad spectrum and there was one of it. The mechanism is recorded because Part V.B.1 and the settled spectral position of this subsection rest on the proposition that short wavelengths are not interchangeable with long ones for biological purposes, and this is another photoreceptor family in this comment for which that is so.

The Foundation also states what it declines to infer from that, because the inference is available and it does not make it. It would be easy to argue that if the clock step is blue-driven, then a light-emitting diode of equal illuminance, having more short-wavelength content than a halogen, would produce at least as large a response. That is an inference and not a finding, and it is not clean in either direction: the halogen used here carried ultraviolet A and B, which most white diodes do not. The honest statement is that this experiment does not compare technologies and that the comparison has not been made in this species.

The fourth is where it happened. This is a United States study of a United States population, by investigators at a United States university, on animals caught in Ohio during two actual fall migrations, and the authors place the exposure on the migratory corridors of the eastern seaboard, the Great Lakes region, the Midwestern central flyway, Texas and Mexico. Nearly all of the ecological evidence in this subsection was produced in Europe. The Foundation offers this one for the narrow proposition that the phenomenon is not a European one, and for no more than that.

One convergence of vocabulary belongs with it. The study is about light trespass, which the authors define as light cast where it is unwanted or not needed at night, emanating from buildings and streetlamps. Part I of this comment takes that category from CIE 150:2017, where it sits beside glare, uplight, skyglow, over-illumination and clutter, and Part II.H.3 identifies those categories as the subject of paragraph 360ii(a)(2) named in another vocabulary. Here is a peer-reviewed ecological study that took one of those engineering categories as its independent variable and found a response to it. The Foundation offers that as a convergence and not as an authority.

What it does not establish, including the part that limits it most

Monarchs are not known to fly at night during the fall migration, and the authors say so plainly: there are no documented reports of it, and fall night temperatures are often too low to sustain flight. The behavior demonstrated is therefore not a behavior anyone has observed in the wild. The authors' claim is about the clock rather than about the flight, with the flight serving as the readout, and they add that an animal roosting beside a streetlight may have its clock shifted without flying anywhere. They offer the urban heat island effect and warming nights as reasons the behavioral consequence could become real, and they cite records of nocturnal flight in other migratory nymphalid butterflies. The Foundation reports the authors' position and does not adopt the forecast.

Three further limits. The flight was tethered and virtual rather than free. Across all trials in the study 39 percent of animals flew at all, 112 of 287, so the analyzed sample is a minority selected by willingness to fly; the authors state the figure and compare it to other work using the same apparatus. And the illuminance or irradiance at the animal is not stated in the body of the paper: the measurements were made, with a light meter and with a spectrometer, and they are in supplementary material the Foundation has not obtained. The entry at Appendix C.140 records that as an outstanding acquisition and the Foundation does not state an exposure level for this study until it has it.

It establishes nothing about human health and is not offered for any. The Foundation offers it on the emissions limb of paragraph 360ii(a)(2) as Part II.D.4 construes it. One further element of the study, an analysis of where monarch roosts lie in relation to lighting, is taken up at Part V.J.4 rather than here, because of the instrument it used.

A final paper, whose findings the Foundation declines and whose recommendations it does not

Grillo F., Marrone A., Gauci A. and Deidun A., Maltese Coastline Never Sleeps: The Effects of Artificial Light at Night (ALAN) on the Local Infralittoral Assemblages—A Case Study, Journal of Marine Science and Engineering, volume 12, issue 9 (2024), article 1602, open access. Described at Appendix C.134, where the entry is built in the inverted form the Foundation uses when it takes something from a paper other than its result.

The study put a baited underwater video camera on the seabed at two locations in a harbor on the north coast of Malta, one beside a ferry quay and one on a rocky reef, and recorded one-hour samples under three lighting conditions produced by dive torches: high-intensity white, low-intensity white, and red. Eighteen samples in total, in August 2023, three per combination. Nearly twenty-four thousand animal counts resulted, of which eighty percent were a single species of bogue.

Why the Foundation does not rely on the findings

The reasons are set out at Appendix C.134 and summarized here. There was no dark control: the red treatment served as what the authors themselves call a pseudo-control, so every one of the eighteen samples had a lamp burning, and the study compares three lights to one another rather than any light to darkness. The camera was baited, so a preference for the bright treatment cannot be separated from the ability to find bait under it, and the authors report that the fish exploited the bait bag specifically on illuminated nights. The two locations differ in seabed, in wind exposure, in boat traffic and in being or not being a harbor, so the site contrast is not a light contrast. There were three replicates per cell. The claim that light mattered more than habitat is supported by comparing probability values rather than variance components, which is not a comparison of magnitude. The diversity index showed no effect of light at all. And the authors disclose that the species making up eighty percent of all counts was undercounted in the high-light treatment, for a reason connected to the treatment.

The Foundation states this plainly because it has been asked to assist the Department in weighing a literature, and a literature is weighed by reading it rather than by counting it. A paper that reaches a congenial conclusion on a design that cannot support it is of no use to the Department, and citing it would invite the Department to discount what else the Foundation has put forward.

The first thing the Foundation does take: a specification written by marine scientists which is the same specification this comment asks for

The paper's recommendations are not a finding and do not depend on its design. They are the authors' statement, as marine ecologists, of what coastal lighting should be required to do. The Foundation sets them out because they are organized by the same four characteristics of an emission that Part VI and Part IX are organized by, and because they were written by people who had never heard of this comment.

- Direction. Full cut-off fixtures aimed downward, achieving what the authors specify as a zero percent Upward Light Output Ratio. That is a numerical limit on an emission characteristic, of exactly the form section 360kk requires a performance standard to take.
- Quantity. That light intensity be limited to what is strictly necessary for safety and operational purposes.
- Containment. That lighting be focused on specific areas, preventing overflow into ecologically fragile regions, into the sky, and — the authors' own words in a paper about fish — into nearby residences.
- Duration. That schedules be used to dim or switch lighting off during periods of inactivity.
- Spectrum. That lighting be selected with a correlated color temperature below 3,000 kelvin.
- And a sixth the comment does not presently address: that reflected light be reduced by using non-reflective, dark-colored materials in coastal construction.

Four of those six are the four characteristics of an emission that this comment asks the Department to regulate, arrived at independently, in a marine engineering journal, by authors with no interest in the American statute. The Foundation offers that convergence for what it is worth, which is not evidence of a health effect but is evidence that the characteristics it has selected are the characteristics practitioners in the field actually reach for. The fifth of them is the reason this paper closes the subsection.

The second thing: the field recommends below 3,000 kelvin, and the studies in this very subsection show that below 3,000 kelvin is not enough

What this subsection establishes, from five independent studies, is that it is a partial measure offered as a complete one.

- Appendix C.125. Lamps at 2,700 to 3,000 kelvin, at under one lux, did not prevent the loss of diapause in the mosquito. The authors wrote that changes in brightness or light color may not be sufficient to mitigate ecological impacts.
- Appendix C.133. The lamp the shearwater fledglings avoided was 3,000 kelvin. Its measured spectral peak was at 455 nanometers.
- Appendix C.128. Reducing short-wavelength content reduced moth activity suppression from 93 and 85 percent to 82, 73 and 57 percent. It did not remove it, and at low intensity some species increased their activity under amber rather than decreasing it.
- Appendix C.132. The same remedy, tested against a brief intense pulse rather than continuous exposure, did help — which is why the Foundation's position is about exposure regimes and not about amber.
- Appendix C.135. High-pressure sodium at 2,000 kelvin, the lamp the field nominates as insect-friendly and warmer than anything the recommendation contemplates, produced a barrier across a landscape and reduced flight efficiency in two families of moths.

The position this bears on is the settled one stated at the end of the moth studies above, and the Foundation does not restate it here. What this paper adds is an illustration of it. The field recommends a correlated color temperature below 3,000 kelvin. The field's own data, in five studies collected here, show that lamps at or below 3,000 kelvin produce the effects the recommendation is meant to prevent. The reason is set out at Part V.B.3: correlated color temperature is a single number describing a resemblance to a blackbody, and two lamps sharing it can differ substantially in the quantity that matters.

The consequence for a performance standard is stated with the settled position above and is not repeated. The Foundation notes here only that the ecological literature, by recommending the convenient number in place of the quantity that governs, illustrates the problem rather than solving it.

The third thing: how the two study sites were characterized

The paper reports the ambient light at each location as a photometer reading in lumens: zero at the reef, eighty at the harbor, rising to one hundred and forty-five when charter boats passed.

The lumen is a unit of luminous flux. It measures the light leaving a source, integrated over all directions. It is not a measure of light arriving anywhere, and a photometer placed at a point does not read it. What such an instrument reads is an illuminance, in lumens per square meter, which is the lux. The same methods section uses the lumen correctly a few paragraphs later, when it gives the maximum output of the dive torches as 2,600 lumens, because that is a source quantity. So the two sites, whose difference in light is the entire premise of the comparison, are characterized in a unit that cannot express the difference.

The Foundation records this without any suggestion that it was deliberate or that these authors are unusual. It records it because Part V.B.3 and Part V.J.4 argue that the exposure information the Department needs does not exist in usable form in this literature, and because the argument is better made with an example than with an adjective. Here is a peer-reviewed study in the field, published in 2024, whose two experimental sites are specified in the wrong physical quantity, printed three times, alongside a correct use of the same unit. And here, at Appendix C.133, is a study from the same year that characterized its light in two receptor spaces and reported the spectral peaks of its lamp to a tenth of a nanometer. The Department is being asked to build a standard on a body of work with that range of practice in it. That is the problem, and the remedy is the one Part IX asks for: that the Department measure, in stated units, under a stated procedure, and publish what it measures.

A closing note on what this subsection omits, and three things taken from a review of it

Everything above is terrestrial except in four particulars, which the Foundation names so that the statement is accurate: a seabird at its land colony at Appendix C.133, the inverted Maltese entry at Appendix C.134 whose findings the Foundation declines, the model of an intertidal shore at Appendix C.141, and the field experiment in a Polynesian lagoon at Appendix C.144, which is set out at the end of this note. Beyond those four, the literature of the sea is represented in this comment by two reviews and by nothing else. That is a limit of the Foundation's reading and not a judgment about the sea, and because question 14 asks about ecological effects without qualification the Foundation states the omission rather than leaving it to be noticed.

Fobert E.K., Miller C.R., Swearer S.E. and Mayer-Pinto M., The impacts of artificial light at night on the ecology of temperate and tropical reefs, Philosophical Transactions of the Royal Society B, volume 378, issue 1892 (2023), article 20220362, open access, in a theme issue on light pollution in complex ecological systems. Described at Appendix D.7. It is a review article and not a study: it reports no original measurement, states that it has no additional data, and is organized around what the authors expect rather than what they found. The Foundation does not treat it as evidence and declines its system-level framework, which the authors themselves frame as potential scenarios. It takes three things from it, each of which the authors took from somewhere else and each of which is recorded as an acquisition.

First, the extent of the exposure in water, which the comment had nothing on

The review collects four figures. About 22 percent of the world's coastal regions experience some degree of light pollution. Biologically important artificial light reaches more than 75 percent of the seafloor near coastal developments. Approximately 1.6 million square kilometers of coastal sea are exposed at a depth of ten meters. And biologically important levels are estimated to reach 70 meters down from skyglow and 100 meters from waterside street lighting.

The Foundation reports those as the review reports them, which is at second hand from four primary papers it has not read. They are recorded here because the comment has no other statement of how far this exposure extends below a water surface, and because the last of them is a statement about a product: waterside street lighting, delivering a biologically significant emission one hundred meters down.

Second, a spectral mechanism the comment did not have

The review states the physical point plainly: short wavelengths penetrate deeper through the water column, and many marine organisms are sensitive to short wavelengths because of the environment in which they evolved. The consequence is that the transition to light-emitting diodes increases the reach of the exposure and not merely its spectral content.

That is a different argument from any the comment has made about spectrum, and the Foundation identifies the difference. Elsewhere the comment argues that a shift toward short wavelengths changes what an emission does to a receptor, and that the instruments and descriptors in use cannot express the shift. Here the shift changes how far the emission travels. A diode and a sodium lamp of equal output do not illuminate the same volume of water. The settled position at the end of the moth studies is unaffected, because this is not a claim that a spectral change would be a sufficient remedy; it is a claim that the spectral change already made has enlarged the exposed volume.

Third, the lowest effect thresholds anywhere in this comment

Three figures, again at second hand, and the Foundation sets them against the only measurement of natural darkness it holds.

- Embryos of the common clownfish failed to hatch under artificial light at approximately 15 lux.
- Daily rhythms of the Pacific oyster were disrupted at intensities as low as 0.1 lux.

- Hatching of the sergeant major, a damselfish, was inhibited at light intensities as low as 0.03 lux.

The moth study at Appendix C.128 measured the ambient night at its field sites one hundred and eleven times and found a median of 0.0168 lux. The lowest figure above is therefore about twice that ambient figure, which as Part V.I now records is itself one to two orders of magnitude brighter than a moonless natural sky. The Foundation draws no biological conclusion from that comparison, which is between a laboratory threshold in one taxon and a field measurement in another country. It draws a measurement conclusion, and it is the same one Part V.J.4 draws: an effect threshold of three hundredths of a lux lies below the resolution of nearly every instrument the literature in this comment has used, and far below anything a satellite radiometer can see. If thresholds of that order are real, the Department cannot find them in the published record. It would have to measure.

What the Foundation does not take

Three things. The system-level framework, including the four mechanisms and the three scenarios in which the authors suggest novel ecosystems could arise, which is a research agenda and is offered as one. The example of diversity collapse through spawning desynchronization, because the study behind it attributed the desynchronization to temperature and the authors here offer light only as something that could interfere comparably. And the route from reef collapse to human beings through fisheries, which the authors mention as an ecosystem service and which the Foundation declines for the reason given twice already in this subsection: the construction of paragraph 360ii(a)(2) adopted at Part II.D.4 does not run an effect on another species through to a person, and the limb the comment relies on is engaged by the emission itself.

What the review does supply, beyond the three items above, is the ninth attestation collected at Part V.J.4 that the instrument cannot see the exposure, and it is the most severe of the nine because in the marine case the act of observing introduces the thing observed. The authors also close with a sentence the Foundation adopts without alteration: that light pollution is largely an unregulated environmental stressor globally. They are describing the world. This comment is about one statute that was enacted to address it and has not been used.

A second review of the same subject, published a year earlier, and what it adds

There is a second review of artificial light in the sea, by ten authors, and the Foundation adds it here rather than in a subsection of its own because it covers the same ground. Marangoni, Davies, Smyth, Rodríguez, Hamann, Duarte, Pendoley, Berge, Maggi and Levy, Impacts of artificial light at night in marine ecosystems — a review, Global Change Biology, volume 28, issue 18 (2022), pages 5346 to 5367. Described at Appendix D.7. The authors declare no competing interests. It is a review and the Foundation treats it as one: it reports no original measurement and its data statement records that no new data were created or analyzed.

It is not independent confirmation of the figures above, and the Foundation says so before taking anything from it. Three of the four exposure-extent figures in the preceding paragraphs trace to primary papers of which Davies is an author, and Smyth of one of them; Davies and Smyth are two of the ten authors of this review. The figures are therefore being repeated by some of the people who produced them. That is ordinary in a field this small and it is not a criticism of anyone. It is the reason the Foundation does not describe the agreement between the two reviews as corroboration.

What it does supply, first, is the definition of a term the paragraphs above quote without defining. “Biologically important” artificial light, in those figures, is not a judgment by the people who drew the maps. It is the minimum irradiance of white light that elicits diel vertical migration in female Calanus copepods, measured in an earlier experiment and then used as the criterion for the global depth maps. The Foundation records that because it is an instance of the thing Part IX asks for and has had almost no example of: a threshold defined by a measured response in a named organism, and then applied as a mapping criterion rather than asserted. Whether a copepod is the right organism on which to set a criterion for a whole ocean is a separate question and the Foundation does not answer it. The structure is the right structure.

Second, the extent of the exposure with depth, and one figure the comment did not have. Approximately 1.9 million square kilometers of the world's coastal seas are exposed at one meter depth, 1.6 million at ten meters and 840,000 at twenty meters. The most exposed regions are given as the Mediterranean, the Red Sea and Persian Gulf, and the seas of southeast Asia. And 20 percent of the world's contiguous Marine Protected Areas are exposed across 100 percent of their range. All of these are at second hand.

Third, the ninth attestation gets a measurement, and the red-light question gets an answer

The review devotes a box of its own to how research activity creates the bias it is trying to measure. It records that the optical instruments used to count plankton and fish at depth — it names five of them — all require an external light source; that red light has been recommended for marine surveys on the assumption that most species react to it less than to shorter wavelengths; and that two studies supported the assumption, finding that mesopelagic fish avoid white, blue and green light but not red. It then records that the assumption was contradicted.

Geoffroy and others, in 2021, mounted echosounders on a hull above probes carrying lights of different colors and found that pelagic organisms in Arctic and temperate regions strongly avoid artificial light, including visible red light at 575 to 700 nanometers. The density of organisms fell by as much as 99 percent. The distance of avoidance ran from 23 to 94 meters from the source, varying with color, with irradiance and possibly with the species present. The light levels were 11 to 18 microwatts per square centimeter.

Three things follow and the Foundation separates them. The first is that the ninth attestation collected at Part V.J.4 is no longer only the proposition that observing disturbs what is observed. The disturbance has been measured, it is very large, and it reaches tens of meters. The count at Part V.J.4 is unchanged, because this is the same attestation better quantified and not a new one.

The second is that this answers, for one environment, a question put to the Foundation during the preparation of this comment: whether red light is a remedy. In the sea it is not. The Foundation has declined to ask for red light anywhere in Part IX, and the reasons recorded at Appendix D.7 for the terrestrial case are now joined by a measured avoidance response in the pelagic case. The narrow proposition about insect attraction is unaffected and is stated where it belongs.

The third is that a measurement of avoidance distance in meters, at a stated irradiance in radiometric units, for three stated colors, is the shape of the relationship Part IX.C asks the Secretary to establish. It exists, in an environment where almost nothing else does, and it was produced incidentally by investigators trying to stop their own instruments from corrupting their own surveys.

Fourth, what the review says about regulation, and two cautions against this comment's own direction

The Foundation reports the regulatory statement because it is made by ten specialists in a peer-reviewed journal and because this comment has no comparable survey. The review records that a few countries — it names Spain, in Catalonia; Chile; France; and Italy, in Piedmont — are trying to establish laws regulating light pollution, and that most of the documents that address the subject are guidelines, codes or standards issued by regulators, advisory committees, non-governmental organizations or professional bodies "with no legal basis for enforcement of recommendations." It adds that many of the professional guidance documents are addressed to lighting engineers and designers, give little detail on management for the protection of sensitive receptors, and "must be purchased at a substantial cost." And it records that guidance for the marine environment "does not currently exist" in the English-language literature at all.

The United States is not among the four, with a qualification the Foundation has had to add to this sentence and sets out at the end of this subsection: one American State does impose an enforceable lighting condition for a biological purpose, in an instrument too narrow for a survey of this kind to

have caught. The Foundation does not offer the general absence as an indictment of any agency and does not need to. It offers it as the state of the world against which section 360kk is to be read. A performance standard is enforceable and a guideline is not; a standard published by the Secretary appears in the Code of Federal Regulations and costs nothing to read, while the specification the review identifies as the relevant professional document must be bought. Those are the two differences between what section 360kk authorizes and what the field presently has.

Two cautions run the other way and the Foundation states them in the same place. The first is that the guidelines this review endorses recommend a case-by-case approach to assessment, management and mitigation, on the express ground that specific assessment trigger values are difficult to set across the range of variables involved. The Foundation asks for a numerical performance standard, which is the opposite approach, and it does not pretend the two can be reconciled by argument. It states the distinction instead. A case-by-case assessment is what an environmental regulator does about an installation in a place. A performance standard is what section 360kk does about a product in commerce. The first is not available to the Department and the second is the authority it holds.

The second caution is narrower and sharper. On sea turtles the review states that the thresholds of concern for both wavelength and intensity are likely to vary within and among species, and it identifies all seven species of marine turtle as affected. A threshold that varies within a species cannot be met by one number chosen for that species. The Foundation's answer is the one it gives throughout and it is not a rebuttal: a performance standard does not have to be the threshold of the most sensitive organism, and nothing in section 360kk requires it to be. It has to be a stated quantity that a product either meets or does not. Determining what quantity is the work that paragraph 360ii(a)(4) assigns to the Secretary and that the Foundation asks to have done.

Fifth, a ranked priority, and what the review concedes about its own evidence base

The review sets out six best-practice rules for outdoor lighting design — begin with natural darkness and add light only for a purpose; use adaptive controls over timing, intensity and color; light only the object or area intended; use the lowest intensity appropriate to the task; use non-reflective, dark-colored surfaces; and use lights with reduced or filtered blue, violet and ultraviolet wavelengths — and then ranks them. "Of these, the most important is avoiding short wavelength blue light due to its ubiquitous visibility across a wide range of taxa, as well as its higher capacity to penetrate the water column." The Foundation reports both halves of that sentence. The ranking supports the priority Part IX gives to spectral content. The second of the two stated reasons is specific to water and does not transfer to land, and the comment does not transfer it.

The review concedes twice that its evidence base is not at environmentally realistic intensities, and the Foundation records both concessions because they bear on every figure in it. In introducing the biological sections the authors state that many of the short-term experiments they collect used "high ALAN levels (not considered environmental realistic)" and offer them as a step toward understanding mechanism rather than as estimates of effect in the field. On sandy beaches they state that the intensities used in some studies were those measured under the light source in the promenade area, which "could be higher than those occurring in the intertidal area," and they rebut the concern with unpublished data of one of their own authors. Neither concession discredits the review. Both describe the condition of a young literature, and it is the same condition Part V.A.2 describes for the terrestrial work.

And the findings in it do not all run one way. The Foundation sets out the exceptions because a reader given only the review's summary would not know they were there. Within this one document: a beach study found the locomotor activity of an amphipod no different between a lit and an unlit beach; another found no effect on the growth rate of an isopod and an increase in its absorption efficiency; the microbial community of a coral remained stable under artificial light; a study of juvenile bonefish and a study of a seagrass fish assemblage found almost no effect; the Atlantic dog whelk forages more under artificial light rather than less, which is the opposite of what the Chilean abalone does; artificial light increased the biomass and the photosynthetic efficiency of intertidal

microphytobenthos; and little penguins preferred lit paths to dark ones in reaching their nests. The Foundation does not treat that heterogeneity as evidence of safety, and the review does not either. It treats it as the reason a single threshold applied across taxa is not presently derivable from this literature, which is the proposition Part V.A.3 states and the reason the request in this comment is for research rather than for a number.

One further thing the review contains is taken up at Part V.J.4 rather than here, because it concerns measurement and not the sea: a box in which the authors state that there is no agreed unit for the quantity this whole literature reports.

And one primary study in the sea, which is the only long-term field experiment anywhere in this comment

The two documents above are reviews. One primary study belongs with them, and the Foundation sets it out at length because its design is rare and its endpoint is the one this comment has least of. Schligler J., Cortese D., Beldade R., Swearer S.E. and Mills S.C., Long-term exposure to artificial light at night in the wild decreases survival and growth of a coral reef fish, Proceedings of the Royal Society B, volume 288 (2021), article 20210454, doi 10.1098/rspb.2021.0454. Described at Appendix C.144. The authors declare no competing interests. Ethical approval was granted by the animal ethics committee of the French national research agency under a stated permit number.

What was done. In the lagoon of Moorea, French Polynesia, three subtidal fringing reef sites exposed to long-standing shore lighting from streetlights and hotels were each paired with a nearby site of comparable depth and reef structure lit only by the moon. Forty-two territories were created, each consisting of one healthy magnificent sea anemone collected from the northern lagoon and randomly distributed. Forty-two laboratory-reared juvenile orange-fin anemonefish, raised from eggs collected from about fifty wild breeding pairs, were weighed, photographed and measured, and then placed singly into the anemones: twenty-four in the dark territories and eighteen in the lit ones, with no difference in size between the groups. The species lives in obligate mutualism with its anemone and cannot leave it without exposing itself to predation, which is why these authors chose it. Survival and growth were then monitored over a mean of twenty and a half months.

The exposure was measured in both kinds of unit, which is rare enough in this comment to be worth stating on its own. Illuminance in lux and photosynthetically active radiation in watts per square meter were recorded at the depth of the anemones, sixty centimeters, with a named instrument, in triplicate, at one location in each of the six sites, after moonrise, on twelve nights spanning the four lunar phases across four months: two hundred and sixteen measurements. Lit territories averaged 4.3 lux and control territories 0.03 lux, a factor of one hundred and forty-three. The three lit sites differed significantly from one another, at 0.9, 2.3 and 8.9 lux. The control sites did not differ from one another at all.

Two things about that exposure matter to this comment more than the finding does

The first is that the authors say their levels are low. They write that the illuminances measured are representative of what shallow fringing reefs receive under street lighting and hotel lighting, that these are considerably lower than those produced by the light-emitting diode lighting used at ports, and that the impacts of artificial light in coastal marine ecosystems "could be greater than observed in the present study."

The second is the control figure. Three hundredths of a lux is a measured natural nighttime illuminance, taken underwater at sixty centimeters with a radiometric instrument, across four lunar phases. Appendix C.128 measured the night at its field sites in Cornwall, England one hundred and eleven times and found a median of 0.0168 lux. The Foundation had set those two figures beside each other as agreeing measurements of natural darkness, and has had to withdraw that characterization. The point Part V.A.2 makes, that a dose-response relationship for this exposure must extend below the illuminance of a natural night, stands; but these two numbers do not establish where a natural night is.

What the two figures are not. They are not measurements of the same quantity and neither is a measurement of a pristine natural night. The lagoon figure is an average across four lunar phases, so it contains moonlight by construction. The Cornwall figure is the ambient night at two sites on a university campus in a populated county, taken with an instrument whose stated sensitivity is 0.005 lux, so it sits about three times above the floor of its own detector. A clear moonless night sky, lit only by starlight, galactic light and airglow, is conventionally placed on the order of a thousandth of a lux, and the analysis at Appendix C.147 places the moonless natural level at between one ten-thousandth and one thousandth of a lux. Both figures above are therefore one to two orders of magnitude brighter than an unlit sky, and their agreement with one another corroborates nothing.

The Foundation states the correction because it made the error and because the corrected version is the stronger point. What these two studies measured is the darkest condition available to field investigators working where people live. If that condition is ten to a hundred times brighter than a natural moonless night, then the dark controls in this literature are not dark, every effect reported against them is an effect measured against an already-lit baseline, and the part of the dose-response relationship lying between a natural night and a field control has been examined by nobody. These figures do not show where a natural night is. They show how far from one the experiments have been conducted.

The findings, with the weakest stated first because the abstract does not

Survival. The fish in the lit territories had lower survival, by 36 percent. The probability attaching to that comparison is 0.055, and the authors accordingly write that survival "tends to be lower." The abstract reports the 36 percent without the probability. The Foundation reports both, and treats the survival result as suggestive rather than established, which is what its authors call it in their own Results.

Growth. Three measures and one of them significant. Height, 15 percent lower, at a probability of 0.036. Weight, 51 percent lower, at 0.074, which the authors again describe as a tendency. Length, 21 percent lower, at 0.251 and not significant. The abstract gives a single figure of 44 percent for growth. The Foundation has not been able to reconstruct that number from the three reported values, whose arithmetic mean is 29 percent, and records the discrepancy for verification rather than relying on either figure.

And the counts behind those percentages are very small. Of the forty-two fish, twenty-one were present at twelve to seventeen months (fifteen control and six lit) and fifteen at eighteen to twenty-three months (twelve control and three lit). The growth comparison in the final period rests on three exposed animals. The Foundation is not disparaging the study. It is a twenty-month field experiment in a lagoon, it could not have been done another way, and it is the only one of its kind in this comment. The Foundation states the counts because a reader given the abstract's percentages without them would be misled about what they rest on.

The authors' own competing explanation, which the Foundation adopts as it adopted the same move at Appendix C.138

They write that the difference in growth "may be due to phenotypic plasticity in morphology in response to ALAN and may be adaptive," that it may represent a reallocation of resources rather than a deficit, and that a lower growth rate in height "may therefore be the optimal strategy for anemonefish exposed to ALAN," facilitating escape from predation. Whether such plasticity is adaptive in the long term, they say, remains unknown. This comment does not assert that the growth difference is an injury, for the same reason it does not assert it of the eye-size difference in songbirds at Appendix C.138: the investigators themselves put adaptation forward as a competing reading, and a commenter who suppressed that would be doing something the Foundation has criticized others for.

Three further limits

The fish could move, and absence was scored as death. The authors address this: they report the distances between anemones within a treatment and between treatments, and they cite a study finding that this species is the most mobile of six anemonefishes tested, with 13 percent changing host anemone within four months. But at the first site the control and lit territories were 8.6 meters apart, which is within the range of movement the same paragraph describes, and one new recruit appeared on a lit territory during the study, so immigration occurred. Individual identity was confirmed photographically at every visit from the shape and length of the white stripes, which is the right control and does not remove the difficulty that a fish which left is indistinguishable from a fish which died.

The anemones themselves were lost in numbers. Seven control anemones and seven lit anemones were gone by the end; the authors describe that as an equal number, and in count it is, though as a proportion it is 29.1 percent against 38.8 percent. Seven fish were removed from the survival analysis because both fish and anemone were absent and the cause could not be attributed.

And the lit territories were systematically closer to shore than the control territories, at every site: seventeen to twenty-nine meters against forty-six to three hundred and twenty-two. The authors argue that other coastal stressors are unlikely to explain their results because the design spans three sites differing in exposure to those stressors, which answers variation between sites and does not directly answer the systematic difference in distance from the shore within them. The Foundation records the observation and does not press it, because the supplementary figure that maps the territories would be needed to say anything further and has not been obtained.

What the Foundation takes is accordingly narrow and, it submits, worth having. A field experiment ran for twenty months in the sea, at an illuminance the authors call representative and low, against a measured natural control of three hundredths of a lux, and the exposed animals grew less in one of three dimensions with the other two pointing the same way, and died more often at a probability just above the conventional threshold. Nothing in it concerns human health and the Foundation offers it on the emissions limb of paragraph 360ii(a)(2) alone, together with the two natural-darkness figures, which are the most useful thing in it.

Last in this subsection, the one enforceable American lighting rule written for a biological purpose that the Foundation has found, and how narrow it is

The survey above records four countries attempting to legislate on light pollution and does not name the United States. That is accurate as a statement about general light pollution law. It is not the whole picture, and the Foundation corrects it here rather than leaving a sentence in the comment that a reader with State regulatory experience would know to be incomplete. At least one American State already requires outdoor lighting to be low in intensity and shielded, for the express purpose of protecting an animal, as an enforceable condition and not as guidance.

The instrument is the hydraulic code of the State of Washington, administered by the Washington Department of Fish and Wildlife. Washington Administrative Code section 220-660-140 governs residential and public recreational docks, piers, ramps, floats, watercraft lifts and buoys in fresh water. Subsection (3)(d) provides that if artificial nighttime lighting is used in the design, the applicant is to use low-intensity lights that are located and shielded, and the stated purpose of the requirement is to prevent light from attracting fish, unless there are safety constraints. A second provision in the same section, subsection (7)(f), directs that to avoid attracting fish to lights at night, impact pile driving be limited to daylight hours whenever feasible.

The Foundation states the limits of that instrument before its use, and they are severe. It is a condition attaching to a permit for one narrow class of in-water construction in one State, not a rule about lamps and not a rule of general application; it reaches the designer of a dock and not the manufacturer of a luminaire. The protected subject is a fish and not a person. The operative term, low-intensity, is not defined in the provision, no illuminance, luminance, radiance or spectral quantity appears in it, and nothing in it states how an inspector is to decide whether a given light

complies. And the whole requirement yields to unspecified safety constraints, on the face of the subsection, with no standard governing when that exception is available.

What the Foundation takes from it is therefore not that the problem is solved anywhere. It is three narrower things. First, that an American regulator has already decided, in binding text, that artificial nighttime lighting is a thing to be limited in intensity and directed by shielding when a biological receptor is present, which is the premise Part IX proceeds from and which is here conceded rather than argued. Second, that the drafter stopped exactly where this comment says the Federal gap lies: the duty is stated and the number is missing, because no instrument of general application supplies one. A State permit writer who wanted to know what low-intensity means has nowhere in the Code of Federal Regulations to look. That is the work paragraph 360ii(a)(5) directs the Secretary to do and section 360kk gives the Secretary power to complete, and it would be done once federally rather than improvised in every State permit. Third, that a safety carve-out with no standard attached is the same device Part VI.C examines in the vehicle lamp setting, and it behaves the same way: it swallows the rule unless something tells the decision-maker how much light safety actually requires.

The Foundation came to that provision through a document it does not otherwise rely on and describes at Appendix D.1: an interim briefing memorandum of March 10, 2020 on artificial lighting and salmon, prepared for the Salmon Recovery Council of the Lake Washington, Cedar and Sammamish watershed forum, an interjurisdictional body administered through King County, Washington. The memorandum is a staff summary rather than research; its two most arresting figures are drawn from an unpublished presentation to its own technical committee; and it repeats a proposition about the atmospheric behavior of blue light that this comment has declined at Part II.D.4 on the authority of the people who measure skyglow. The entry sets all of that out. The Foundation notes it here because the regulation is verifiable primary law whatever the memorandum is worth, and because the memorandum is the reason the Foundation looked.

One further thing in that line of work belongs in this subsection rather than in the appendix, and it tells against the direction a reader might expect the Foundation to take it. The same watershed forum commissioned field research, and the final report delivered to it in April 2025 by a university wetland ecosystem team does not report a simple gradient of fish abundance with light. On the account the Foundation has of it, juvenile salmon densities were highest both at the brightly lit residential sites and at the dark reference sites and lowest at the brightly lit commercial sites, and water depth mattered more to their distribution than lighting did. The Foundation has not read that report, has only a description of it, builds nothing on it and states it anyway, because the 2020 memorandum is the kind of document a comment can quote confidently and the research that followed it is the kind that makes confident quotation unwise. Obtaining that report is recorded as a priority at the appendix entry.

J. Exposure Assessment Methods and Their Limitations [RFI Q7, Q8]

This subsection concerns how exposure is measured, and the Foundation begins with what is known about its scale, because the scale bears directly on the duty stated at Part II.D.

Guo, Liu, Kyba and others, publishing in Environment International in 2026, merged two satellite datasets into a single time series to estimate the human population exposed to outdoor artificial light at night, and projected forward under standard socioeconomic scenarios. They found that the population exposed to outdoor light emissions rose from 4.3 billion in 2000 to 6.3 billion in 2020, with 88 percent of that growth occurring in areas of medium to high light emission. For the high-emission areas, which are predominantly urban, 73 percent of the increase was attributable to population growth and migration. For the medium-emission areas, which are predominantly suburban, the increase in radiance itself accounted for the larger share, 63 percent. They project that by 2050 nearly 70 percent of further growth will occur in medium to high emission areas, and conclude that “Preparation for potential increased disease burden and actions to reduce light growth are therefore advisable.”

The Foundation offers that study for the purpose identified at Part II.D rather than as evidence of any health effect. Paragraph 360ii(a)(2) directs the Secretary to plan, conduct, coordinate and support research, development, training and operational activities to minimize the emissions of and the exposure of people to unnecessary electronic product radiation. The paragraph speaks of emissions and of exposure, and a duty to minimize a quantity presupposes knowing what the quantity is.

The quantity is being tracked. It is being tracked by academic researchers working from satellite radiance data, published in the peer-reviewed literature, at global scale, with projections to 2050 and an express recommendation that action be taken to reduce the growth. What does not exist is any federal measurement of what a person in the United States is exposed to, any federal inventory of the emitting products, and any federal baseline against which a minimization duty could be assessed. The Foundation asked the Department to establish such a baseline at Part II.D.6, and renews that request at Part IX.C.

The limits of satellite radiometry are real and the Foundation states them. These data measure light radiated upward and detected from orbit, which is a proxy for what reaches a person at ground level and not a measurement of it. They describe outdoor light and say nothing about interior exposure, which for most people is the larger part of the total. They do not identify the technology producing the light. Appendix C.3 sets out the study in full.

One further point belongs in this subsection, and it answers an objection rather than making a claim. It might be said that individual optical exposure cannot practicably be measured, and that this is why the federal record contains no measurement of it. The premise is not correct. The study described at Appendix C.4 measured nighttime light in the bedrooms of 454 individual participants, on three separate occasions each, using a handheld illuminometer costing on the order of tens of dollars. Whatever else may be said about that study, and Part V.F says a good deal, it establishes that direct measurement of a person's nighttime optical exposure is neither technically difficult nor expensive.

The absence of such measurement in the United States is therefore not explained by its difficulty.

Those limits are themselves the argument of this subsection. The best available description of how much artificial light the human population is exposed to comes from instruments in orbit, because no instrument on the ground is systematically collecting it.

1. Instruments and measurands currently available

a. Source geometry, apparent source size, and retinal irradiance

A further difficulty attaches to the characterization of a finished luminaire rather than of a component, and the Foundation states it here because it determines what a photometric file can be taken to describe. The optical study at Appendix C.88 designed, built and measured two secondary optics, each converting the output of the same named light-emitting diode into uniform illumination of a defined area, and each achieving over 95 percent uniformity on the authors' stated measure. The finding was that the two differed not in what they achieved but in how securely they held it: "the uniformity produced by the freeform lens reduces abruptly compared with the CDTIRO when some parameters such as size and the position of the light source are changed."

What follows is a proposition about the object of measurement. The distribution a luminaire delivers is a property of the emitter and the optic taken together, and for at least one common class of optic it is not robust to a change in the size or the position of the emitter. A photometric file describes the pairing that was measured. It does not follow that it describes a unit built with an emitter of slightly different dimensions, or with the same emitter mounted slightly differently, and the manufacturer document at Appendix D.3 supplies the reason such substitutions are unremarkable: two components may carry the same reported half width and distribute their output differently. The Foundation states the limit of this point as the source states it. The

degradation is described as abrupt and is not quantified anywhere in that paper, and the Foundation does not assert a magnitude. What it asserts is that the quantity is sensitive to a variable that no reporting convention examined in this comment records.

2. Laboratory measurement versus real-world exposure conditions

A measurement of an optical emission is a measurement under conditions, and changing the conditions changes the number. This subsection sets out the difference between the conditions under which these products are measured and the conditions under which people meet them, because several requests in this comment depend on the distinction.

Four differences, each of which has been identified elsewhere in this Part and is collected here.

Geometry. Irradiance is referred to a surface, so its value depends entirely on where the surface is placed, and Part III.D.6 records that a criterion expressed in it is uninterpretable without a stated measurement geometry. A laboratory measurement fixes the geometry by convention. A person meets the product at whatever geometry the installation and their own posture produce.

Motion. A laboratory presentation is static. A headlamp approaches, a beacon is passed, a display is traversed, and Part III.D.9 treats movement through space as a characteristic requiring a boundary. Part V.D.2 sets out the stroboscopic and phantom-array effects, which exist only because the source or the eye is moving, and which no static measurement produces.

Multiplicity. Part V.J.3 sets out the single-emitter design of the instruments and Part III.D.8 treats the number of emitters during exposure. A measurement of one luminaire does not describe a field of view containing twenty.

Adaptation. The eye that meets a source at night against a dark field is in a different state from the eye in a laboratory, and Part V.D.1 and Part V.C.3 set out why that state is the condition under which glare and straylight do their work.

Two consequences follow for the requests this comment makes. The first is for the Department: Part IX.C asks that the evaluation directed by paragraph 360ii(a)(4) be conducted under the conditions in which the product is actually met rather than under static laboratory presentation, and this subsection is the ground of that request. The second is for everybody else: Part VIII.E.3 establishes that a public entity which acquired an instrument would still not know under what conditions to use it, because no federal document states the conditions, and Part VIII.D.3 establishes that the resulting number could not be evaluated in any event.

3. Multi-emitter exposure, and the single-emitter design of the existing literature

a. Multiple high-radiance images on the retina

That proposition is now supported from the industry rather than asserted against it. The manufacturer white paper described at Appendix D.3 and at Part V.C.4.f addresses the same point under the name pixelation, and states it in terms the Foundation could not improve on. It identifies as the difficulty “the inadequacy of the photometric measurements that assumes the source is a single point. Instead, it is an array of closely spaced sources: very small high luminance zones separated by low luminance zones.” It continues: “The current photometrics for glare assumes a single source of luminance and so requires only a snippet of information — a measurement taken from one spot facing this single point source. Of course, a LED luminaire contains multiple light sources within that single luminaire, so it’s obvious that new metrics are needed to take account of this.”

And on what the measurement discards: “A photometric measure uses a light sensor to collect the light from multiple LED sources as if the light has been emitted from a point source of light where distance is irrelevant. In other words, the photometry cuts down the luminaire’s details to one pixel of information.” The document observes that glare calculations then compare one pixel per

luminaire against the background, while the person sees every variation of intensity within the optic.

The Foundation records that the same document proposes the remedy it identifies at subsection g below, namely imaging rather than single-point measurement: it notes that high-resolution digital cameras now permit radiant imaging of every point in the field, and that this could quantify what people actually experience. That is a measurement capability, which is the subject of § 360ii(a)(5), and it exists.

A measured result for an array rather than a single emitter bears on this subsection, and the Foundation records it because it is the only one it has. Appendix C.86 describes near-field goniometric measurement of a task lamp carrying twenty-one discrete light-emitting diode modules mounted on flat surfaces. The measured distribution was not the distribution of a single emitter enlarged. The author reports a weighted Lambertian and attributes the departure from the single-emitter form to three properties of the array: the number of elements, their coarser spacing, and the greater size of the emitting plane. Her conclusion is that "the Lambertian LIDs are indeed weighted according to the x and y dimensions of the flat LED sources", and she notes that the measurement would reveal more asymmetry at higher angular resolution than she used.

The Foundation does not overstate what that shows. The measurement was of luminous intensity distribution in relative units, reported in candelas per kilolumen, and the author states that the magnitudes were not tied to her analytic solution. It is not a measurement of what an array deposits on a retina. What it establishes is the proposition this subsection needs and the single-emitter literature cannot supply: the emission of a multi-emitter assembly differs in shape from that of its elements, in a manner that depends on the geometry of the assembly, and a measurement that averages across the aperture records none of it.

The optical side of the same point is reported at Appendix C.88. Where refractive optics of the kind used on roadway luminaires are placed close together, they obstruct one another: on the authors' account "it is necessary to provide a gap between them in order to keep uniformity of illumination. Otherwise the lenses act like obstacles and uniformity deteriorates." An array is therefore not the sum of its elements on the optical side any more than on the photometric side, and the spacing of the elements is a variable that governs what the assembly emits. The Foundation notes that the quantity degraded in that study is uniformity of an illuminated surface rather than anything about an observer, and offers it only for the proposition that elements of an array interact.

A further matter belongs here and it changes the character of the deficiency this subsection describes. The manufacturer document at Appendix D.3 and Part V.C.4.f proposes imaging measurement as the remedy for single-point photometry. A second manufacturer, in the document described at Appendix D.3, reports that the measurement is already being made. Designers are instructed to "use ray files of the LEDs which contain near field information," and the manufacturer states that it "offers measured ray data for all LEDs and all standard programs."

The Foundation asks the Department to note precisely what that is. A near-field ray file records where on the emitting surface each ray departs and in what direction. It is the characterization that a single photometric reading taken at a distance discards, and it is the characterization that would permit the number, position and intensity of the retinal images described at paragraph b above to be computed rather than estimated. On the manufacturer's own account it is measured for every device in its range and supplied to its customers in the file formats of the standard optical design packages.

Three consequences follow, and the Foundation separates them because they bear on different parts of this comment. The first is that the deficiency identified in this Part is not that the measurement is infeasible, that the instruments do not exist, or that nobody performs it. It is performed, per product, as a commercial routine, by at least one major manufacturer on its own statement. The second is that what has not happened is its entry into any public or regulatory

channel: the Foundation has located no federal requirement that such data be produced, no federal repository that holds it, and no evidence in the public record that any federal body has asked for it. The third is the statutory one. Paragraph 360ii(a)(3) directs the Secretary to maintain liaison with and receive information from industry. The information the study required by paragraph (a)(4) would need is in the hands of industry, in a measured and standardized form, and is distributed to anyone with a commercial reason to ask for it.

4. Photometric reporting as a limitation of the existing literature

A limitation runs through the whole of the literature described in this Part, and the Foundation brings it forward here because it determines what that literature can and cannot be used for.

The studies of artificial light and human health characterize exposure in one of three ways, and all three are blind to the same thing.

Satellite radiance at the residential address. The coarsest. It measures light radiated upward from a neighborhood, in broadband units, as a proxy for what a person living there receives. The ulcerative colitis study at Appendix C.5 uses this method.

Wrist-worn light sensors. Better, because the instrument is on the person. The sensor records illuminance in lux, a photometric quantity weighted by the photopic luminous efficiency function. The cardiac study at Appendix C.2 uses this method.

Direct measurement with an illuminometer in the room where the person sleeps. The most precise of the three as to place and time, and still a reading in lux. The study at Appendix C.4 uses this method.

Each of the three is photometric or broadband. None is spectral. A reading of 3 lux, or 50 lux, or a satellite radiance value, says how much light there was as the standard observer's eye would weigh it. It does not say what the light was made of. Two exposures reported as identical in these units may differ entirely in the short-wavelength content that Part V.C identifies as bearing on the retina and Part V.F identifies as bearing on circadian timing, and in the long-wavelength content that Part V.B.6 identifies as bearing on mitochondrial function.

What the satellite instrument can and cannot see

The first of those three methods requires a further statement, because to call it broadband understates the difficulty. A broadband instrument is one that cannot distinguish one spectrum from another. The instrument on which this literature depends does something different. Its sensitivity band begins above the emission peak of the products with which this comment is concerned.

Kyba and others, publishing in Science Advances in 2017, reported the first analysis of the calibrated satellite radiometer from which the global record of artificial light at night is now derived, and described the instrument in these terms:

> "This sensor provides the first-ever global calibrated nighttime radiance measurements in a spectral band of 500 to 900 nm, which is close to the visible band, with a much higher radiometric sensitivity than the DMSP, and at a spatial resolution of near 750 m."

The band begins at 500 nanometers. The emission peak of a phosphor-converted white light-emitting diode lies between approximately 450 and 470 nanometers, as Part V.B.1 describes. The authors state the consequence in terms the Foundation need not paraphrase:

> "So-called 'white' LEDs emit a portion of their light at wavelengths below 500 nm (blue), where the DNB is effectively blind."

What follows from that is the material point, and the Foundation asks the Department to read the next two passages together.

> "This means that a street light transition from (orange) high-pressure sodium lamps to (white) LEDs in which surface luminance is held constant results in a decrease in the radiance observed by DNB."
>
> "…whereas decreases in city center radiance in the DNB band likely indicate absolute energy reductions, white LED transitions will often increase the skyglow experienced on the ground…"

The instrument does not merely under-record the conversion to light-emitting diode street lighting. For a conversion at constant surface luminance it records the conversion as a reduction, while the quantity to which a person standing on the ground is exposed increases. The authors observed that pattern in the data. Many large cities showed falling radiance at the center alongside rising radiance in outlying areas, and the authors attribute the fall at the center to "the sensor's lack of sensitivity to light in the range of 400 to 500 nm." They add that the rise in scattered skyglow "would be considerably more noticeable if the DNB was sensitive to light below 500 nm," the clear sky scattering short wavelengths preferentially.

Three consequences follow. The Foundation states first the one that runs against its own appendix.

At least fifteen of the one hundred and fifty-three entries collected in Appendix C take satellite radiance as their own exposure variable: C.3, C.5, C.9, C.16, C.17, C.22, C.31, C.33, C.37, C.43, C.44, C.129, C.138, C.145 and C.147. The last two are refinements of the category rather than plain instances: neither uses raw radiance, each using instead a published product modeled from it, which inherits the band limitation of the instrument and adds a modeling step on top of it. Appendix C.147 adds a second modeling step, converting the modeled sky brightness into a predicted illuminance at the ground. The last of those is a refinement of the category rather than a plain instance: its exposure variable is not raw radiance but a published atlas of night sky brightness modeled from it, which inherits the band limitation of the instrument and adds a modeling step on top of it. Two further entries, C.14 and C.35, are reviews of literatures composed substantially of such studies. The denominator has been conformed to the present size of the appendix and must be conformed again whenever an entry is added, which has now been missed on four occasions and was found stale again when Appendix C.143 was added; the list itself has not been re-audited.129 records that task and it remains outstanding. Appendices C.139 and C.143 are not among the thirteen and are not candidates for the list: it has no outcome variable, being a study of the instrument rather than a study conducted through it, though it does use the satellite product to calibrate its intensities and to mask its maps.

> The same fact forecloses the contrary inference. If that literature cannot establish an effect attributable to the emission of light-emitting diode products, neither can it establish the absence of one. A review of the published literature on artificial light at night and human health, of the kind the response of May 24, 2024 states the agency commissioned and relied upon, will have drawn substantially on studies whose exposure instrument cannot detect the wavelengths in question. That is not a criticism of whoever conducted the review. It is a statement of what the available literature is capable of showing, in either direction, and it is the reason the Foundation asks for measurement rather than for a further review.

The field has now conceded the point in print

When this comment was first drafted the proposition above was the Foundation's inference from the instrument description. It is no longer only that. The authors of the exposure study at Appendix C.3, which is one of the thirteen entries just named and the one this comment relies on for the size of the exposed population, state the difficulty themselves among their limitations, and state the consequence for their own numbers.

> "Both DMSP/OLS and VIIRS/DNB have limited sensitivity to short-wavelength (blue) light below 500 nm, which is the spectral range most strongly associated with non-visual physiological effects such as circadian disruption."

They add that blue-rich emission has increased substantially with the adoption of solid-state lighting, that satellite radiance accordingly underestimates both the visual and the non-visual exposure burden, especially where the conversion to light-emitting diode lighting is rapid, and then state the conclusion that governs how this comment uses their figures:

> "Consequently, the ALAN exposure estimates presented in this study should be interpreted as conservative lower-bound estimates, and the actual environmental and biological light burden may be greater than indicated by satellite observations alone."

Three things follow, and the Foundation puts the unhelpful one in the middle rather than at the end.

The first is that the exposure figures this comment reports from that study are a floor. The Foundation is not defending them as estimates of the biologically relevant exposure and does not need to. The authors have said they are lower bounds, and a duty to minimize a quantity is not discharged by leaving the only available measurement of it below the true value and unimproved.

The second runs against the Foundation. The same authors identify a second reason the satellite record may mislead, and it has nothing to do with spectrum. The conversion to light-emitting diode lighting is commonly accompanied by better shielding and a changed angular distribution, which reduces direct uplight. They state that this may weaken the relationship between ground-level illumination and the radiance a satellite observes, and introduces further uncertainty into long-term trend analysis. The Foundation accepts that and states the consequence plainly: the direction of the ground-level trend is not established by this record. Better shielding at constant or rising ground illuminance would show in these data as a reduction. So would a genuine reduction. The instrument cannot tell the Department which it is looking at, and neither can the Foundation.

The third is the request, and it is modest because the second point makes it so. The Foundation does not ask the Department to find that ground-level exposure is rising. It asks the Department to notice that the only continuous national measurement of this emission cannot answer the question in either direction, that its own authors say so, and that paragraph 360ii(a)(4) directs the Secretary to study and evaluate emissions of, and conditions of exposure to, electronic product radiation. An instrument that is blind to the wavelengths at issue and confounded by the optics of the fixture is not that evaluation. It is the reason one is needed.

> The remedy was identified by the same authors in the same paper: "From a remote sensing perspective, the situation could be greatly improved if nighttime satellites had color sensitivity." Nine years have passed and the Foundation is aware of no federal program to provide it. Paragraph 360ii(a)(4) directs the Secretary to study and evaluate emissions of, and conditions of exposure to, electronic product radiation. A measurement convention whose band excludes the wavelengths at issue is not a characterization of the emission.

The remedy was not supplied. What was built instead, and what it measured

Five years after the instrument paper, three of its authors — Sánchez de Miguel, Bennie and Gaston — published in the same journal the work that the sentence just quoted anticipates. No satellite carrying color sensitivity had been launched, so they used the only color imagery of the night side of Earth that exists in quantity: photographs taken out of the windows of the International Space Station by astronauts, with ordinary digital single-lens reflex cameras. The study is at Appendix C.139. The Foundation takes four things from it and declines the rest.

The first is the specification of the instruments, stated independently of the 2017 paper and more completely:

> "the key satellite sensors have been panchromatic, providing no information on the spectral composition of artificial light at night (ALAN), and while the bandwidths have been broad, they have also been insensitive to the blue part of the visible spectrum (380 to 450 nm); the Defense Meteorological Program/Operational Line-Scan System (DMSP/OLS) was sensitive from 450 to 1000 nm, and the Suomi-National Polar-Orbiting Partnership/Visible and

> Infrared Imaging Radiometer Suite–Day/Night Band (SNPP/VIIRS-DNB) and NOAA20 VIIRS-DNB are sensitive from 480 to 920 nm."

Two numbers in that passage are worth separating. The interval the authors name as the one to which the sensors are insensitive runs up to 450 nanometers, which is the lower edge of the emission peak of the phosphor-converted white light-emitting diode as Part V.B.1 describes it. The nominal lower limit of the band of the instrument now in service is 480 nanometers, which lies above the whole of that peak. The 2017 paper gave the band as 500 to 900 nanometers and said the sensor was "effectively blind" below 500. These are compatible statements about different things — the nominal limits of a band, and the wavelength below which its response has fallen to nothing of use — and the Foundation reports both rather than harmonizing them. What neither permits is the view that the instrument records what a white diode emits at its peak.

The authors state the consequence in a single sentence:

> "satellite-borne imagery may provide a poor or limited quantitative indicator of the exposure to environmental risks associated with ALAN, as shifts toward potentially harmful lower-wavelength emissions are masked by the low sensitivity of the sensors at these wavelengths."

The second thing the Foundation takes is that the masking has now been measured rather than inferred. The authors built two composite color maps of Europe from calibrated astronaut photographs, one for 2012 to 2013 and one for 2014 to 2020, at five-hundred-meter resolution across twenty-six countries, and compared them. They conclude:

> "We have demonstrated that one consequence of this shift in the spectral composition of artificial nighttime lighting emissions has been a marked progressive underestimation in the intensity of those emissions as determined by the principal satellite platform used for this purpose (SNPP/VIIRS-DNB)."

The word to notice is "progressive". The error is not a constant that could be calibrated away once and for all. It grows as the conversion proceeds, which means that a time series assembled from this instrument carries a bias that increases along the series, in the direction of understating the change. The authors add that the same radiance values are used to estimate population density and urbanization, economic activity, the extent of wilderness and the effects of the coronavirus pandemic. The Foundation does not pursue those uses and notes only that the defect is not confined to lighting research.

The third bears on Part IX, and it is the reason this paper is worth more to the Foundation than its findings. Having recovered the spectral information, the authors re-expressed their maps as indices of biological consequence: a melatonin suppression index, a star light index, and an index of the phototactic response of moths, each computed from the color ratios through published response curves, and each mapped across the continent and reported country by country. Part IX.G.1 asks that a performance standard prescribe the spectral characteristics of the emission, and Part IX.J asks the Department to state that lumens, watts and correlated color temperature do not describe spectral content. The objection to be expected is that no practicable spectral measure exists at scale. It does. One has been computed for a continent, at five-hundred-meter resolution, from imagery that cost nothing to acquire.

The fourth is the authors' own statement about whether the short-wavelength content is necessary to the technology. On the benefits claimed for it:

> "The benefits of LED technology do not rest principally in the ability to produce broad white light emissions (this is also achievable with other technologies)."

And on how the emission came to have the composition it has:

> "the increased use of LEDs in public lighting has also led to intentional shifts in the spectral composition of the associated emissions, with these often becoming whiter, with the intention of providing improved color rendering for human vision."

That is a statement by investigators in the field that the characteristic at issue is a design choice made for an identified reason, and not an inherent property of the emitter. It answers the objection that a standard addressed to short-wavelength content would be a standard against light-emitting diodes. It would be a standard against one design decision, which the people who study the emission say was taken deliberately and is not required by the technology.

Four qualifications belong with all of that, and the Foundation states them here rather than leaving them to the appendix. The camera is not a spectrometer: it has three broad channels, and the spectra are inferred from two color ratios by synthetic photometry against the known emission spectra of lamp types. The three indices are not three findings; they are deterministic re-expressions of the same two ratios, and the paper's own statistics show it, because the Kruskal-Wallis statistic reported for the green-to-red ratio, for the melatonin suppression index derived from it and for the star light index derived from it is the same number to two decimal places, a monotone transformation of a variable leaving its ranks unchanged. One reported percentage cannot be reconciled with the medians printed beside it, and Appendix C.139 sets out which. And the composite maps are masked using the very satellite product whose blindness is the paper's subject, at a threshold of half a nanowatt per square centimeter per steradian, so the corrective map cannot see lighting that the criticized instrument cannot see.

None of the four disturbs the use made of the paper here, and the Foundation says why rather than asking the Department to take it on trust. The band limits are instrument specifications and not results: they do not depend on the camera, the statistics or the mask, and can be checked against the sensor documentation without reference to this paper at all. The demonstration that an index of spectral consequence can be computed and mapped is a demonstration rather than an estimate, and it survives an error in any particular figure. And the direction of the spectral shift is established by the color ratios, which the authors state in their Methods are the better-determined quantity, rather than by the absolute intensities, which they state are the worse.

One note on the arithmetic of what follows. This paper is not an eleventh instance in the list below. The instances in that list are investigators who used the instrument to measure something else and either disclosed or did not disclose that it could not see what they were studying. These authors set out to measure the blindness itself. The paper is the source for the list and not a member of it.

What the blindness does to the record itself, and what it does to the only long-run number for this country

The same five authors published a year earlier the companion to the work just described, and the Foundation takes it out of chronological order because its subject is not a map but the time series. Sánchez de Miguel A., Bennie J., Rosenfeld E., Dzurjak S. and Gaston K.J., First estimation of global trends in nocturnal power emissions reveals acceleration of light pollution, Remote Sensing, volume 13, issue 16 (2021), article 3311, open access under a Creative Commons Attribution license. Described at Appendix C.143. The authors declare no conflict of interest and the work carries the same research council grant as the mapping study.

What they did was assemble a global, country-by-country series of satellite-detectable emitted power from 1992 to 2017 by reconciling three mutually incompatible datasets — the uncalibrated Defense Meteorological Satellite Program archive, whose values are digital numbers between one and sixty-three that saturate in any bright city; the radiance-calibrated subset of that archive, which exists for only eight years; and the Visible Infrared Imaging Radiometer Suite — and anchoring all three to a ground truth, which was the recorded electricity consumption of municipal street lighting in seventy-five Italian provinces. They then modeled what the sensors could not see.

The headline, as they state it, is that satellite-detectable light increased by at least 49 percent over the twenty-five years. For the part the sensors miss they give a projection: a global total in the blue band of 513 megawatts in 2017, which would be 806 megawatts if forty percent of lighting were diodes at 3,000 kelvin and 1,294 megawatts at 4,000 kelvin. From those they derive the figure in

their abstract, that the true increase in radiance in the visible spectrum "may be as high as globally 270% and 400% on specific regions."

The Foundation relies on the 49 percent and declines to lean on the 270. The larger figure depends on an assumed rate of conversion taken from a Spanish manufacturers' association and on an assumed color temperature for the lamps that replaced the old ones, and the authors offer it as a bound on uncertainty rather than as a measurement. The 49 percent is what the instruments recorded. Everything the Foundation takes from this paper is available without the larger number, and a comment that leaned on it would be relying on a modeled quantity where a measured one was at hand.

The finding that bears on the United States

At the continental scale the authors report persistent growth in detected light in Asia, South America, Oceania and Africa; a rise in Europe that levelled off around 2010; and this:

> "in North America it appears to be in decline."

They then qualify it, and the Foundation asks the Department to read the two sentences together rather than separately:

> "any conclusions as to the apparent levelling off or decrease in lighting intensity in Europe and North America should be treated with caution as the shifting spectral distribution of light towards blue-rich LEDs is likely to mask the effects of increases."

The only continuous multi-decadal measurement of this emission over the United States shows it falling. The investigators who constructed that measurement say the fall should be treated with caution, because the instrument is becoming blind to the technology that replaced the one it was calibrated against. A Department that took the national trend at face value would be relying on a number its own authors disclaim, and the direction of the error is the one that most favors doing nothing.

This is not an inference the Foundation constructed. The beginning of this subsection quotes the 2017 instrument paper for the mechanism: a conversion from sodium lamps to diodes at constant surface luminance "results in a decrease in the radiance observed by DNB." That was a prediction about what the instrument would do. This is the continental observation of its having been done, by three of the same authors, four years later.

How large the artifact can be, how the 2017 authors described their own headline figures, and what they found for the United States

The Foundation has since read the 2017 instrument paper in full and takes three further statements from it. They bear on the passage above and the Foundation sets them out here rather than at the head of this subsection, because together they answer the question a reader of that passage will ask, which is how much of an apparent decline the instrument could manufacture on its own.

The first is a magnitude. The authors state that a decrease of about thirty percent in recorded radiance could be produced by a complete conversion from high-pressure sodium to diode lighting rather than by any reduction in visible light at all. That is the artifact quantified by the people who built the measurement. The comment has until now been able to say only that the instrument would record a decrease where none had occurred; it can now say how large a false decrease is available, and thirty percent is larger than any national change reported in the period.

The second is the authors' own characterization of their headline numbers, and it is the sentence this subsection would choose if it could choose only one: "The measurements of change in lighting reported here are therefore actually lower bounds on the increase of lighting in the human visual range." The paper reports that the artificially lit surface of the Earth grew by 2.2 percent a year from 2012 to 2016, that total radiance grew by 1.8 percent a year, and that continuously lit areas

brightened by 2.2 percent a year. Those are the figures in general circulation. Their authors describe them as lower bounds.

The third runs against this comment and is the reason the first two matter. Among the few countries in which lighting was stable rather than growing over the period, the authors name some of the world's brightest, and the United States is on that list, with Italy, the Netherlands and Spain. Read alone, that is a finding that American outdoor light was not increasing during the four years in which American street lighting was converting to diodes. The Foundation does not suppress it and does not accept it, and the ground for not accepting it is the authors' own: the instrument is blind below five hundred nanometers, a complete conversion can manufacture a thirty percent apparent decrease, and the reported figures are lower bounds. A measurement that cannot see the new technology will report stability in the country doing the converting.

That is now the second satellite analysis in this subsection to find American or North American light flat or falling, and the second whose own authors supply the reason to distrust the finding. The Foundation draws no conclusion about whether American outdoor light rose or fell between 2012 and 2016. It draws the conclusion this subsection exists for: that the question cannot be answered from the satellite record, that the two published answers are in the direction least favorable to this comment, that in each case the investigators say so themselves, and that paragraph 360ii(a)(4) directs the Secretary to study and evaluate emissions rather than to adopt the only number that happens to exist.

Two further matters, which bear on arguments made elsewhere in this comment

The first is the share of the emission that comes from street lighting, which this comment has never been able to state for the United States and which these authors decline to state for anywhere. They write that the proportion is "unclear and debated in the literature" and likely to vary between countries and cities, and they give a published range that runs from 12 percent in Flagstaff, Arizona to nearly 100 percent in Spain. That is an eightfold spread between two developed countries. Set it beside the volunteer count at Appendix C.130, where streetlights in dense German urban areas were outnumbered by other sources by a factor of five to seven, and beside the observatory review at Appendix D.7, which supplies the Flagstaff end of the same range. Three sources now say the same thing: the streetlight share is small in some places, dominant in others, and not known for this one. The Foundation does not assume a figure for the United States and asks the Department not to either.

The second is the hour. The older satellite passed at about half past nine in the evening and the present one passes between midnight and two in the morning, so the two instruments do not measure the same night. These authors build two separate series for that reason, recalibrating each sensor against the other for 2012, the one year in which both operated. The Foundation notes the consequence rather than the method: the difference between an evening series and a post-midnight series is itself a measurement of how much lighting is switched off or dimmed between those hours, and it is the only measurement of that quantity at national scale that this comment has encountered. It bears on any request addressed to the duration of an emission, and the authors report that the gap is large in Europe, North America, Asia and Oceania and much smaller in South America and Africa.

One sentence from the abstract is adopted without alteration, because it is the whole of what this comment needs on the efficiency question at Part IV.G: "there is limited evidence that advances in lighting technology have led to decreased emissions."

What the Foundation does not take

The global calibration rests on one country. The entire series, for every nation on Earth, is anchored to the recorded street-lighting electricity consumption of seventy-five Italian provinces, chosen because that is where the historical provincial data exist. The authors are explicit about it and validate the result against national figures for eleven other countries, which is the right thing to do and is not the same as calibrating on them. The Foundation reports the direction of travel and not

the magnitude for any particular country outside that validation set, and it does not report a figure for the United States at all, because none is given and the authors' own caution forbids inferring one from the continental curve.

Nor does the Foundation adopt the authors' further claim that the transition to solid-state lighting "actually resulted in a dramatic rise in that consumption compared with that which had previously been occurring." That is a statement about energy consumption rather than about emission, it is supported by a citation the Foundation has not been able to match to the proposition, and the comment does not need it. What the comment needs is the measured direction of the emission and the authors' statement that the apparent decline in North America is probably an artifact of the instrument. Both are in the paper.

The difficulty had reached the health-effects literature by 2018. Argys, Averett and Yang, publishing in the Southern Economic Journal in 2020, examined skyglow and birth outcomes and declined to use satellite data, writing that satellites "are not sensitive to the blue part of the visible spectrum of light… such as that emitted by Light-Emitting Diode (LED) streetlights" and that "satellite images may fail to capture the skyglow added by LED streetlights, a growing source of light pollution." In its place they used a citizen-science dataset in which the sensor is the unaided human eye, recorded as the faintest star an observer can see. The Foundation does not rely on the findings of that study and does not include it in Appendix C. It relies on the methodological fact alone, which is this. By 2018 investigators working on this question had concluded that the best available measure of the exposure was volunteers counting stars, because no instrument in orbit could see the part of the spectrum they required.

The authors of the ulcerative colitis study state the point against their own result. Among the limitations they identify is that wavelength-specific effects could not be differentiated. That is not a defect of their study. It is a defect of the measurement conventions available to them, and every research group in this field inherits it.

And a fifth attestation, from the journal where it costs most to make

The Foundation adds one more, because of where it appears and because the paper that makes the admission is wholly dependent on the instrument it is admitting about. Johnston, Kim and Harris, publishing in Nature Climate Change in November 2025, combined satellite light measurements with carbon flux observations from eighty-six eddy covariance towers in North America and Europe. Described at Appendix C.129. Their statement about the instrument is made among the limitations of their own analysis:

> The available nighttime light satellite products used here, being the Visible Infrared Imaging Radiometer Suite and the Defense Meteorological Satellite Program, "are coarse in spatial resolution, are insensitive to blue light emitted by white light-emitting diode (LED) lighting and cannot fully capture local heterogeneity in ALAN exposure at flux tower sites."

And on the exposure variable itself they go further than any other source in this comment. Their measure is not calibrated radiance. It is a harmonized digital number, an index, and they state that such values "represent relative radiance indices and cannot be directly converted into absolute illuminance units such as lux, as they do not capture spectral composition or ground-level variability", and that the categories built from them "should thus be interpreted as relative exposure gradients rather than specific ecological thresholds".

The pattern, stated once and counted, with the three kinds of blindness distinguished

The Foundation has now had to report ten times in this comment that the instrument used to observe this exposure cannot record it. It collects the instances here so that they are counted once rather than remarked on each time they arise, and so that the Department can see that the difficulty is a property of the field and not of any paper.

- Kyba and nine co-authors, Science Advances, 2017. The instrument paper. The Day/Night Band records a spectral band of 500 to 900 nanometers, and the authors state that white diodes emit a portion of their light below 500 nanometers, "where the DNB is effectively blind." They give the consequence: a conversion from sodium to diode lighting at constant surface luminance produces a decrease in the radiance the instrument records.
- Guo, Liu, Kyba and others, Environment International, 2026. Appendix C.3. Both the sensors used have "limited sensitivity to short-wavelength (blue) light below 500 nm," and the authors therefore label their own global exposure figures conservative lower-bound estimates.
- Argys, Averett and Yang, Southern Economic Journal, 2020. The economists who declined to use satellite data for birth outcomes at all, rather than use it and qualify it.
- The ulcerative colitis analysis at Appendix C.5. Among its own limitations, that wavelength-specific effects could not be differentiated.
- Johnston, Kim and Harris, Nature Climate Change, 2025. Appendix C.129. The products used are "insensitive to blue light emitted by white light-emitting diode (LED) lighting," and the digital numbers that carry the exposure variable "cannot be directly converted into absolute illuminance units such as lux."
- Wang, Meng, Richardson and others, Nature Cities, 2025. Appendix C.131, taken up at Part V.I. The same band, with a refinement specific to plants: the band covers much of the range to which phytochrome responds, roughly 620 to 1,000 nanometers, and is blind to the blue to which phototropins and cryptochromes respond. The instrument is therefore blind in a way that is not uniform across the biology.
- Degen and eleven co-authors, Proceedings of the National Academy of Sciences, 2024. Appendix C.135, taken up at Part V.I. Different in kind, and the only one in which the shortfall was measured.
- Dietenberger, Jechow, Kalinkat and others, Communications Biology, 2024. Appendix C.136, taken up at Part V.I. Citing the radar study immediately above, these authors write that the number of insects caught in traps at a light source "represents only a fraction of the insects affected." It matters which way that cuts: their own measured reductions are therefore more likely to understate the benefit of shielding than to overstate it.
- Fobert, Miller, Swearer and Mayer-Pinto, Philosophical Transactions of the Royal Society B, 2023. Appendix D.7. Different in kind again, and the most severe. Reviewing the marine literature, these authors state that any nocturnal sampling method which introduces artificial light into the sampling environment will alter the outcome, and report work finding that light from a large vessel, or even from a headlamp on a small open boat, induces an avoidance response in the pelagic community to a depth of more than eighty meters.
- Boyes, Evans, Fox, Parsons and Pocock, Science Advances, 2021. Appendix C.142, taken up at Part V.I. Different again, and the one that forecloses the obvious answer to the first six. Having measured the exposure at their field sites with a hand-held photometer at the height of a caterpillar, these authors write that "lux is based on human vision, and thus potentially ecologically relevant spectral information can be omitted when using this unit," that identical readings in lux may not correspond to the same illumination as the animal perceives it, and that they used the unit anyway because it is the SI unit and is convenient.

These are three failures and not one, and the Foundation asks the Department not to run them together.

The first six concern a radiometer whose spectral band excludes the wavelengths at issue. That is an instrumental blindness: the quantity exists, the instrument does not record it, and the error is in a known direction, because the emission the band excludes is the one that has grown fastest. The tenth is of the same kind in a different instrument and at the opposite end of the scale, and the Foundation separates it for that reason. It is a hand-held photometer held at the height of a

caterpillar in an English hedge, whose weighting function discounts rather than excludes the short wavelengths, and whose users say so in the methods section of the study that depends on it. It matters because it forecloses the obvious answer to the first six. If the satellite cannot see the emission, measure it at the ground; the people who measured it at the ground report that the unit they had to use cannot carry the information either.

The seventh and eighth concern a biological sampling method, the light trap set at the lamp post, which can by construction record only those animals that flew to the lamp. That is a selection blindness: the instrument records a subset defined by the very response under study, and says nothing about the rest.

The ninth is the one the Department should find most difficult, because it cannot be corrected by a better instrument. In the marine case the act of observing introduces the exposure. A nocturnal survey needs light to see by, and the light it brings disturbs the community it came to measure, to a depth of eighty meters from a headlamp on a small boat. There is no version of that measurement which leaves the subject undisturbed, so the marine literature is constrained not by the resolution of its instruments but by the physics of looking.

The seventh is the most useful of the ten because it is the only one where someone built an instrument that could see both and compared them. Tracking individual moths by radar inside and outside the lit area, the investigators found that four percent of animals already selected for flying toward light terminated their flights at a streetlight, while the lights significantly altered the flight paths of the others and barred one family from crossing a lit circle. The established method was recording four percent of what was occurring. The Foundation does not extrapolate that ratio to any other instrument, and does not need to. What the nine have in common is narrower and harder to answer: in this field the blind spot of the instrument has repeatedly coincided with the thing at issue, and the coincidence has been identified by the investigators themselves rather than by any critic of theirs.

Eight research groups, ten papers, eight journals, three disciplines, and the same admission in each: the measurement on which the study of this exposure principally rests cannot see what is at issue. The consequence the Foundation draws from it is set out immediately below and is not repeated elsewhere; where this pattern is mentioned in Part V.I or in the appendices it is mentioned by reference to this passage.

The Foundation draws the consequence it has drawn throughout and adds one. The consequence throughout is that paragraph 360ii(a)(4) directs the Secretary to study and evaluate emissions of, and conditions of exposure to, electronic product radiation, and that a measurement convention which excludes the wavelengths at issue is not a characterization of the emission. The addition is this. A quantity that cannot be converted into any physical unit cannot be the basis of a performance standard under section 360kk, which requires that a standard prescribe an emission characteristic. The absence of a usable national measurement is therefore not merely a gap in knowledge. It is the specific obstacle standing between this Department and the instrument Congress gave it.

A tenth and an eleventh instance, which make no admission, and what the difference tells the Department

Every one of the ten above is an admission. In each case the investigators identified the limitation in their own work, and the Foundation has been able to quote them doing it. That is to the credit of the field and it is also the reason the pattern was visible at all. This subsection would be incomplete without an instance in which the limitation is present and is not identified, because the difference between the two cases determines how carefully the Department must read. There are two, and the Foundation takes them in turn.

Jones T.M., Llamas A.P. and Phillips J.N., Phenotypic signatures of urbanization? Resident, but not migratory, songbird eye size varies with urban-associated light pollution levels, Global Change Biology, volume 29 (2023), first published 20 September 2023. Described at Appendix C.138.

Five hundred and two breeding songbirds of four species were caught, measured and released at nine sites across San Antonio, Texas. In the two species resident year-round, eye size was negatively associated with light pollution and with daytime brightness, and birds in the urban core had smaller eyes than those at the edge. In the two migratory species there was no such association. Body size showed no effect of urbanization in any species once a difference in age structure was accounted for. The finding on eye size is novel and the Foundation does not dispute it.

The exposure variable was taken from a public online light pollution map, using its 2021 product from the Visible Infrared Imaging Radiometer Suite, in radiance units, sampled at one point per tenth of a square kilometer and averaged to a single value for each site.

That is the instrument described at the beginning of this subsection. Its spectral band begins at five hundred nanometers, and the emission of a white light-emitting diode below that wavelength is the part it cannot record. A study of eye morphology is a study of a visual system, and the wavelengths the instrument omits are not incidental to a visual system. The authors do not mention the limitation.

A second limitation compounds it, and this one the authors do state. Across their nine sites, light pollution and daytime brightness were correlated at 0.96, which they describe and which led them to decline to put both variables in the same model. Their own summary attributes the finding to light levels comprising both daytime brightness arising from urban development and artificial light at night. So the association is with a composite of nighttime satellite radiance and daytime openness which the design cannot separate, measured at night by an instrument blind to the wavelengths that matter most to an eye.

What the Foundation is not saying

That the investigators did anything improper. The satellite product they used is the standard exposure proxy in this field, it is freely available, and using it is ordinary and reasonable practice. Several of the ten papers above used the same product. The observation is about the practice and not about these authors, and the Foundation would make it of any study in the collection that did the same, including those whose findings favor its position.

The two consequences, which are the reason this instance is here

First, the Department cannot rely on this literature to disclose the limits of its own exposure variables. Ten papers identified the problem and two did not, and nothing on the face of either of those two papers would alert a reader to it. A Department reading this literature to find a number would have to open the methods of every study, establish which instrument produced the exposure variable, and determine for itself what that instrument can record. The Foundation has done that for the entries in Appendix C and reports the result at the census above: at least thirteen of them rest on satellite radiance.

Second, this is the specific reason paragraph 360ii(a)(4) directs the Secretary to study and evaluate emissions of, and conditions of exposure to, electronic product radiation, rather than to collect what others have studied. A literature cannot be made usable by being read more carefully if the measurements in it were never of the right quantity. The duty is to measure, and the reason for the duty is on display here.

What survives the criticism, which the Foundation records in fairness

The comparison between the resident and the migratory species does not depend on the absolute accuracy of the exposure metric. It depends only on the rank ordering of the nine sites, and on the fact that the same metric was applied to all four species. Both groups were measured against the same imperfect yardstick; only one showed the association. That contrast is therefore more robust than the dose-response coefficient, and it bears on a characteristic this comment asks the Department to regulate. The species exposed all year showed the association and the species exposed for part of the year did not, which is a statement about duration of exposure. The

Foundation records it as suggestive and not as established, because the authors offer an alternative explanation of their own: migratory birds may face conflicting selective pressures across their annual cycle, and the younger migrants found in the urban core may have fledged elsewhere entirely. Appendix C.138 sets out both.

The eleventh, in a different discipline, with a sharper mismatch and a milder consequence

The tenth instance stood alone when it was written and it does not now. Parlin, Stratton and Guerra, publishing in iScience in 2022 and described at Appendix C.140 and at Part V.I, established in a flight simulator that a lamp switched on at night makes quiescent migratory monarch butterflies fly immediately, and in a direction that reveals a shift in their circadian clock. Having established that indoors, the authors asked whether monarchs encounter such lighting in the field. They answered it with the Day/Night Band of the Visible Infrared Imaging Radiometer Suite, taking the monthly cloud-free composites for 2012 to 2020 and extracting a radiance value, in nanowatts per square centimeter per steradian, at each volunteer-reported roost location.

That is the instrument this subsection began with, and the mismatch here is sharper than in the tenth instance. In the songbird study the subject was eye morphology, so the omitted wavelengths were relevant to a visual system in general. Here the mechanism the authors themselves identify is specific. The light-sensitive step in the monarch's antennal clock is mediated by cryptochrome 1, which the same paper describes as a blue-light circadian photoreceptor. The exposure variable chosen to show that these animals meet the relevant light is a band that begins above the blue. The authors do not mention it.

The difference in kind from the tenth is stated so that the two are not treated as equivalent, because they are not. In the songbird study the satellite product supplied the exposure variable of the finding, and the finding was an association with it. Here it supplies a supplementary demonstration that roosts occur in lit places, presented in a supplementary figure, and none of the paper's conclusions depends on it. The limitation is the same. Its consequence is milder.

What the Foundation is not saying is what it was not saying about the tenth. That the investigators did anything improper. The product is the standard proxy; the question they put to it was whether these animals roost where there is light, which is a question of presence rather than of dose; and for a question of presence a band-limited instrument is a conservative one, because it can only understate how much of the relevant light is there. The Foundation would make the same observation of a study whose findings favored it, and in this comment it has.

The consequence is the one the tenth instance established and this one confirms. Two papers now, in different disciplines, in different journals, four years apart, used the same band-limited product without noting what it omits, in studies whose own subjects were a visual system and a blue-light photoreceptor respectively. The ten admissions collected above remain ten and remain to the credit of the field. What the eleventh adds is that the practice of not noticing is not a single lapse. A Department reading this literature for a number cannot rely on the literature to tell it when the number is wrong, and that is the whole of the point.

A twelfth instance, of a third kind, in which the investigators did everything this subsection asks for and the animal still outran the instrument

The eleven instances above divide into two kinds: ten in which investigators identified the spectral limitation of their own measurement, and two in which the limitation was present and was not identified. A third kind exists and the Foundation sets it out last, because it is the only one that tells the Department what happens when the measurement is done properly.

Shier D.M., Bird A.K. and Wang T.B., Effects of artificial light at night on the foraging behavior of an endangered nocturnal mammal, Environmental Pollution, volume 263 (2020), article 114566. Described at Appendix C.146. The subject is the Stephens' kangaroo rat, a nocturnal rodent listed as

endangered under the Endangered Species Act, studied in southern California by investigators at a zoological society and two campuses of the University of California.

These investigators did not use a lux meter and said why. “We measured vector irradiance (mW/cm2) rather than lux, as lux measurements are weighted according to human visual spectral sensitivity.” The instrument was a spectroradiometer covering 190 to 1,110 nanometers with a cooled silicon charge-coupled detector and an ultraviolet-to-near-infrared cosine receptor, calibrated for irradiance against calibration lamps traceable to the National Institute of Standards and Technology. It was mounted on a tripod eight centimeters above the ground, facing the source, which the authors state is where the measurement reflects the illumination the animal would experience. Three measurements were averaged at each of ten points. That is a radiometric measurement, at a biologically relevant height and perspective, with a nationally traceable calibration, in the field, by field biologists, in 2020. Every element of the specification the Australian guidelines set out, and which Part IX asks the Secretary to establish, was met here by a team studying a rodent.

And the finding that matters to this subsection is what happened next

The experiment placed ten baited foraging trays five meters apart in a line running away from a light on a three-meter pole, and scored whether the animals emptied each tray. The lights were two consumer products, identified by manufacturer: a solar flood light of one hundred and eight diodes rated at 756 lumens emitting between 400 and 700 nanometers, and a yellow compact fluorescent bug light rated at 300 lumens emitting between 550 and 650 nanometers. Then this:

> “Light intensity from the bug and flood lights, as measured by vector irradiance, decreased with distance from the artificial light source up to 25 m, at which point light was no longer detected. Yet, our results showed significant effects of artificial lighting on SKR foraging up to 40 m from the bug light and 50 m from the flood light.”

The animals responded at twice the distance at which the instrument could detect that there was any light at all. The authors state the two available readings of that and decline to choose between them: either the spectroradiometer was not sensitive enough beyond twenty-five meters, or “the effects of ALAN on SKR extend beyond the point at which light in the form of irradiance, is measurable.” They add the consequence for method, which is the sentence this subsection takes: that the results “suggest that effects of sky glow on behavior may extend beyond those of irradiance, and highlight the need to measure both irradiance and radiance to understand the effects of ALAN on a species’ behavioral ecology.”

The Foundation draws three consequences and keeps them apart.

First, this is not an instance of the pattern collected above and is not added to the count. Nothing here was spectrally blind. The measurement captured 190 to 1,110 nanometers, which is wider than the range any instrument in this subsection has reached, and the authors rejected the photopic unit on the record. What failed was sensitivity at low levels, which is a different defect, and it is the defect the Australian guidelines identify when they state that optimal methods will have “the sensitivity to detect and measure change at the low light levels represented by artificial light skyglow.” This comment has argued that the field measures the wrong quantity. This study shows that measuring the right quantity is necessary and not sufficient.

Second, it disposes of the objection that the measurement Part IX asks for cannot be performed outside a laboratory. It was performed, with a traceable calibration, at the height of a rodent’s eye, by a conservation research team on a field site, and the authors published the instrument, the geometry, the number of replicates and the data. The Foundation has spent this subsection establishing that the literature does not do this. One study did it, and the reason the Department should notice is that the study is ordinary: a small team, commercial instruments, a public dataset.

Third, and this is the part that bears on what a standard could achieve, the relationship the Department is asked to establish was not bounded by this experiment. The arrays were fifty meters

long and the flood-light effect reached the furthest tray, so the authors write that the impact "may extend into habitat beyond 50 m from the light source as we found significant effects all way to the furthest patches." The home range core of this species averages thirty meters. A single consumer flood light on a three-meter pole therefore altered the foraging behavior of an endangered mammal across a distance larger than its entire core home range, and the far end of the relationship was never reached. That is the shape of the dose-response this comment asks the Secretary to establish, in the one study that tried to measure it, and the answer came back open at one end.

One qualification the Foundation records because it runs against the convenience of the passage above. The same authors also converted their irradiance figures to lux, by assuming all the energy lay at 555 nanometers, and state the reason: to allow comparison with other studies. A team that had just explained in print why lux is the wrong unit nonetheless had to produce a lux figure so that its work could be read alongside everyone else's, and the conversion they used is a crude one that the choice of a single wavelength makes approximate. The Foundation does not criticize the decision. It reports it as the clearest demonstration in this subsection of the cost of having no agreed unit: the pressure to report the wrong quantity is exerted by the literature itself, on investigators who have identified the problem and solved it for their own purposes.

A thirteenth instance, of a fourth kind, in which the emission is not characterized at all

The twelve instances above divide into three kinds: an instrument that cannot see the wavelengths at issue and investigators who say so; an instrument that cannot see them and investigators who do not; and an instrument that saw the right quantity and ran out of sensitivity before the animal ran out of response. A fourth kind exists and the Foundation sets it out because it is the simplest and the most common condition in this literature.

Van Doren B.M., Horton K.G., Dokter A.M., Klinck H., Elbin S.B. and Farnsworth A., High-intensity urban light installation dramatically alters nocturnal bird migration, Proceedings of the National Academy of Sciences, volume 114 (2017), pages 11175 to 11180. Described at Appendix C.150 and set out at Part V.I, where its finding is used. It is among the best-designed studies in this comment. Seven years of weather surveillance radar and acoustic recording at a single installation whose operators switch it off and on, with the biological response measured in both states, at two radar elevations, with a simulation to test the mechanism, and with effect sizes and probabilities reported throughout.

The Foundation has read it and can find in it no lumen, no candela, no lux, no irradiance, no radiance, no wattage and no spectrum for the light source. The word intensity appears in the title and in a comparison with another installation, and nowhere as a quantity. The exposure variable is whether the lights were on.

That is not a criticism of the investigators, and the Foundation states why in the same terms it has used throughout this subsection. They are ornithologists studying birds at four kilometers with radar, the installation is not theirs to measure, and the on-and-off design is what gives the study its strength. The observation is about the state of the record. The Department is being asked by many parties to act on this literature, and the best-controlled field study in this comment of a real American lighting installation does not say how much light the installation emits. A performance standard under section 360kk must prescribe an emission characteristic. Nothing in this study could be converted into one, and the comment relies on it for the shape of the response and for the reversibility rather than for any number a standard could use.

A fourteenth instance, of a fifth kind, in which a spectral explanation is offered and no spectrum is measured

The four kinds above concern what an instrument could or could not see. The fifth concerns what is said about a spectrum when no instrument was pointed at it, and the Foundation sets it out last because it is the condition in which most of this literature reasons.

The two bat experiments described at Appendices C.152 and C.153 are by the same three authors, on the same species, in consecutive field seasons. The earlier used high-pressure sodium luminaires, the later used white light-emitting diode luminaires, and both characterized the exposure in lux measured with the same model of handheld illuminance meter. Neither publishes a spectral power distribution for either lamp, and neither reports a correlated color temperature for the diodes, which are described as cool white and by product name. The later paper then explains one of its own findings spectrally. Having recorded no increase in the feeding activity of two pipistrelle species at the lights, it attributes that to the spectral content of the diodes, reasoning that they emit little ultraviolet and are therefore less attractive to the insects bats feed on, and it adds that although the diodes emit white light they are comparable with high-pressure sodium in spectral content for that reason.

The Foundation makes three observations and no accusation. The reasoning is sound and the general proposition about ultraviolet is correct; this is not an error. The support for it is the published properties of two lamp classes and the entomological literature, not a measurement of the two luminaires that produced the results, which is a different kind of support and the paper does not distinguish them. And the claim is confined to the ultraviolet, while the difference between a cool white diode and a sodium lamp is largest in the blue, which is the part of the spectrum at issue in almost everything else in this comment and is not addressed.

The Foundation records this instance for one reason. In Part V.A.2 it relies on the comparison between these two experiments, and that comparison would be far stronger if the Department could be told what the two lamps actually emitted. It cannot, because nobody measured. Paragraph 360ii(a)(4) directs the Secretary to plan and conduct research into the effects of electronic product radiation, and the first thing such a program would do that the existing literature does not is record the emission.

What the instrument cannot tell the Department, counted by hand

Everything above concerns what the satellite cannot see. One project set out to establish what is actually there, by sending people out to count it, and the result bears on the structure of this comment as much as on the measurement question.

Team Nachtlichter, Citizen science illuminates the nature of city lights, Nature Cities, volume 2 (2025), pages 496 to 505, open access. Described at Appendix C.130. The authorship is collective and the Foundation states it as published.

In the autumn of 2021, 258 registered participants walked 3,868 transects in 4,409 surveys and classified 234,044 individual light sources into eighteen categories, covering about twenty-two square kilometers in thirty-three communities, mostly in Germany. The transects were laid out to cover the publicly accessible area of specified satellite pixels completely. Participants completed mandatory online training, and variability between observers counting the same street was estimated at ten to twenty percent, which the authors note is similar to the month-to-month variability of the satellite sensor itself. Streetlight counts were checked against municipal databases and agreed to better than seven percent in three cities; in two others the hand counts were forty and ninety percent higher, because they included streetlights on private roads that the public databases omit.

The composition of the light, which runs against this comment's own emphasis

The Foundation reports the principal finding first and then states what it costs the Foundation.

- Private windows were the most frequently observed light source, ahead of streetlights and commercial windows.
- In dense urban areas, lights used for advertising outnumbered streetlights. In the early evening there was roughly one illuminated sign and one commercial window for every streetlight.

- Late at night the streetlight share rises as signs and windows go dark, but streetlights remained outnumbered by other sources by a factor of about five to seven in dense areas.
- Extrapolated nationally, approximately 78 million individual light sources, plus or minus 3 million, remain illuminated at midnight across the mainland of Germany, and about 2.52 million in Berlin. Against that, the authors give published estimates of nine to nine and a half million public streetlights in the country.

Part VI.D of this comment treats roadway lighting at length and Part VI.J treats signage. If these proportions hold anywhere outside Germany, the emphasis of this comment, and of the literature it draws on, follows the availability of records rather than the distribution of the emission. The authors say so about lighting policy generally: street lighting has been the dominant focus because public authorities own those lights and, with geographic information systems, have records of them. The Foundation records that its own treatment is subject to the same criticism, and that the finding cuts in favor of the attention it gives signage at Part VI.J, which on this evidence is not a marginal product class but one that outnumbers street lighting in city centers.

The most common source is the one the Foundation has not addressed at all, and it names the gap rather than leaving it. A private window is not a light source. It is an aperture, and what passes through it is the emission of a lamp indoors. On the construction of paragraph 360ii(a)(2) that Part II.D.4 sets out, that lamp is an electronic product and what reaches a person outside the building is its emission, no differently from a lamp mounted on the outside of the same wall. The Foundation does not ask the Department to regulate curtains. It observes that the single most numerous contributor to the outdoor light environment is a product class this comment treats only as interior lighting at Part VI.E and Part VI.G, and that the Department should know this before accepting any characterization of outdoor light that begins and ends with street lighting.

Shielding and brightness, which are two of the four variables Part IX asks to have characterized

The participants recorded the emission direction, apparent brightness and color of what they counted, and the results speak to the geometry variable more directly than anything else in this comment.

- German streetlights were largely controlled: forty-eight percent fully shielded and forty-nine percent partially shielded.
- Lights mounted on the sides of buildings were not: only twenty-nine percent fully shielded, and twenty-six percent unshielded.
- Floodlights were worst. Fifty-eight percent were unshielded, which the authors state implies upward rather than downward lighting, and in continuous urban fabric the unshielded fraction was seventy percent.
- On brightness, twenty-four percent of bollards were reported bright, which the authors read as indicating glare or a mismatch with the surroundings; and in commercial and industrial areas over a quarter of signs were reported as exceptionally bright.

The authors draw from that last figure a conclusion this comment makes at Part VI.J.6 and has not previously been able to attribute to anyone else: that the reported brightness of signs is consistent with earlier research finding signs often much brighter than is recommended or appropriate, and that this "may reflect a need to update regulations about glare as the existing guidelines predate the use of highly luminous LEDs by several decades."

What the project failed to do, which limits what the Foundation may take from it

The authors attempted to convert their inventory into a radiometric model, by fitting weights representing how much a single light of each type contributes to the radiance an overhead sensor records. They tried it against three datasets of increasing resolution: the satellite day-night band at 750 meters, a higher-resolution satellite at 10 meters, and aerial photographs at about one meter. It

failed in every case. The fitted parameters were unphysical, assigning larger weights to small signs than to large ones, and the authors report that regardless of what they tried the procedure never returned physically meaningful results.

Two consequences. The translation the paper does offer, that a German satellite pixel at midnight corresponds to about 219 lights per square kilometer per unit of radiance, plus or minus 11, is a bulk statistical relationship and not a physical model; it is country-specific, the same figure outside Germany being about 120; and it converts radiance into a count of lamps, not into any measure of what reaches a person. And the failure is itself evidence for the proposition this subsection advances. If a complete hand inventory of every visible light in a satellite pixel, combined with imagery at one-meter resolution, cannot be made to reproduce the radiance that pixel reports, then the radiance is not a characterization of the emission in any sense a performance standard could use.

A federal prediction, and what was measured afterwards

The Foundation separates the following because it concerns this Government and not a foreign one, and because it is the only item in this subsection that does.

The paper records that in 2017 a report of a Department of Energy national laboratory concluded that widespread conversion to light-emitting diode street lighting was likely to decrease skyglow. It then records what was measured over the period during which much of that conversion occurred, 2011 to 2022, which was an increase of roughly ten percent a year. The authors write that whether existing approaches failed because private lighting was neglected or for other reasons is an open question, but that it is "at least clear that existing policy results in increasing light growth."

The Foundation states four qualifications before it states the point. It has not read the 2017 report and takes its conclusion from this paper's description. The ten percent figure is not radiometry: it is derived from citizen-science observations of how many stars are visible to the unaided eye, converted to an equivalent rate of sky brightening, and it is in tension with the two percent a year that late-night satellite observation reports over a similar period — a discrepancy of a factor of five which these authors suggest may itself be explained by changes in the type, color and direction of lights active at different times of night. The conversion to light-emitting diodes was not the only thing that changed in those years. And a prediction that proves wrong is not thereby shown to have been unreasonable when made.

What survives all four is this. A national laboratory of the United States made a quantitative prediction in 2017 about an environmental consequence of a federal efficiency policy, Part IV.G describes that policy, the best available subsequent measurement points the other way by a large margin, and the Foundation is aware of no federal reassessment of the prediction. That is the same structure Part V.M describes in a British city and Part II.E describes in this Department: a quantified benefit asserted in advance, and not checked afterwards by the body that asserted it. Paragraph 360ii(a)(3) directs the Secretary to maintain liaison with and receive information from other Federal departments and agencies with related interests. This is such information, and the Foundation asks whether it was received.

What it does not establish

No health effect, and it addresses none. No radiometry whatever: a count is not a measurement of emission, and the apparent brightness categories are a participant's judgment, the authors noting that signs of twenty and of a hundred candelas per square meter would both likely be recorded as normal in a bright area. The composition findings are German and the authors say the radiance relationship appears specific to Germany. Areas with high-rise buildings and private industrial parks were not surveyed. Lights not visible from public space, in back yards, courtyards and on rooftops, were not counted, so the inventory undercounts. And the contribution of vehicle headlamps, which is the subject of Part VI.B, remains, in the authors' words, unknown.

Its place in this comment is accordingly narrow and, the Foundation submits, important. Paragraph 360ii(a)(4) directs the Secretary to study and evaluate emissions of, and conditions of exposure to, electronic product radiation. This is what the beginning of such a characterization looks like. It was performed by volunteers, in one country, over one autumn, at a cost the Foundation would guess to be a small fraction of a single federal study, and no American counterpart to it exists.

Two consequences follow, and the second is the one this comment turns on.

The literature can establish that exposure to artificial light at night is associated with disease. It cannot establish which light. The epidemiology is therefore capable of justifying concern and incapable, by itself, of specifying a remedy.

A performance standard must specify an emission characteristic. It must say what a product may emit, in what quantity, at what wavelengths, with what temporal structure. A body of evidence expressed entirely in photometric units cannot supply that specification, however large it becomes. Adding another cohort study in lux will not produce a number that a standard could use.

That is why the Foundation asks for study rather than for a standard, and why the two requests are not interchangeable. The gap between the existing literature and a prescribable standard is a measurement gap, and it will not close on its own. No individual research group can retrofit spectral exposure assessment onto a cohort recruited twenty years ago. A federal research program can specify spectral exposure assessment at the outset, and 21 U.S.C. § 360ii(a)(2) and (a)(4) direct the Secretary to conduct one. Parts IX.H.3 and IX.H.6.

The field's own verdict on its exposure assessment

The preceding paragraphs state a criticism of a body of scientific literature, and a criticism of that kind is worth more when it comes from inside the field than when it comes from a commenter. It comes from inside the field.

Palomar-Cros and others published in Science of the Total Environment in December 2024 a systematic review and meta-analysis of artificial light at night and cancer incidence across multiple cancer sites. The authors searched six databases, two trial registries and Google Scholar from inception to April 17, 2024, screened 9,835 records, and included 28 studies comprising 2,508,807 individuals. Twenty studies of breast cancer, covering 731,493 individuals, supported a quantitative synthesis. Higher outdoor artificial light at night was associated with breast cancer risk, with a pooled relative risk of 1.12 (95 percent confidence interval 1.03 to 1.23). The association for indoor light was positive but not statistically significant, 1.07 (0.95 to 1.21). Appendix C.14 sets out the review in full, including the findings for the other cancer sites and the reasons for caution.

The Foundation offers it here for the sentence with which the authors qualify their own principal finding. Having reported the association, they state that most of the included studies relied on satellite images of very low resolution, between one and five kilometers, drawn from the Defense Meteorological Satellite Program, and, in the authors' own words, "without information on color of light." They conclude that future studies with better exposure assessment are needed.

That is the proposition of this subsection, stated by the authors of the most comprehensive synthesis of this literature yet published, among whom are investigators of considerable standing in cancer epidemiology. The Foundation did not have to construct the argument. The field has reached the limit of what broadband satellite radiometry can tell it, and says so.

Two things follow, and the Foundation separates them carefully because they point in different directions.

The first is a caution against overreading the review. An instrument that carries no information about the color of light cannot distinguish a warm low-correlated-color-temperature source from a blue-rich one. It follows that this body of evidence, whatever it shows about the quantity of

outdoor light, is silent on the question this comment actually asks. It cannot be cited for any proposition about light-emitting diode products as against the sources they replaced, and the Foundation does not cite it for one. Twenty studies and 731,493 individuals do not answer the question of which light, because none of them measured it.

The second is what that silence costs. A performance standard under § 360kk must specify what a product may emit. The largest body of evidence bearing on artificial light and human health has been assembled from an instrument that cannot see the characteristic a standard would have to govern. That is not a reason to doubt the evidence. It is a reason to doubt that more of the same evidence will ever produce a prescribable number, which is what the Foundation has said throughout and what the authors of this review, in their own terms, confirm.

Read together with the study described in the next paragraphs, the pattern is consistent. Measured without regard to spectrum and at kilometer resolution, the association across twenty studies is 1.12. Measured with spectral weighting at thirty-meter resolution in a single study, within the subgroup reporting light entering the sleeping room, it is 1.53. The Foundation does not present those figures as comparable, because they are not: different populations, different designs, different exposure definitions, and the second arising in an exploratory subgroup. What the juxtaposition illustrates is the proposition that the choice of measurand is not neutral, and that the conventional choice is the one that discards the variable a standard would act upon.

One qualification is necessary, and it sharpens the point rather than softening it. A spectral metric does exist. The International Commission on Illumination has standardized melanopic equivalent daylight illuminance, which weights an exposure by the sensitivity of the retinal pathway that governs non-visual responses rather than by the photopic function. Quantitative recommendations expressed in that metric have been published: a melanopic equivalent daylight illuminance above 250 lux during the day, below 10 lux in the pre-sleep environment, and below 1 lux in the sleep environment.

So the instrument exists and the thresholds have been proposed. What has not happened is the application of either to the large cohorts in which health outcomes are actually measured. The studies at Appendices C.2, C.4 and C.5 report photopic lux, satellite radiance and illuminance respectively, and none reports a melanopic quantity. The expert consensus described at Part V.L identifies this as one of its nine gaps, under the heading of inconsistent exposure descriptors and metrics, and reports that real-world exposure data indicate both daytime and pre-sleep exposure fall largely outside the published recommendations.

That is a more precise statement of the difficulty than the absence of a metric would be, and a worse one for the present position. The field is not waiting for someone to invent a way of expressing spectral exposure. It has one. What is absent is the infrastructure to apply it at population scale, and the coordination that would require.

The one study that resolved wavelength, and what happened when it did

The claim in the preceding paragraphs requires one further qualification, and it is the most important fact in this subsection. Wavelength-resolved exposure assessment has been attempted in a human health study. It was done once, recently, and it changed the answer.

Quinn and others, publishing in Environment International in November 2025, pooled two cohorts comprising 24,793 women with 674 breast cancer cases. Rather than using the conventional broadband satellite product, they estimated outdoor light at residential addresses from photographs taken from the International Space Station, at approximately 30-meter resolution. Because those photographs carry color information, the investigators were able to derive three distinct exposure measures: average visual radiance, which is brightness in the conventional sense; a melatonin suppression index, which weights the light by the extent to which its spectral composition suppresses melatonin; and the product of the two, which they term average impact.

The result is the point. No statistically significant association was observed in the overall study population on any measure. Among women who reported light entering their rooms while sleeping, the spectrally weighted measure was significantly associated with breast cancer overall and across each subtype examined, with those in the highest tertile of average impact carrying a 1.53-fold hazard against the lowest (95% CI 1.18 to 1.98). The authors conclude that both intensity and wavelength of light should be considered when evaluating exposure to artificial light at night.

The Foundation is careful about what that demonstrates, because the positive finding arises in a subgroup and the authors describe that analysis as exploratory. A subgroup result among several exposure measures and several disease subtypes is not a secure finding, and Appendix C.7 sets out the reasons for caution at length. The Foundation does not assert that light at night at the levels studied causes breast cancer.

What the study does establish does not depend on the subgroup finding replicating, and it is this. A spectrally weighted exposure measure can be constructed from available data. It has been constructed. And in the one study that constructed one, the choice of measurand was not neutral: brightness and spectral weighting did not return the same answer. That is an empirical demonstration of the proposition this subsection advances, and it comes from the literature rather than from the Foundation.

The conclusion the Foundation draws is accordingly narrow and, it submits, difficult to resist. Nearly the whole of the epidemiology measures light in units that discard the information about spectral composition. The one study that retained that information found that retaining it mattered. Whether its particular finding survives replication is exactly the sort of question that 21 U.S.C. § 360ii(a)(2) directs the Secretary to support research upon, and § 360ii(a)(4) directs the Secretary to study and evaluate.

The same limitation in the laboratory literature, and an audit of which studies escape it

The preceding paragraphs concern the epidemiological literature, where exposure is assessed by satellite radiance, by a worn sensor or by a meter in a room. The same limitation appears in the laboratory literature, by a different route, and the Foundation states it as a characteristic of the evidence base rather than as a criticism of the investigators. A cell-biology or animal study is designed to establish whether a mechanism operates. It is not designed to establish an exposure-response relationship, and its exposure is therefore reported to whatever precision the experiment required rather than to the precision a standard would require.

Two quantities are needed before any reported exposure can be compared with a limit of the kind described at Part V.C.2: the spectral distribution, and a level in radiometric units or in photometric units together with enough spectral information to convert. Either one alone is insufficient, and the insufficiency is not marginal. Because the photopic weighting function is small and steeply varying across the short wavelengths, a level reported in lux for a source whose spectrum is not given cannot be converted into the blue-light weighted quantity the framework uses, and the error in assuming otherwise runs to one or two orders of magnitude. Appendix C.66 records a worked instance.

The Foundation has audited the studies collected during the preparation of the retinal subsections of this Part, and reports the result in both directions. Among those studies, the following report exposure in terms from which the blue content can be recovered:

- C.63 – spectral distributions for a white phosphor-converted source and for monochromatic blue, green and red arms, with the exposure apparatus built and characterized by a national building science laboratory.
- C.65 – a single stated wavelength of 470 nanometers with a stated illuminance, which permits conversion because the source is substantially monochromatic.

C.60 – exposure in radiometric units at a stated wavelength, for both the environmental measurement and the applied dose.

C.59 – spectroradiometric measurement performed under the procedure of the governing standard, with the aperture and integration time stated.

C.62 – luminance in candelas per square meter with correlated color temperatures stated for each condition.

C.69 – irradiance in milliwatts per square centimeter at a stated peak wavelength, with photon flux density also given, and with the control arm matched on irradiance and differing only in spectrum. The best-specified exposure in this group.

C.75 – retinal radiant exposure dose in joules per square centimeter, computed from the measured radiance of the source with the ocular transmittance of the animal taken into account, together with the source luminance and radiance and a named commercial lamp model. This is the only exposure in the appendix reported in the same unit as the exposure limit, and it is therefore the only one that can be placed directly against it. The computation depends on an assumed pupil diameter, which the entry discusses.

C.76 – corneal irradiance in microwatts per square centimeter measured at the exposure position for each of three monochromatic arms matched to within one percent of each other, with the peak wavelength of each stated, the spectral power distribution of the white source characterized, the control irradiance given, and a dedicated author responsible for the photometry and radiometry. The best-characterized exposure in the appendix. It is radiometric and wavelength-resolved, so the blue content is recoverable; the paper does not itself convert to retinal dose or compare against the exposure limit.

C.70 – illuminance with correlated color temperature and manufacturer part numbers for every lamp, which is more than most studies give and still not sufficient on its own; the spectral power distributions exist but are in a supplementary figure the Foundation has not obtained. Classified here as recoverable in principle and not yet recovered.

The following do not:

C.61 – a stated wavelength with no irradiance reported anywhere in the paper, the illumination having been the imaging light of a microscope rather than a designed exposure.

C.66 – illuminance in lux at three levels, with the peak wavelength of the diodes not stated. This is the combination from which nothing can be recovered.

C.68 – neither quantity available to the Foundation, the article being closed access with no accessible version and the abstract reporting no exposure conditions.

The division is not a ranking of the studies by quality. Two of the three in the second group are published in journals of standing and one reports a mechanism established through genetic and pharmacological interruption. The division is a ranking by one property only: whether the reported exposure can be placed against a numerical limit. That property is what a standard-setting record requires and what the present literature, taken as a whole, does not supply.

The same inconsistency has been identified from within the field. The review at Appendix C.67, surveying the human clinical literature, reports that research groups have defined the mesopic condition anywhere from 0.1 to 50 lux and that the wavelength and stimulus duration used for experimental exposure vary between studies, and gives that inconsistency as among the reasons the literature is difficult to interpret. A body of work whose exposure specifications differ by more than two orders of magnitude between laboratories cannot be synthesized into a dose-response relationship, however many studies it contains.

The Foundation draws the conclusion that bears on the request made in this comment. The absence of a standardized exposure specification is not only a limitation of the literature; it is a

function the Secretary's authority under 21 U.S.C. § 360ii(a) exists to perform. Paragraph (a)(2) directs the planning and conduct of research and testing relating to electronic product radiation, and paragraph (a)(4) the study and evaluation of emissions and conditions of exposure. A specification of how optical exposure is to be characterized and reported, issued or adopted federally, would make the next decade of this literature comparable in a way that the last two decades are not. That is a request for study and for a reporting convention, and it is a smaller request than a performance standard.

The field's own verdict on its unit of measurement, which is more specific than the verdict above

The verdict just quoted, from the cancer meta-analysis, concerns the resolution of one instrument and its blindness to color. There is a second, published in 2022, and it concerns the unit itself. It appears in a box of its own in a review of artificial light in marine ecosystems by ten authors, described at Appendix D.7 and taken up at Part V.I, and the box is headed "Challenges in measuring artificial light in biological studies."

The Foundation quotes it at length because paraphrase would weaken it and because what it says is what this subsection says. On the state of the practice:

> "Measuring light for ecological studies is still undefined and is poorly understood by biologists who have used a wide range of techniques and instruments to measure light at scales ranging from a few centimeters to tens of kilometers. The wide range of instruments employed typically use different measurement systems and units, which means study results cannot be confidently compared. There is currently no globally recognized standard method, or agreed unit of measurement, for monitoring biologically active light…"

On the instrument in general use:

> "Commercial lux meters only quantify light that is within the CIE curve … and exclude light wavelengths that fall outside of the CIE curve."
>
> "Photometric detectors have reduced sensitivity to wavelengths below 450 nm (blue light) or above 650 nm (red light). Consequently, photometric instruments commonly used to quantify light in biological studies, such as lux meters, do not account for the blue light that is most visible to biological receptors."

And on where the instrument came from:

> "Lux meters are further limited in that they were designed for use in measuring light in buildings, have poor sensitivity to low light levels and cannot detect sky glow or dim light in a field setting. Finally, they do not provide any spectral information…"

Four propositions are stated there, and each of the four is a proposition this comment reached from its own reasoning before it had this source. That the photopic weighting discards the short wavelengths at issue. That the units in use are not commensurable across studies, so the results cannot be pooled, which is what the audit immediately above found by a different route. That the instrument on which this literature depends was designed for architectural use and is unsuited to field measurement at low levels. And that there is no agreed unit for the quantity. The Foundation did not construct any of the four, and it does not need to be believed about them.

The demonstration inside the document, which the Foundation reports as a characteristic of the field and not as a fault of the authors

The review then demonstrates its own proposition, in a way its authors cannot have intended and which the Foundation reports because it is the clearest illustration in this comment of why the measurement has to be performed by someone with the authority to standardize it. Having stated in a box that lux cannot measure biologically active light, that photometric detectors are insensitive below 450 nanometers, and that no agreed unit exists, the review reports the exposure of essentially every study it collects in lux. Two hundred lux, one hundred and twenty, one hundred, ninety-seven

down to eleven, eighty, seventy, sixty, fifty down to forty, forty down to thirty, thirty, twenty-seven, twenty, fifteen, five, four and three tenths, two tenths, one tenth. Across the whole review the Foundation counts two exposures reported in radiometric or quantum terms, and both are in the pelagic sections: an irradiance of eleven to eighteen microwatts per square centimeter in the avoidance experiment, and a surface measurement of 2.2 micromoles of photons per square meter per second from shipboard lighting.

That is not a criticism of these authors, and the Foundation states why in the same terms it used about the satellite product. The investigators whose work the review collects reported what their instruments gave them, and the instrument in general use gives lux. The review's own box explains the reason: there is no agreed unit. A field cannot report in a unit that does not exist. The shortfall is therefore not a shortfall of diligence on anyone's part. It is the absence of a standard, and the establishment of measurement standards for an emission of this kind is the thing that 21 U.S.C. § 360ii(a)(4) directs the Secretary to do and that § 360kk requires before any emission limit can be written at all.

The review asks for it, in terms the Foundation adopts without alteration. Among the questions it lists for future research is this:

> "What are the best practice techniques to monitor and measure biologically meaningful (i.e., radiometric as opposed to photometric) light, both underwater and on land, at both fine (meters) and broad (kilometers) scales?"

The parenthesis is the authors'. Radiometric as opposed to photometric is the distinction Part V.J.5 draws and the distinction on which the requests at Part IX depend. One further question of theirs belongs beside it:

> "What are the thresholds (intensity, wavelength, exposure time) that elicit biological responses in marine species?"

Intensity, wavelength and exposure time are three of the four emission characteristics Part IX asks to have characterized. The fourth, the spatial distribution of the emission, this review addresses as a design recommendation rather than as a research question. The Foundation adds nothing to any of this. The consequence is the one already drawn twice in this subsection and is not drawn a third time.

The document that review points to, which is a national government's attempt at the answer, and what it found

The research question quoted immediately above asks what the best practice techniques are for measuring biologically meaningful light. The review that asks it cites, for a fuller treatment, a document of the Commonwealth of Australia. The Foundation recorded that document as an acquisition target of the first rank and has now obtained it. Department of Climate Change, Energy, the Environment and Water, National Light Pollution Guidelines for Wildlife, version 2.0, May 2023, Canberra. Described at Appendix D.1. It is published under a Creative Commons Attribution 4.0 International license and costs nothing, which bears on a contrast drawn at Part V.I. Its technical appendices were drafted by practitioners in this field, and among the named technical reviewers are two investigators who appear elsewhere in this comment.

What makes this document different from everything else collected in this subsection is its purpose. The eleven instances above are investigators noting a limitation in their own methods. This is a national government instructing the people who will do the measuring. It therefore does not merely concede the limitation. It surveys the available instruments one by one, states what each can and cannot do, tabulates the answers, and recommends against the two instruments on which almost all of the literature in Appendix C depends.

On the satellite products, which supply the exposure variable in fourteen entries of Appendix C, the guidelines state that maps derived from satellite-collected information have limited value in

quantifying light for wildlife; that the images measure light after it has passed through the atmosphere and been subject to scattering and absorption, and do not give an accurate representation of the light visible at ground level; that annual composite images are assembled from images collected under different atmospheric conditions and so cannot be used to quantify light confidently within or between years; and, in terms this comment has had to establish for itself from instrument specifications, that "the most commonly used instrument (VIIRS DNB) is not sensitive to blue light, so light in this part of the spectrum is undersampled." The recommendation that follows is not a caveat. It is that remote sensing products are "currently not an appropriate approach for measuring light as part of a wildlife monitoring program, as they do not accurately quantify light as observed from the ground, they underestimate the blue content of light, and results are not repeatable due to environmental conditions."

On the lux meter, which is the instrument of the terrestrial literature as the satellite is of the remote-sensing literature, the conclusion is the same and is expressed as a prohibition rather than a qualification. "Commercial lux and luminance meters are not appropriate for the measurement of light in wildlife monitoring programs, because they have low sensitivity and low accuracy at low light levels." The guidelines add that more expensive tailored devices do not cure the defect, because the objection is not to the quality of the instrument but to the quantity it measures.

On the sky quality meter, which is the instrument of the dark-sky measurement community and the source of most of the night-sky brightness figures in public circulation, the guidelines report two things the Foundation had not previously established and would not have asserted without a source. The first is that the instrument does not do what it is designed to do: "Although the SQM is designed to have a photopic response, it is generally more sensitive to shorter wavelengths (that is, blue) than a truly photopic response, but this will depend on the individual instrument." The second is a calibration result. Instrument accuracy is reported by its maker at about ten percent, but a calibration study of a group of these instruments found errors ranging from negative sixteen percent to positive twenty percent, and the guidelines state that the long-term stability of these meters has not been established. An instrument whose spectral response varies by unit and whose error spans thirty-six percentage points across units is not a basis for a national criterion, and the Foundation says so about an instrument that its own allies in this field rely on.

And on the American unit, in the glossary, in one sentence: the footcandle "is not appropriate for understanding how animals perceive light." Part VI.J.6 records that the only operative American brightness criterion the Foundation can identify for digital billboards is expressed in footcandles above ambient.

The table, which the Foundation reproduces in words because it is the most compact statement of this subsection's thesis that exists anywhere

The guidelines tabulate eight measurement techniques against ten attributes. The account that follows is taken from the formatted table in the published document and not from a reading of running text. One column is headed by the question whether the instrument measures biologically relevant light. For satellite imagery the entry is no. For the sky quality meter the entry is no, with a footnote recording some sensitivity to short blue wavelengths and none to long orange and red ones. For the telephone application the entry is no. For the lux meter the entry is no. For the three imaging systems — the all-sky transmission monitor, the digital camera with a fish-eye lens, and the National Park Service all-sky mosaic — the entry in each case is that calibration is required. For one instrument, a field spectroradiometer built to detect aerosols at night, the entry is yes.

Two further columns complete the picture and the Foundation sets them out because each disposes of an answer that might otherwise be made. The first is the column asking whether the instrument is commercially available. For the one instrument that measures the relevant quantity, the entry is no; the running text adds that the prototype is no longer in operation. So the instrument that can do the job cannot be bought, and the question is not one of budget: the table prices it at seven thousand dollars, against twenty thousand for an all-sky mosaic that cannot do the job without calibration. The second is the column asking whether the instrument detects skyglow at all. For the lux meter the

entry is no. The instrument that supplies the exposure figure in most of the terrestrial literature in Appendix C is recorded by this government as unable to detect the phenomenon and as not measuring the right quantity when it does measure.

One entry in that table bears directly on an appendix entry in this comment. Satellite imagery is recorded as detecting skyglow, with a two-word footnote attached to that entry: “Via modelling.” Appendix C.145 takes as its exposure variable a published atlas of night sky brightness modeled from satellite radiance, and Part V.J.4 records that entry as a refinement of the satellite category rather than a plain instance of it because the modeling step is added to the instrument limitation. The Australian table makes the same distinction in a footnote of four words.

Of eight techniques surveyed by a national government, four cannot measure the quantity at issue, three can do so only if separately calibrated by a specialist for each deployment, and the one that does it directly cannot be purchased and is no longer running. That is the state of the measurement art as a government found it in 2023, and it is stated twice in the document in general terms: “There is currently no globally recognised standard method for monitoring light for wildlife,” and “Currently there are no generally agreed methods for measuring biologically relevant light for wildlife or for quantifying skyglow.” The table itself is not original to the guidelines; it is modified from a published review, which is recorded here because the proposition is therefore not one government’s view of the field but the field’s view of itself, adopted by a government.

The guidelines also state what a method would have to do, and the Foundation sets the specification out because it is the closest thing to drafting language that exists for the request at Part IX. A method should be reasonably priced, repeatable, accessible and deployable; should capture the whole visual field to which the subject may be exposed, generally horizon to horizon; should be “capable of quantifying all wavelengths of light equally (radiometric), including at least 380 nm to 780 nm, or capable of being calibrated over the range of wavelengths of relevance for the species of interest”; should be sensitive enough to detect change at the low levels that skyglow represents; and should distinguish individual point sources locally from skyglow across tens of kilometers. Every element of that specification is within the competence paragraph 360ii(a)(5) confers, and none of it has been performed by any agency of the United States.

On modeling, the guidelines are equally direct and the Foundation records it because Part V.J.1 discusses the substitution of models for measurement. Most commercially available light modeling software is weighted to the photopic curve and therefore does not account for the wavelengths to which most wildlife is sensitive; a second class of limitation is the inability of such models to carry atmospheric conditions, topography, other light sources, luminaire spectra and viewing geometry, which the guidelines say would require a complexity science and technology have not yet delivered.

And the sentence in that document which is the most serious thing said anywhere in this comment against what the Foundation asks for

The Foundation places it here, in the subsection that relies on this document most heavily, rather than in a part of the comment where it would be less noticed. Having set out the problem the preceding paragraphs describe, the Australian guidelines decline to solve it in the way this comment asks the Secretary to solve it. In their introduction: “It is not possible to set prescriptive limits on lighting. Instead, these guidelines take an outcomes approach to assessing and mitigating the effect of artificial light on wildlife.” And in the appendix on modeling: “it is not possible to objectively estimate how much artificial light is going to cause an impact on a particular species, or age class, over a given distance and under variable environmental conditions.”

That is the second time in this Part that the people who do this work have said that the thing the Foundation asks for cannot be done. The first is recorded at Part V.I, where the marine review endorses guidelines recommending a case-by-case approach on the express ground that assessment trigger values are difficult to set. The Foundation does not argue either of them away, and a comment that buried them would deserve to be discounted entire. It states three distinctions and then states what survives them.

The first distinction is the subject. These guidelines govern the assessment of individual developments against listed species under a national environmental statute, across a continent, for taxa ranging from marine turtles to bats to ecological communities. A prescriptive limit in that setting would have to be a single number good for every species in every habitat, and the Foundation agrees that no such number exists. Section 360kk authorizes something different: a performance standard on the emission of an electronic product, which is a statement about what a manufactured article may emit and not a statement about what any organism can tolerate.

The second distinction is the one the document itself draws by its conduct, and it is the Foundation's principal answer. This document declines to prescribe a biological threshold and prescribes a great deal about the emission. It directs that a lighting design include spectral power distribution curves for all planned lighting types. It specifies what a measurement method must be capable of, down to a wavelength range. It tabulates, for five separate taxa, which commercial luminaire types are less disruptive and which are to be avoided. It records a filtered sodium source defined by the exclusion of wavelengths below a stated figure. It states that correlated color temperature does not disclose the blue content of a lamp and that "The only way to determine whether the spectral content of a light source is appropriate for use near sensitive wildlife is to consider the spectral curve." Every one of those is a prescription about the emitting article rather than about the receptor. That is the architecture of Part IX and it is the architecture of the first limb of paragraph 360ii(a)(2): a duty to minimize radiation that serves no purpose does not wait upon proof that the radiation is harmful.

The third distinction is narrow and the Foundation does not lean on it. The guidelines were written to be administered by assessors examining particular projects, and an outcomes approach is what such a reader can use. A performance standard is written for a manufacturer and is a different instrument addressed to a different person.

What survives the three is real and the Foundation states it without softening. The reason the guidelines give — that biological response varies by species, by location and by environmental conditions — is true of human beings as well, and Part V records variation by age, by ocular media, by photosensitive condition and by circadian phase. The Foundation's answer is the one it gives throughout and it is a choice rather than a refutation: a performance standard does not have to be set at the threshold of the most sensitive individual, any more than the performance standards already in 21 C.F.R. part 1040 are. It has to be set, published, and capable of being measured. The Australian document is the Foundation's best evidence that the measuring is the part nobody has done, and the Foundation notes that it took a national government and two years of revision to produce an outcomes approach, which is a larger undertaking than anything paragraph 360ii(a)(5) would require of the Secretary to produce a measurement method.

One further thing in the same document the Foundation declines, for completeness and because the pattern now has three instances. The guidelines state that short-wavelength light scatters more readily than long-wavelength light, contributing more to skyglow. Part II.D.4 declines that formulation on the authority of the people who measure skyglow, and the reasons are given there. The Foundation records that the simplified claim now appears in a peer-reviewed review, in a regional watershed memorandum in the United States, and in a national government guideline, which is the clearest demonstration it has that a proposition about the physics of this emission can propagate through official guidance without being checked. That is an argument for paragraph 360ii(a)(4) and not against this document.

5. Expressing optical exposure in the units used for radiofrequency exposure

This is the subsection that ties this Part to the notice, and the Foundation puts it as simply as the arithmetic allows.

Radiofrequency exposure limits are expressed in watts per square meter. Optical irradiance is expressed in watts per square meter. The quantities are the same quantity, and the instruments that measure them differ in spectral range rather than in kind.

Two consequences follow. A research program that reported optical exposure radiometrically, as Part IX.C.1 asks, would produce data directly comparable with the radiofrequency exposure literature this Department is assembling under this notice. And it would permit a single exposure framework across the non-ionizing spectrum, rather than two vocabularies that cannot be reconciled: one expressed in power per unit area and one expressed in units weighted to human brightness perception, which Part V.J.4 establishes is what the optical literature has largely used.

K. The Three Expert Assessments on Which Reliance Is Placed [RFI Q5]

Question 5 of the request for information asks what national and international frameworks federal health agencies should consider. For light-emitting diode products the practical answer is three documents, and this subsection sets out what each is, what each concluded, what condition each attached to its conclusion, and what each stated it could not conclude. The Foundation treats them together because they are the basis on which this question is presently taken to be settled, because the second cites the first, and because the first and second share an author.

The Foundation states first what it does not contend, because the contrary claim is available and the chronology forecloses it. It does not contend that these documents brought about the replacement of incandescent and halogen lighting by light-emitting diode products in the United States. That replacement was driven by the federal energy policy described at Part IV.G, beginning with the Energy Independence and Security Act of 2007, and by June 2018, when the earliest of the three was adopted, the transition was already far advanced, as the adoption figures at Part II.D.4 record. Neither of the first two bodies has authority over lighting policy in the United States in any event: one is an advisory committee of the European Commission and the other is a registered non-profit association. The Foundation imputes no motive to any author of any of the three.

What the Foundation contends concerns the present. These are the documents relied upon now, when the question is whether the subject warrants examination. The remainder of this subsection is therefore addressed to what they say, and principally to what they say about their own limits. Part V.A.2 records the weight the Foundation accords assessments of this kind: they establish what expert bodies have concluded and recommended, and they are evidence of the state of expert opinion rather than primary evidence of effect.

1. The three documents identified

a. The SCHEER Opinion, June 2018

Scientific Committee on Health, Environmental and Emerging Risks, Opinion on Potential risks to human health of Light Emitting Diodes (LEDs), adopted at the Committee's ninth plenary meeting on 5 and 6 June 2018 and cited by the Committee as of 6 June 2018. Published by the European Union, 2018; ISSN 2467-4559; ISBN 978-92-76-00197-3; doi 10.2875/605415. Ninety-two pages. The Committee is one of two non-food scientific committees advising the European Commission, and the Opinion was prepared in answer to four terms of reference put to it by the Commission, directed to the hazards of LED emission in the general population, the dose-response relationship, and the risks associated with LED displays and with LED lamps in the general population and in vulnerable and susceptible populations.

The Opinion names its working group. Of the Committee: Rodica Mariana Ion, Ana Proykova as Chair, and Theodoros Samaras. As external experts: Ellen Bruzell, Jean-François Doré, Massimo Nicolò, John O'Hagan as Rapporteur, Celia Sánchez-Ramos, and Linda van Kerkhof. The Opinion records no minority opinion. Declarations of interest are not reproduced in the document; it states that all declarations of working group members and supporting experts are available on a Commission webpage, which it identifies.

b. The ICNIRP statement, 2020

International Commission on Non-Ionizing Radiation Protection, Light-Emitting Diodes (LEDs): Implications for Safety, Health Physics, volume 118, number 5, pages 549 to 561, 2020. The Foundation identifies it as a statement rather than as guidelines, and the distinction matters: the Commission's exposure limits for incoherent optical radiation are a separate and earlier instrument, described at Part V.C.2, and this document does not amend them. Among the collaborators the statement names are Sharon A. Miller and John O'Hagan, the latter identified as of the Commission's Scientific Expert Group and of Public Health England. The statement cites the SCHEER Opinion described above.

c. The IEA 4E assessment, October 2024

Martinsons and others, Solid State Lighting: Review of Health Effects, published by the International Energy Agency's 4E Solid State Lighting Annex in October 2024. Part V.C.2.f treats this document where it bears on the exposure limit, Part V.C.4 where it bears on discomfort glare and Part V.D where it bears on temporal light modulation. This subsection is concerned only with its place among the three and with the chronology.

2. The chronology, and the authorship common to two of the three

The Foundation sets out the sequence and declines to characterize it.

From 2012 onward, as the 2024 assessment reports and as Part V.C.2.f quotes, several independent research teams reported retinal damage below the exposure limit of the International Commission on Non-Ionizing Radiation Protection, using more sensitive detection techniques and different animal models including rats and living macaques.

On 5 and 6 June 2018 the SCHEER adopted its Opinion. Its Rapporteur was John O'Hagan.

In 2020 the International Commission on Non-Ionizing Radiation Protection published its statement on light-emitting diodes. John O'Hagan is among the named collaborators. The statement cites the 2018 SCHEER Opinion.

On May 24, 2024 the Center for Devices and Radiological Health issued the Final Response described at Part II.A, disposing of four citizen petitions concerning visible light emitted by LED products.

In October 2024 the IEA 4E Solid State Lighting Annex published the review described above, which reports that there is currently no consensus between the lighting community and many retinal experts about the need to revise the exposure limit on which the two earlier documents rest.

Two further facts about the 2018 Opinion belong in this sequence, and the Foundation states them as facts about the document rather than as criticism of any person. The Opinion relies on work of its own Rapporteur for substantive content. Its conclusion about exposure from screens is attributed in terms: O'Hagan and others, 2016, assessed emissions from various screens and concluded that exposure levels were below ten percent of the relevant limit. Figure 3 of the Opinion, comparing the emission spectra of a sixty-watt incandescent lamp and an equivalent-lumen LED lamp, is attributed to the same 2016 work. Figures 10 and 11, showing the temporal modulation of a domestic LED installation and the spectra of LED lighting in a kitchen, are attributed to John O'Hagan, 2017, and no publication is given for them.

The Foundation draws no inference from that and asks the Department to draw none. Rapporteurs are appointed for their expertise in the subject, and an expert's own measurements are an ordinary reason to appoint one. The facts are stated because the three documents are put forward as independent corroboration of one another, and the Department should know that the first and second share a contributor and that the first relies in part on that contributor's own unpublished measurements.

3. The condition attached to the safety conclusion, and what the condition rests on

The SCHEER conclusion is stated three times in the Opinion and is conditioned in each. In the abstract:

> "The Committee concluded that there is no evidence of direct adverse health effects from LEDs emission in normal use (lamps and displays) by the general healthy population."

In answer to the first term of reference:

> "The SCHEER concludes that the available scientific research does not provide evidence for health hazards associated with LEDs when the total exposure is below the ICNIRP exposure limits. However, reversible biological effects in terms of flicker, dazzle, distraction and glare may occur."

And in answer to the second:

> "If the exposure is below ICNIRP exposure limits, the SCHEER is not aware of any risk of damage to the eye and skin."

The Opinion then states what those limits are derived from, and the Foundation asks the Department to read this sentence against the three above:

> "The ICNIRP guidelines are based on observed eye or skin injury after experimental exposure of primates and rodents, and on information from human accidents. Reduction factors are used in setting the exposure limits for humans when animal studies are used."

The limits are constructed from observed injury in acute exposures of animals and from human accidents. The Opinion elsewhere states, in its identification of research needs:

> "In general there is a lack of knowledge regarding the injury threshold for effects from long term chronic exposure."

The Foundation states the consequence without embellishment. The safety conclusion of the 2018 Opinion is that the research does not evidence hazard below a limit, where the limit was constructed from acute injury and where the same document records that the chronic injury threshold is not known. That is not an error of reasoning and the Foundation does not call it one. It is a conclusion about a question narrower than the one the Department is now asking. A finding of no evidence of hazard below an acute-injury limit is not a finding about chronic exposure, and the Opinion does not claim otherwise.

The 2024 assessment then reports, as Part V.C.2.f sets out, that the limit itself has been contradicted in the published literature since 2012 and that no consensus exists on revising it. The Foundation does not assert that the limit is wrong, which it is not competent to determine. It asserts that a conclusion conditioned on a limit is worth what the limit is worth, and that whether this limit is settled is a question on which the most recent of the three documents reports there to be no consensus.

One further matter belongs to this subsection, and the Foundation places it here because it bears on the condition rather than on the conclusion. The Opinion states that reversible biological effects in terms of flicker, dazzle, distraction and glare may occur, and states separately that it is not aware of any risk of damage to the eye and skin where exposure is below the limits. Both statements may be true together. The question the Foundation asks the Department to consider is how far apart they are.

That distance has been measured, for a different emitting technology, by the research community that regulates it. Appendix C.87 and Part V.C.3 describe exposure limits for visual impairment derived from human subject experiments by authors at the United Kingdom defence research laboratory and the United States Air Force, and proposed for incorporation into international laser safety standards. Those limits are expressed in the same units as the injury limits and can

therefore be set directly against them. At night, an exposure sufficient to obscure 40 degrees of the visual field sits about one thousand seven hundred times below the injury limit for a ten-second exposure, and the mildest impairment the framework recognizes sits about one millionth of the way to it. The ratios are the Foundation's arithmetic on published values and the underlying numbers are set out at Appendix C.87.

The Foundation draws no conclusion about light-emitting diodes from laser values and does not invite one. The inference it does draw concerns the structure of the condition. Where a safety conclusion is conditioned on exposure below a limit, and the limit is constructed from observed injury, the conclusion carries no information about effects that occur far below that limit. The Opinion names four such effects in the same sentence as the condition. For the one emitting technology where the distance between the injury limit and the onset of impairment has been quantified, the distance is three orders of magnitude in darkness. The Foundation does not assert that the distance is the same here. It asserts that nobody has measured it here, that the Opinion's own sentence indicates it is not zero, and that measuring it is precisely the study paragraph 360ii(a)(4) directs.

4. What the 2018 Opinion states it could not conclude

The Foundation sets out the following in the Opinion's own words, because each corresponds to a request made in this comment and because the correspondence is closer than the Foundation would have dared to assert on its own authority.

> "The search of the literature for long-term impact of LED emission on human health did not identify studies investigating the healthy general population." The headline conclusion is that there is no evidence of adverse health effects in the general healthy population. The literature search found no studies of that population. Part V.A.2 makes the same point about the determination of May 24, 2024 and about the finding that the quality of the evidence was low.

> "Although there are no reliable data to be used for risk assessment of eye-safety of life-time usage of LED light sources, there might be some concern on the potential negative consequences of LED emissions particularly in a susceptible population which already present early signs of pathologic senescence of the macula."

> "There is insufficient knowledge about the actual exposure of people to optical radiation from LED sources and the total exposure from all optical radiation sources – information about the exposure of the general healthy population is needed for assessing the potential health effects." That is the baseline the Foundation requests at Part II.D.6 and again at Part IX.C, and the absence Part V.J describes.

> "Cumulative exposure over a twenty-four hour time period should be considered, and further research should be done into the reported effects of long-term, low-level exposure on age-related macular degeneration." Part V.C.2.c and Part V.C.2.d describe the absence of any cumulative framework for this waveband. The Opinion recommends the thing the Foundation says has not been done.

> "Reliable information on the dose-response relationship for adverse health effects for the healthy general public is not available in the scientific literature for all wavelengths emitted by LED devices." And, on the possibility of supplying one: "Since LED emission characteristics like exposure patterns and spectra (wavelength-dependent intensity) vary from one emitter to another, it is not possible to predict the profile of the dose-response function for a general LED emitter." The Foundation draws attention to the reason given. It is the variability of the products, which is a fact about what is in commerce and is the subject of the characterization request at Part IX.C.

> And the statement that sits least comfortably beside the conclusion, in the same answer to the same term of reference: "Animal experiments and in vitro studies suggest that cumulative

blue light exposure below the levels causing acute effects can also induce photochemical retinal damage."

The Foundation is careful with the last of those. The Opinion elsewhere discounts that body of work, stating that the conclusions of the cellular and animal studies "derive from results obtained either using exposure conditions that are difficult to relate to human exposures or using exposure levels greater than those likely to be achieved with LED lighting systems in practice." That is a fair criticism and it is the same criticism the Foundation makes of its own appendix at Part V.A.2, paragraph on mechanistic and in vitro studies. The Foundation does not offer the sentence as establishing that cumulative exposure at ordinary levels damages the retina. It offers it as the Committee's own statement that the mechanism is not confined to acute exposure, which is the premise of the research request rather than of a finding.

5. What the 2018 Opinion states that bears on a performance standard

Four passages in the Opinion bear on the statutory questions in Part II rather than on the science, and the Foundation brings them forward because they are findings of an expert body about products in commerce.

On temporal light modulation: "There appear to be no technical reasons why LED lamps need to produce time-modulate emissions, since many models do not." Section 360kk(a)(2) directs that a performance standard be technically achievable. A finding that there is no technical reason for a characteristic, because products without it are already on the market, is a finding of technical achievability in substance if not in those words. Part II.G.3 and Part V.D.

On the purchaser's ability to avoid it: "It is not possible for consumers to identify which LED lamps exhibit TLM and which do not at the point of purchase." The Opinion adds that some LED lamps have modulation of almost one hundred percent, and that "A small number of people report adverse health effects such as migraine or headaches." Part V.E.2 addresses that population. The disclosure point bears on Part IX.

On luminaire design: "Some sources available on the market incorporate 'point' LED sources without diffusers, which can cause glare if viewed. This was also reported to be a concern with some LED street lights." Part V.B.2 sets out why the presence or absence of a diffuser governs the radiance of a product and therefore the irradiance delivered to the retina, and why enlarging the emitting aperture is the available remedy.

On vehicle lighting, where the Committee uses its own voice: "The SCHEER is concerned about the high luminance sources used on some vehicles, particularly daylight running LED lights that remain on without dimming at night. Current examples appear to be blue-rich, which increases glare and scattering, particularly for older observers. These running lights are a greater glare source in fog than more traditional vehicle lighting." Part VI.B and the citizen petitions described at Part IV concern vehicle lighting. The Foundation notes that the reduction of intensity at night is among the available techniques listed at Part II.G.3.

One further passage identifies a regulatory gap in terms: "There is a European standard for electronic toys that limits the emission of optical radiation from toys" but "The standard does not take into account a product that is not a toy, which may be given to a child to use (for example smartphones or tablets)." The Foundation offers that as an illustration of the point made at Part II.C: a standard addressed to a product category leaves uncovered the same emission from a product outside the category.

That passage can now be taken further than the Opinion took it, and the Foundation does so because the Opinion's criticism turns out to understate the position. The Committee treated the existence of the toy standard as settled and identified the gap as one of scope: the standard does

not reach a product that is not a toy but is given to a child. That is a sound observation. It is not the whole of the problem.

In July 2026 the results of a three-year market surveillance campaign under that standard were published. Of fifty toys purchased anonymously from French retailers and tested by accredited laboratories, thirty percent contained at least one light-emitting diode that failed the eye safety limits of the standard, and approximately eighty-seven percent of the failures were failures of the blue light hazard limit. Appendix C.59 and Part V.C.2.k. One of the authors of the 2024 intergovernmental review described at subsection 1, and one of the external experts of the 2012 predecessor Opinion described at subsection 9, are among the authors of that study.

The Foundation draws a narrow conclusion and states its limits. The study concerns the French market and a European standard that has no application in the United States, and its sample was not statistically representative. It does not establish a non-compliance rate anywhere, and the Foundation asserts none. What it establishes is that the existence of a standard addressed to a product category is not the same thing as compliance by the products in that category, and that where a national authority has looked, it has found a substantial proportion of marketed products exceeding the limits. A comment that relied on the presence of a standard as evidence of safety would be relying on the wrong fact, and so would a determination that did the same.

6. Two statements in the Opinion that tell against the Foundation

The Foundation brings forward the two passages most adverse to its position, because a reviewer will find them and because each admits of an answer.

The first is a comparison with the lamp the light-emitting diode replaced. Having reported that the blue-light-weighted radiance from screens is below ten percent of the photochemical retinal hazard limit, the Opinion adds: “For a comparison, 14% of that limit corresponds to a mid-range incandescent lamp.” On that measure a screen is less hazardous than an incandescent lamp, and the Opinion states elsewhere that for the same color temperature the blue component of an LED lamp is similar to that of an incandescent lamp.

The Foundation accepts the figures and disputes what follows from them. The quantity compared is the blue-light hazard weighted radiance, which is an acute photochemical injury metric built on the weighting function described at Part V.C.2.a. A comparison expressed in that quantity establishes that neither source approaches the acute injury threshold. It establishes nothing about circadian response, for which the relevant weighting is the melanopic one described at Part V.F; nothing about discomfort or disability glare, for which the relevant quantity is luminance and the relevant variable is the geometry treated at Part V.B.2; nothing about temporal modulation, which an incandescent filament does not produce at the depths recorded for some LED lamps; and nothing about the long-wavelength content that Part V.B.6 identifies and that the Opinion itself raises when it notes that the infrared and possibly ultraviolet emission of an LED lamp “may be greatly reduced or absent (in comparison with other types of lamps), which might influence (positively or negatively) the normal human physiology.”

The second adverse passage is broader: “For many people, exposure to natural optical radiation will predominate, i.e. exposure to optical radiation from LEDs is likely to be insignificant compared with the exposure to natural light outdoors.”

One measurement bears on that passage and the Foundation brings it forward because it is the only quantification of the comparison the Foundation has located. The study at Appendix C.63 reports that the French agency for food, environmental and occupational health safety, in a 2019 report on new lighting technologies, carried out measurements in real-life conditions and concluded that artificial lighting adds up to 50 percent of the phototoxic dose received from natural lighting, rising to 200 percent where only cool light-emitting diode sources are used, with screens among the largest artificial contributors.

If those figures hold, the Opinion's characterization does not. An increment of half the natural dose is not insignificant, and a doubling is not an increment at all. The Foundation states the qualification with the figure: it has not obtained the 2019 report, the figures are taken at second hand from a paper citing it, the measurements are French, and the comparison is of phototoxic dose weighted by the hazard function whose adequacy Part V.C.2.f questions. The report must be obtained and read before the comparison is filed. But the Foundation records now that a national health agency appears to have made the measurement that the Opinion's sentence assumes the answer to, and to have reached the opposite conclusion.

The Foundation accepts that as to total daily radiant exposure and denies its relevance to the questions this comment raises. The proposition is about aggregate dose. The circadian argument at Part V.F is not about aggregate dose but about light at a time of day when the natural stimulus is absent, and the Opinion concedes that point separately when it states that normal use of LEDs or LED-illuminated screens in the evening can perturb the circadian system. The glare and discomfort argument at Part V.C.4 is about the luminance of a source in the field of view against a given background, not about how much light the person received that day. And the exposure that matters for the photophobic population described at Part V.E.2 is the exposure present, not the exposure summed. Sunlight is a large quantity of light that almost no one looks at directly; the products at issue are smaller quantities of light arranged to be looked at.

7. What the three documents establish, and what they do not

The Foundation states its position on the three as a whole.

They establish that expert bodies have examined the question and have not found evidence of adverse health effects from LED products in normal use by the general healthy population at exposures below the international limits. The Foundation does not dispute that and does not ask the Department to disregard it.

They do not establish that such effects are absent, and none of them says they are. The 2018 Opinion says the literature search identified no studies of the population about which it concluded, that no reliable data exist for lifetime eye-safety assessment, that the actual exposure of people is insufficiently known, and that the chronic injury threshold is not known. The 2024 assessment says there is no consensus on whether the limit the conclusion is conditioned on requires revision.

They are European and intergovernmental documents. None of them is a performance standard, none has force of law in the United States, and none purports to discharge any duty of the Secretary. Part I.E records their status in the framework table.

The use the Foundation makes of them is accordingly narrow and, it submits, difficult to resist. Each of the three identifies, in its own words, research that has not been performed and measurement that has not been made. Paragraph 360ii(a)(2) directs the Secretary to plan, conduct, coordinate and support research to minimize exposure to unnecessary electronic product radiation, and paragraph 360ii(a)(4) to study and evaluate emissions and conditions of exposure. The three documents on which reliance is placed are, read in their own terms, a list of the work those paragraphs direct and that has not been done. Part V.L sets out the gaps as the field states them.

8. A contribution of the 2018 Opinion to Part V.B.2

One passage of the Opinion is quoted here because it corroborates the optical conventions on which Part V.B.2 relies, from an institutional source and independently of the Foundation's own arithmetic. In answer to the third term of reference:

> "Evaluating the retinal blue light hazard effectively requires taking account of the irradiance of the retinal image of the source viewed. For momentary viewing, the retinal image subtends the same angle as does the source. With increasing exposure time, the retinal image is spread over an increasingly large area of the retina due to eye movement (saccades) and task-determined

> movement, resulting in a corresponding reduction in retinal radiant exposure at any given point on the retina. A time-dependent function of the angular subtense of the retinal image for exposures from 0.25 sec (aversion response time) to 10,000 sec is defined, ranging from 1.7 mrad (taken as the smallest image formed on the retina) to 100 mrad."

That passage states, in an assessment adopted by a scientific committee of the European Commission, that the quantity governing the retinal hazard is the irradiance of the retinal image; that the smallest image the eye forms corresponds to an angular subtense of 1.7 milliradians; that the upper bound of the averaging field is 100 milliradians; that the aversion response time is taken as 0.25 second; and that the framework extends to 10,000 seconds and no further. Part V.B.2 relies on the first three of those values and Part V.C.2.c on the last. The passage also supplies the reason the averaging angle grows with duration, which is the spreading of the image by saccadic and task-determined eye movement.

One divergence between that passage and the guidelines it describes must be recorded, because Part V.B.2 was built on the Opinion's figures and has since been corrected. The Opinion gives the smallest image formed on the retina as 1.7 milliradians and the averaging range as 1.7 to 100 milliradians. The guidelines of 2013, obtained and set out at Appendix D.1, give the minimum angular subtense as 1.5 milliradians corresponding to a retinal spot of 25 micrometers, and give the averaging field for the photochemical hazard as 11 milliradians for exposures of 100 seconds or less, rising to 110 milliradians at 10,000 seconds. Neither of the Opinion's two figures appears in the 2013 guidelines. The Foundation does not know the explanation and does not speculate beyond noting the likely one, which is that the Opinion of 2018 describes the guidelines of 1997 rather than those of 2013. Part V.B.2 now uses the values in the 2013 guidelines and states that it does. The Foundation draws no inference adverse to the Opinion from the discrepancy and records it because a comment that corrected its own figures while leaving its source uncorrected would be concealing the reason for the change.

Two observations follow, and the Foundation separates them from the quotation. The first is that the Opinion's own treatment of screen exposure was carried out in terms of source radiance, and the Opinion states the consequence: "Since the assessment was carried out in terms of source radiance, the assessment conclusion was made independent of viewing distance." The proposition advanced at Part V.B.2, that retinal exposure from a resolved source does not diminish with distance, is therefore not a contention of the Foundation's against the expert bodies. It is the convention those bodies apply, stated by them.

The second is that the aversion response time of 0.25 second is the interval the framework assumes a person requires to look away. Part V.C.2 addresses the weight the guidance places on the aversion response. A framework whose shortest exposure is the time taken to avert the eye is a framework for sources a person encounters once and turns from, which is not the condition of exposure described at Part VI.

9. The predecessor opinions, and what they already stated

The three documents identified at subsection 1 are the documents on which reliance was placed. They are not, however, the beginning of institutional assessment of this subject, and the Foundation sets out what came before them because the earlier record bears on how the later documents should be read.

The committee that adopted the 2018 Opinion was itself a successor. Before its reconstitution the corresponding body was the Scientific Committee on Emerging and Newly Identified Health Risks, and that committee adopted two Opinions bearing on this subject. Both are listed at Appendix D.1.

The Opinion of September 23, 2008

The first, titled Light Sensitivity, was adopted at the committee's 26th Plenary on September 23, 2008. Its mandate was narrow and is worth stating because of who prompted it: the Commission

asked the committee to determine whether the claims of light-sensitive citizens' associations, that energy-saving lamps aggravated their symptoms, were justified on the evidence; if so, which lamp characteristics were responsible; and how large the affected population was.

Three of its findings bear on this comment, and two of them cut against positions the Foundation has seen advanced in this field.

- Of the candidate mechanisms, only ultraviolet and blue light were identified as a potential risk factor. As to the others the committee stated that "No evidence was found that would indicate that either EMF or flicker could be a significant contributor." It further stated that there is no scientific evidence that fluorescent lamps, including compact fluorescent lamps, induce seizures.
- On blue light the committee found that compact fluorescent lamps "could create a risk of blue light over-exposure contributing to some retinal damage" when used close to the eye, and that "Blue light may be harmful to those with retinal diseases." The second of those is graded at the committee's evidence level B.
- On the sufficiency of the record the committee stated that "There is a need for additional experimental and epidemiological studies before final conclusions can be drawn."

Light-emitting diodes are not mentioned in that Opinion. The European assessment of this subject began in 2008 on fluorescent lamps, before the light-emitting diode was a general illumination product, which is a fact about the age of the inquiry rather than a criticism of it.

The Opinion of March 19, 2012

The second, titled Health Effects of Artificial Light, was adopted at the 17th Plenary on March 19, 2012. It is the direct predecessor of the 2018 Opinion, and four of its statements are material here.

- On the adequacy of its own evidence base as to this technology: "LEDs were under-represented in the present analysis of lamps."
- On the classification question treated at Part V.C.2.k: "Further consideration also needs to be given to the risk classification of high power LEDs." The committee records that industry data placed a 6,000 K high-power diode in the Exempt Group, but only when it was analysed as a small source. The Foundation asks the Department to notice that the group assignment turned on the analytical treatment of the source geometry, which is the point Part V.C.2.k makes about the 11 milliradian criterion.
- On what a low risk group does and does not establish, which is the argument at Part V.C.2.c in the committee's own words: the Exempt Group classification should not be taken to imply adequate protection of the general population as a whole from long-term effects. The committee also stated that there is no evidence that artificial light from lamps in the Exempt Group or Risk Group 1 would cause any acute damage to the human eye. The word is acute, and the two statements together are the acute-to-chronic division this comment describes throughout.
- On the distance at which diode products should be assessed, the committee stated that their retinal hazards need further assessment at 20 centimeters, since diode luminaires can be used at that distance in the home. That is the 200 millimeter reference distance discussed at Part V.C.2.k, identified by a European scientific committee in 2012 as requiring further work.

The 2012 Opinion also addressed light at night, stating that exposure while awake may be associated with an increased risk of breast cancer, and adding that such effects are associated with light in general without any specific correlation to a given lighting technology. Part II.E.6 and Appendix C.58 describe the state of that literature in the same period. Its research-gap list includes items this comment asks for independently: emission data across lamp types, a personal exposure database, and risk group categories that account for chronic effects.

Authorship continuity, and a link to Appendix C

The membership of the two working groups overlaps substantially and overlaps again with the literature appraised in Appendix C. Professor Mats-Olof Mattsson was rapporteur in 2008 and chair and rapporteur in 2012. Dr. Thomas Jung chaired in 2008 and served in 2012. Dr. Frank de Gruijl and Professor Harry Moseley served as external experts on both. Professor James Ferguson served as an external expert on both, and Professor Francine Behar-Cohen joined for 2012.

One of those names appears in this comment already. The 2016 review at Appendix C.55, which supplies the spectral design criterion this comment relies on and which limits its own safety conclusion to exposures of days to weeks, is co-authored by Ferguson. The Foundation draws the same narrow point it draws at Part V.A.1: the body of expert assessment and the body of primary literature on this subject are produced by a small and overlapping group of people. That is a feature of the field rather than a criticism of any individual, and it bears on how much independent corroboration a reader should take the agreement of these documents to represent.

What the Foundation draws from the predecessor opinions

Three things, each a matter of record.

First, the European assessment lineage runs 2008, 2012, 2018, and the 2024 intergovernmental review described at subsection 1 continues it. Four documents across sixteen years, from bodies constituted to advise on emerging health risks. Over the same period the Foundation has identified no assessment of this kind by any United States body, and the single North American assessment it has located is the 2013 Canadian evidence brief at Appendix D.1. Part II.E.4.

Second, the questions this comment puts to the Department were identified by the predecessor committee in 2012 and have not been closed since. The risk classification of high-power diodes needed further consideration. The Exempt Group did not imply protection against long-term effects. Diode products needed assessment at the distance at which they are actually used. Emission data across lamp types were lacking and a personal exposure database did not exist. Fourteen years later the Foundation is asking for the same four things, and Part V.L records that the 2024 review still reports the central limit to be unsettled.

Third, and the Foundation states this because it bears on its own credibility, the 2008 Opinion examined and rejected two mechanisms that are frequently asserted in this area. It found no evidence that electromagnetic fields or flicker from the lamps at issue were significant contributors to the symptoms reported to it, and no evidence that those lamps induce seizures. This comment does not advance either proposition. Its case concerns the optical emission of light-emitting diode products in the visible band, the quantities by which that emission is measured, and the absence of any federal determination about it. Part V.C.4 treats temporal light modulation on its own evidence and in its own terms, and Part I.A states the standard this comment holds itself to.

L. Research Gaps and Priorities [RFI Q16]

The gaps set out in this subsection are not the Foundation's alone. The report described at Part V.C.2.f, the work of national research and radiation protection bodies rather than of a party to this proceeding, identifies gaps corresponding to several of them, and where that is so it is noted below. The Foundation offers that correspondence because a research agenda proposed by a respondent carries less weight than the same agenda proposed independently by the bodies that study the question.

In January 2026 an expert consensus on exactly this question was published in BMC Medicine. Thirteen experts drawn from academia, public health, radiation protection and occupational health institutions convened a workshop and consultation process, and set out the research gaps and priorities for ocular light and optical radiation exposure as a determinant of health. Their framing sentence is the one the Foundation asks the Department to read first:

> Light exposure over 24 h is a modifiable environmental influence on human physiology and behavior with significant implications for health and well-being, yet the field lacks coordinated research infrastructure, standardized methodologies, and translational pathways.

They identified nine critical gaps, which they state as follows:

Gap 1: Lack of standardized measurement tools.

Gap 2: Inadequate exposure estimation infrastructure.

Gap 3: Lack of consistent exposure descriptors and exposure metrics.

Gap 4: Absence of core outcome standards.

Gap 5: Limited dose–response evidence.

Gap 6: Limited evidence on intervention effectiveness.

Gap 7: Poor characterization of globally representative and vulnerable populations.

Gap 8: Fragmented data harmonization and sharing.

Gap 9: Limited integration of non-visual effects of light into public health frameworks.

The Foundation did not devise that list and had no part in producing it. It sets the list beside the statute, and asks the Department to notice the correspondence.

Gaps 1, 2 and 3 concern measurement: the tools, the infrastructure for estimating exposure, and the descriptors and metrics. Paragraph 360ii(a)(4) directs the Secretary to study and evaluate emissions of, and conditions of exposure to, electronic product radiation. Paragraph 360ii(a)(6)(A) directs consultation with other Federal departments and agencies on techniques, equipment and programs for testing and evaluating electronic product radiation.

Gaps 4 and 5 concern outcome standards and dose-response. Paragraph 360ii(a)(2) directs the Secretary to plan, conduct, coordinate and support research. Part V.C.2.c sets out what the absence of dose-response evidence beyond the acute range means for the one exposure limit that exists.

Gap 6 concerns intervention effectiveness. Paragraph 360ii(a)(5) directs the Secretary to develop, test, and evaluate the effectiveness of procedures and techniques for minimizing exposure to electronic product radiation. The correspondence here is not approximate. It is the same subject in the same words.

Gap 7 concerns vulnerable populations and windows of vulnerability. Part VII identifies the populations in question, and § 360kk(a)(1)(A) requires the Secretary to consider the latest available scientific and medical data in the field.

Gap 8 concerns data harmonization and sharing. Paragraph 360ii(a)(3) directs the Secretary to maintain liaison with and receive information from other Federal and State agencies, professional organizations, industry and labor associations and other organizations.

Gap 9 concerns integration into public health frameworks. That is the electronic product radiation control program itself, which § 360ii(a) directs the Secretary to establish and carry out.

One word deserves particular attention. The consensus states that the field lacks coordinated research infrastructure. Paragraph 360ii(a)(2) directs the Secretary to plan, conduct, coordinate, and support research. The verb the experts reached for is in the statute.

The Foundation puts the conclusion of this subsection as plainly as it can. Thirteen independent experts, publishing in a peer-reviewed medical journal in January 2026, described a research agenda for optical radiation exposure as a determinant of human health. That agenda is, provision by provision, the program Congress enacted in 1968 and assigned to the Secretary of Health and

Human Services. What is missing in the United States is not a plan. A plan exists, in statute, and has existed for fifty-eight years. What is missing is its execution as to this radiation.

The subsections that follow identify the gaps the Foundation would add to that list, drawn from the particular products and exposures this comment concerns.

1. Multi-emitter and real-world exposure conditions

The nine gaps set out above concern light exposure as a whole. The Foundation adds this one because every instrument and every exposure limit in the field is built around a single source, and the exposure this comment concerns is rarely from one.

Part V.J.3 sets out the single-emitter design of the available instruments and Part III.D.8 treats the number of emitters during exposure as a characteristic requiring a boundary. Question 15 of the notice raises it. What is not known is how exposures from multiple simultaneous sources combine for any of the responses at Part V.C, Part V.D or Part V.E: whether they add, whether the most intense source governs, and whether the answer differs between a photochemical response and a temporal one. Until that is known, a criterion expressed per luminaire cannot be converted into a statement about what a person in a street receives.

2. Radiometric characterization of products in common use

No federal inventory records what the products in commerce actually emit, expressed radiometrically. Part V.J.4 establishes that the existing literature reports exposures photometrically, in units weighted to the visual response, which discards the information needed for every non-visual response this Part treats. Part II.D.6 sets out the absence of the baseline and Part IX.C asks for it.

The gap the Foundation adds is narrower than the request. It is that nobody knows the distribution. Even for the best-studied class, there is no published account of the range of spectral power distributions, source luminances and modulation depths across the products actually on sale in the United States. The 2018 Opinion described at Part V.K.4 gives the variability of the products as its reason for being unable to predict a dose-response function for a general emitter. The variability is therefore not an obstacle to be regretted; it is a measurable property of the market that nobody has measured.

3. Response-specific weighting functions beyond the visual

The weighting functions in general use are the photopic function for light as seen, and the blue light hazard function for photochemical retinal injury. Part V.C.2 sets out the second and Part V.B.3 the limits of the first.

The gap is that the responses this comment concerns are not confined to either. Migraine, photophobia, the trigeminal pathway at Part V.E.4, the melanopsin-mediated pathway, circadian disruption at Part V.F, and the autonomic responses at Part V.E.5 each have a wavelength dependence of their own, and for most of them no agreed weighting function exists. Part IX.C.4 asks that the weighting appropriate to each response studied be adopted rather than a single function applied to all of them. Appendix C records one study indicating that the tissues containing receptors responsive to optical radiation extend beyond the eye, which if correct means the enumeration of responses is itself incomplete.

4. Temporal characteristics below and above the flicker fusion threshold

Part V.D sets out temporal light modulation and Part V.D.3 the recommended practice that addresses it. The gap the Foundation adds has two halves, divided by the frequency at which modulation ceases to be visible.

Below that frequency, what is in dispute is not whether an effect exists but what bounds it: Part V.D.1 sets out modulation depth and frequency, and Part VIII.D.4 records that a visible alarm operating at three hertz and full modulation exceeds the recommended practice by a factor of twenty while

complying with the accessibility framework. Above it, the stroboscopic and phantom-array effects at Part V.D.2 are produced by modulation nobody can see, which means a person cannot know they are exposed to it, cannot attribute an effect to it, and cannot avoid it. Part III.E.2 treats rise and decay times, which are the characteristic that distinguishes a pulse that is abrupt from one that is not, and for which the Foundation has located no federal specification anywhere.

5. Populations identified in Part VII as disproportionately affected

The seventh of the nine gaps concerns globally representative and vulnerable populations. The Foundation adds the particular form the gap takes in this record. Part VII.A.4 records the self-identified condition categories of the 593 reporters at Appendix A, and Part VII.K treats the group. Those categories are what people wrote about themselves on a web form. They are not a sampling frame, not a case definition, and not a population.

So the gap is not merely that the populations are poorly characterized. It is that nobody has enumerated them. No federal body has stated which populations are differently sensitive to optical radiation, which are differently exposed to it, or how many people are in either category, and Part VIII.C.3 establishes that a public entity attempting to identify the populations affected by its own installations runs into the same absence. Part IX.C.6 asks that these populations be studied and Part IX.L that they be addressed expressly in whatever the Department publishes.

6. Longitudinal and cumulative exposure

The last gap the Foundation adds is duration. Part III.E.3 treats cumulative exposure as a characteristic requiring a boundary, and Part V.H sets out the settings in which the exposure is compulsory and repeated.

What is absent is any longitudinal study of the exposure this comment concerns. The literature at Part V is overwhelmingly of acute exposure: a subject is exposed for minutes or hours and a response is measured. The exposure that began with the transition described at Part IV.G is of a different kind, being continuous, nightly and lifelong for the populations at Part IX.L, and no study of it over years exists because the transition is itself recent. Part II.D.6 establishes that there is no exposure baseline from which such a study could even begin, which is the gap Part IX.C asks be closed first.

M. Crime, Safety, and the Benefits Claimed for Outdoor Lighting

Every other subsection of this Part concerns what light does to people. This one concerns a claim made on the other side of the ledger, and the Foundation includes it because a benefit asserted but not delivered changes what the Department is weighing.

Why this belongs in a comment to this Department

The products described in Part VI are installed, and their spectral and photometric characteristics chosen, on a stated justification. For outdoor lighting that justification is public safety, and within it the reduction of crime is the component most often quantified and most often used to carry the cost. Broad-spectrum white sources are selected over the narrow-band orange sources they replaced partly on that ground.

The Foundation does not ask the Department to regulate crime, and it does not suggest that the Department has any competence in criminology. The relevance is narrower and it is one of structure. If a spectral choice carries a biological cost, the question whether it also carries the safety benefit asserted for it is part of the same assessment, and the body assessing the biological side is entitled to know what is on the other. Where the asserted benefit is not found, a biological cost of any size stands unoffset. That is the whole of the Foundation's argument in this subsection and it does not extend further.

A correction the Foundation makes to its own framing

It would be convenient for this comment if the evidence showed that broad-spectrum white street lighting increases crime. The Foundation has examined the question and that is not what the evidence shows, and it says so here rather than allowing the implication to stand anywhere else in the comment. What the best available evidence shows is a null: no detectable change in crime in either direction. The Foundation relies on the null and claims nothing beyond it.

The study

Marchant P.R. and Norman P.D., To Determine if Changing to White Light Street Lamps Reduces Crime: A Multilevel Longitudinal Analysis of Crime Occurrence during the Relighting of Leeds, a UK City, Applied Spatial Analysis and Policy, volume 18, article 77 (2025), open access, described at Appendix C.118.

The Foundation discloses two things at once. The authors declare competing interests in unusually direct terms: the first states that he "has concerns about light pollution affecting astronomical observations and biodiversity, so has been motivated to examine the claims of benefit for increased public lighting" and that he "has previously published work critical of claims of substantial public safety benefit from increasing lighting"; the second states a concern that public money may be wasted on schemes with no proof they achieve their purpose. The Foundation discloses that as it disclosed the dark-sky interest at Appendix C.117 and the advocacy commission at Appendix C.114. And the study records that no funding was sought or obtained for it.

Against those interests the Foundation sets the study's procedural discipline, which exceeds anything else in this comment. It is a confirmatory study following a plan fixed in advance. The protocol was sent to three named independent custodians before the analysis began, one of them at a German geosciences research center and two of them professors at British universities, and is published with the paper. The modeled data are published with it, so the analysis is reproducible, which the authors note is not true of the studies they criticize. The manuscript was written to the reporting guideline for cohort studies.

What was done

Between 2005 and 2013 the city of Leeds replaced substantially the whole of its street lighting, installing 78,189 new white lamps in place of predominantly orange ones. The authors modeled weekly police recorded crime in all 107 of the city's middle-layer super output areas across 456 consecutive weeks. The period yielded 679,452 recorded crimes, of which 471,374 could be assigned to darkness or daylight: 221,644 in darkness and 249,730 in daylight.

The design is the feature that matters. Because the areas were relit at different times, at different rates and to different extents, each area serves as a comparison for the others at any given week, and the underlying trend in crime unrelated to lighting is absorbed by a polynomial in time fitted separately by area. The authors record that the order of installation was determined by the convenience of the contractor working outward from two depots and not by the level of crime in any area, which removes the regression-to-the-mean problem that afflicts studies where the worst areas are lit first. Overdispersion, which they argue is the central statistical error in the earlier literature, is modeled directly.

The result

Three measures, each a percentage change from the start to the finish of the relighting, with ninety-five percent confidence intervals:

- Daylight-adjusted darkness crime, which is the ratio of darkness to daylight crime and the study's principal measure: an increase of 2 percent, confidence interval minus 3 to plus 7 percent.
- Darkness crime unadjusted: an increase of 3 percent, confidence interval minus 1 to plus 8 percent.

- Round-the-clock crime, being darkness and daylight summed: an increase of 3 percent, confidence interval 0 to plus 6 percent.

The authors state the conclusion in their abstract: "no evidence was found for an improvement (or detriment) in the city's level of crime by relighting, contrary to the substantial reduction anticipated by the city council." The point estimates sit slightly on the side of more crime and none of them is distinguishable from zero. The Foundation does not present them as showing harm. What the confidence intervals establish is that an effect of the size claimed for this intervention can be excluded.

What had been claimed

The size of the claim is what gives the null its force, and it was stated in a public document. The city's outline business case for public funding asserted that "The research suggests reduction in crime rates attributable to improved lighting of over 25%. We believe that a reduction of 20% in night-time crime only is a reasonable assumption in the context of Leeds." On that assumption the case put the net present value accruing from crime benefits alone at £109,049,000 and the benefit to cost ratio for the project at 3.75.

A twenty percent reduction was assumed, and a confidence interval of minus three to plus seven percent was found. The Foundation asks the Department to note the shape of that, because it is the shape this comment describes elsewhere in other subject matter: a quantified benefit asserted in advance on a literature that was not examined, used to justify a change to the optical characteristics of an installed product class, and not checked afterwards by the body that asserted it.

That the result is not isolated

The Foundation records the surrounding literature as the study reports it, in each case noting that it has not read these sources itself.

- The national evaluation of street lighting projects for the United States Department of Justice, Tien and others (1979), found no crime reduction benefit.
- A Home Office crime prevention unit paper, Atkins and others (1991), could detect no crime prevention benefit from street lighting.
- The report to the United States Congress, Preventing Crime: What Works, What Doesn't, What's Promising (1997), stated in its chapter on preventing crime at places that "We can have very little confidence that improved lighting prevents crime, particularly since we do not know if offenders use lighting to their advantage."
- The LANTERNS study, funded by the United Kingdom's national health research institute at a cost the present authors give as £414,315.32, used data from 62 of the 174 local authorities of England and Wales and several million crime reports. For the change to white light specifically it found a crime rate ratio of 0.89 with a confidence interval of 0.77 to 1.03, which includes no effect. The Foundation has since read that study and no longer relies on this second-hand account of it. It is set out at the end of this subsection and at Appendix C.124, where the figure above is confirmed and where the characterization its own authors placed on it, which is weak evidence of a reduction rather than an absence of effect, is reported.

The third of those is worth isolating. The sentence reported to Congress in 1997 identifies the possibility that offenders use lighting to their advantage, and records that it is not known whether they do. Twenty-nine years later the Foundation is unable to identify any federal body that has resolved it. The lighting of the public realm has been converted in the interval.

The study that found the opposite, recorded in full

One body of work found a benefit, and the Foundation sets it out because it is the only randomized evidence in the field. Chalfin and others, reporting in 2017, 2019 and 2021, randomly allocated additional lighting across New York City public housing developments and concluded that it was

associated with fewer night-time crimes. That is a stronger design than anything else in this subsection and the Foundation does not diminish it.

The qualification is about what was installed. The present authors record that the intervention used lighting towers of six hundred thousand lumens, against standard outdoor lighting which they give as running typically between five thousand and thirty-five thousand lumens. The treatment was therefore something on the order of twenty to a hundred times a normal street light, deployed for six months. Whatever that study establishes about saturating a housing development with light, it does not bear on the question in this subsection, which is whether changing the spectrum of ordinary street lighting from orange to white delivers a safety benefit. The present authors also note that the analysis involved extensive covariate selection, which places it in an exploratory rather than a confirmatory frame, and that no protocol is available.

A pattern the Foundation notes without imputing motive

The literature on which the Leeds business case relied traces to work carried out at a British university in the nineteen-nineties which the present authors record was "funded by Urbis Lighting Company". That work was then carried into a Home Office research study and three successive meta-analyses, and from there into the business cases of authorities seeking public money to relight their cities.

The Foundation states that as a fact about provenance and draws no inference about any person. It notes only that the structure is the same one Part VI.J.6 describes in another product class: the technical basis for a public decision about the optical characteristics of a lighting product, produced under funding from the industry that sells it, and never independently tested by a body with a health mandate. The Foundation does not say the conclusions were wrong because of the funding. It says that where this pattern appears, independent verification is what is missing, and that supplying it is a public function.

What this subsection establishes, and what it does not

It establishes nothing about health. No study discussed here measured any biological, visual or physiological endpoint; the outcome throughout is recorded crime. It establishes nothing about light-emitting diodes specifically: the Leeds conversion ran from 2005 to 2013 and the lamps are described as white and broad-spectrum, not as diodes, and the Foundation does not represent this as a study of the products at Part VI.D. And it does not establish that white light increases crime.

What it establishes is that the principal safety benefit claimed for converting street lighting from narrow-band orange to broad-spectrum white was not delivered in the one city where the whole conversion was measured against a pre-registered plan, and was not detected in the largest multi-authority study either. The consequence for this comment is stated at Part IX: where the Department weighs a biological question about the spectral content of outdoor lighting, it should not assume that a countervailing safety benefit exists, because on the evidence the Foundation has been able to find, it has not been demonstrated.

A second study, which points both ways and shows why the question is hard

Lee J., Leitner M. and Paulus G., Spatiotemporal Analysis of Nighttime Crimes in Vienna, Austria, ISPRS International Journal of Geo-Information, volume 13, number 7, article 247 (2024), open access, described at Appendix C.119. The first two authors are of Louisiana State University and the third of the Carinthia University of Applied Sciences. The work was supported by the Austrian Marshall Plan Foundation and the authors declare no conflicts of interest.

The Foundation includes this study for a narrower purpose than the one above and states the purpose first, because the study contains findings on both sides and the Foundation relies on neither as proof of anything. It is included because it shows what the evidence actually looks like when the question is examined carefully, and because its authors say so.

What was done

The authors analyzed 522,880 reported crimes in Vienna from 2014 to 2019, of which 128,322 fell within four types occurring at night: assault, theft, burglary and robbery. Night was defined as the period from civil dusk to civil dawn, computed for each day. Two measures of light were used: the density of streetlights, from an open government dataset, and the median brightness recorded from orbit by the day-night band of the Visible Infrared Imaging Radiometer Suite, on a grid of 3,106 cells of five hundred meters. Ordinary least squares and geographically weighted regressions were run, univariate and multivariate, with socioeconomic and infrastructure variables.

The finding that favors the Foundation, and its limits

The regressions came out one way. In the authors' words from their conclusions: the analysis "shows a mostly positive relationship between streetlight density or NTL values with nighttime crimes. This means that brighter areas lead to a statistically significant increase in nighttime crimes". In the univariate results every coefficient was positive, for both measures of light and all four crime types.

The Foundation does not present that as evidence that lighting causes crime, and the Department should not read it so. The study is cross-sectional: it compares places at a moment rather than the same place before and after a change. Bright places are busy places, with more people, more premises and more property, and the authors identify the confounding directly. They note that "brighter areas have higher chances to observe and report crime incidents", which is a reporting effect rather than an effect on crime, and they report from the literature the observation that areas with more streetlights have higher crime rates because those areas overlap with higher rates of human activity. A positive correlation between light and recorded crime is what one would expect whether or not light makes any difference to offending.

The finding that runs the other way, which the Foundation states in the same place

The same paper reports that in 2017 Vienna replaced older hanging lamps with light-emitting diodes under a municipal program, and that the largest single-year fall in nighttime crime in the series followed. Between 2016 and 2017 nighttime theft fell by about 26.6 percent, robbery by about 27.0 percent, burglary by about 18.9 percent and assault by about 9.4 percent. The authors write that the change "may have contributed to a substantial decrease in nighttime criminal activities".

That is adverse to the position this comment takes and the Foundation reports it without qualification before offering any comment on it. It is also, on the authors' own account, the second-best supported of the two findings in their paper: they describe the descriptive result and the regression result as seeming "to contradict" one another, and they do not resolve the contradiction.

The Foundation offers one observation about the descriptive finding, and offers it as a methodological point rather than a dispute about Vienna. A fall in crime in the year after an intervention, with no control and no counterfactual, in a city where the paper separately records "a gradual decrease in nighttime crime incidents" across the whole six-year series, is the uncontrolled before-and-after inference that the preceding study was written to criticize. The Foundation applies that criticism evenhandedly. It declines to rely on the Vienna before-and-after comparison for the same reason it declines to rely on the before-and-after studies that reported benefits, and it declines to rely on the Vienna correlations for the reasons given above.

What the authors conclude, which is what the Foundation takes from the paper

They conclude that the relationship is unresolved, and they identify the specific tension:

> "there appears to be an interesting balance between better lighting to identify opportunities to commit a crime and better lighting to increase the risk of detection/apprehension. This seemingly contradictory effect that increasing lighting has on crime is yet another valuable avenue for future research."

And of the seasonal pattern, in which the brightest months in Vienna are also months of high recorded crime, they write that this "suggests that increased lighting may not be a simple deterrent to crime".

That is the proposition the Foundation advances in this subsection and it is the whole of it. The idea that more outdoor light produces less crime is treated in public decision-making as settled. It is not settled. The largest pre-registered study of a complete municipal conversion found no effect; the largest multi-authority study found no effect; a report to Congress in 1997 recorded that it was not known whether offenders use lighting to their advantage; and a careful spatial analysis published in 2024 produces results its own authors describe as contradictory and unresolved. The Foundation asks the Department not to treat the proposition as established, in either direction, and in particular not to treat it as a reason why the optical characteristics of outdoor lighting need not be examined for biological effect.

Fear of the dark is real, and the Foundation does not argue with it

A comment that treated fear of the dark as an error to be corrected would deserve to be ignored, and would also be wrong. The Foundation does not ask anyone to feel safe in a place where they do not. Its position in this subsection concerns what quantity of light the evidence actually supports, and the evidence on perceived safety turns out to point in the same direction as the evidence on recorded crime.

The Foundation takes the following from a commentary at Appendix D.1 and states its character first: it is a signed essay by a lighting consultancy, not research, and the Foundation uses it for the sources it collects rather than for any finding of its own. The consultancy works in the field of light pollution, which is an interest, disclosed here as this comment discloses the interests at Appendices C.114, C.117 and C.118.

Two propositions in it bear on this subsection and both are taken from work the Foundation has not read and must obtain. The first concerns how much light is needed for a person to feel safe. In an experimental study placing volunteers in nighttime streets in several Israeli cities under varied lighting, feelings of safety are reported to rise fastest in going from no light to low intensity, and then to level off rapidly as light is increased further. If that holds, the subjective justification for outdoor lighting is satisfied at low light levels and is not advanced by high ones. The essay adds, and the Foundation records it as an assertion rather than a finding, that high light levels can make people feel as though they are in a spotlight and so feel more exposed rather than less.

That matters to the question before the Department because it separates two things that are usually run together. A person's need to see and to be seen is real and is met at modest luminances. The luminances actually installed, measured in Part VI at hundreds and thousands of candelas per square meter, are not explained by it. Whatever is driving those values, on this evidence it is not the amount of light a person needs in order to feel safe.

The second proposition is displacement. Work reported there on British streets is summarized as finding that the absence of street lighting "may prevent theft from vehicles, but there is a danger of offenses being temporally or spatially displaced". The Foundation records that because it cuts against a simple reading of the null results above: an intervention may move offending in time or place without changing the total, and a study measuring one area may miss that. It is a reason for caution about all the results in this subsection, including the ones the Foundation relies on.

How the statistician whose work this subsection rests on puts it

The essay quotes the author of the Leeds study directly, and the Foundation reproduces both passages because they state the position more compactly than the papers do. On the state of the literature:

> "Studies which purport to show large lighting benefit for public safety tend to be of poor scientific and statistical quality, done by those with poor scientific and statistical

> background. [Even] better quality, large temporal- and spatial-scale studies are unable to detect any public safety lighting benefit."

And on the relationship between the feeling and the fact:

> "It is hardly surprising that human beings are uneasy about the dark as we are a daytime species" — but "[our] unease does not mean that a less brightly lit night is dangerous in terms of both crime and road traffic collisions."

That is the distinction this subsection exists to draw, and the Foundation adopts it. The unease is real. The inference from the unease to the necessity of the installed luminances is what the evidence does not support, and it is that inference, rather than the unease, that the Foundation asks the Department not to adopt when it comes to weigh the biological question.

How much light a person needs in order to feel safe, measured

The passage above reports, from a commentary, that the subjective benefit of outdoor lighting saturates at low levels, and records that the Foundation did not know at what level. It has now obtained the study and this passage replaces that account and supplies the figure.

Svechkina A., Trop T. and Portnov B.A., How Much Lighting is Required to Feel Safe When Walking Through the Streets at Night?, Sustainability, volume 12, number 8 (2020), article 3133, open access, described at Appendix C.122. Department of Natural Resources and Environmental Management, University of Haifa. Funded by the Israel Science Foundation. The authors declare no conflict of interest.

What was done

One hundred and six people walked designated routes through ten residential neighborhoods in three Israeli cities after dark, and at each of 257 marked points reported how safe they felt, on a four-point scale, through a mobile application that would not accept a reading unless the satellite position matched the designated point and the time was between thirty minutes after sunset and midnight. Seven thousand two hundred and fifty-five individual assessments were collected.

At the same points the illuminance was measured instrumentally with a chroma-meter, following the measurement methodology of the International Commission on Illumination, in three ways: horizontally at ground level, vertically in the direction of walking at a height of 1.5 meters, which is the illuminance on the observer's face, and vertically across an arc of about one hundred and twenty degrees. The Foundation draws attention to the design, because it is the kind of study the comment asks for elsewhere: a reported human response and an instrumental measurement of the optical quantity, taken at the same place at the same time.

The measured levels were ordinary. The horizontal average was 18.52 lux, the panoramic 11.92 and the directional 11.37, which the authors note is close to the 15 lux recommended by that Commission.

The finding

Feeling of safety rose with illuminance, significantly and positively, in every model. The Foundation reports that first because it is the authors' first finding and because this comment does not dispute that light at night helps people feel safe.

The shape of the relationship is the finding that matters. Taking the logarithm of the illuminance improved the fit of the model from an R-squared of 0.13 to one of 0.32, which the authors say "indicates that the relationship between FoS and illumination is, in fact, non-linear", and that "there are diminishing FoS returns, as increasing illumination to high levels leads to smaller and smaller improvements". Their conclusion states the level:

> "our analysis indicates that reasonably high assessment of FoS may occur at relatively low illumination levels of 5–10 Lux, and that increasing illumination levels beyond this threshold may result only in a minor rise in FoS levels."

And they name the belief that this displaces: "This result confirms that the conclusion 'the brighter—the better' is a common misconception, which may lead to unnecessary energy waste."

Five to ten lux is the figure this comment has lacked. It is an illuminance at the point where the person is standing rather than a luminance of a source, and the two are not interchangeable, as Part V.B.2 explains. But it is a measured answer to the question what quantity of light the subjective justification for outdoor lighting actually requires, and it is a small one.

That the requirement is not the same everywhere

The authors also found that the illuminance needed to reach a given feeling of safety differed markedly between cities: to reach the sample average, about 5.67 lux sufficed in Haifa while about 24.46 lux was needed in Be'er Sheba. They attribute the difference to the socio-economic position and recorded crime of the latter city and to the stronger daylight its residents are accustomed to, and they draw the conclusion that a "one-size-fits-all" approach to night lighting is "another misconception".

The Foundation records that because it cuts against any proposal to fix a single number nationally, including its own. What people need differs by place and by population. It does not disturb the central finding, which is that in all three cities the response curve flattened: the authors report "leveling-off of the FoS response curves" for all of them.

What this study does not say, including about spectrum

The Foundation states two limits, the second of which is important to a proposition this comment might otherwise be tempted to make.

First, the study measures a reported feeling, not safety. It is not evidence about crime, and the Foundation does not offer it as such.

Second, and this is the one to be careful about: the study says nothing about the color of the light. The authors selected their sites on a design that deliberately crossed high and low illumination with predominantly short-wavelength and predominantly long-wavelength sources, so both kinds are present in the sample. But they then analyzed illuminance alone. They state that of the attributes their observers rated, only illuminance and feeling of safety were used, and that light temperature, glare and uniformity "are meant to be investigated in follow up studies". Their limitations section repeats it: the analysis "solely focuses on illuminance" and follow-up studies should look into light temperature and the rest.

So this study does not show that amber or other long-wavelength light delivers the same feeling of safety as short-wavelength light at the same illuminance. The Foundation has not found a study that shows it, and does not assert it. What can be said is narrower and still useful: the diminishing returns reported here hold across a sample containing both spectral types, and the authors themselves set the spectral question down as unanswered and in need of work. The Foundation adopts that as one of the research questions it asks the Department to put in hand.

The Foundation notes one thing the authors do say about spectrum, in their introduction and on the authority of other work rather than their own data: that the evidence of adverse effects of short-wavelength outdoor lighting on circadian rhythm and melatonin secretion in people and wildlife "cannot be ignored", while the health and ecological impacts of long-wavelength light "appear to be less severe". That is a statement about health and not about perceived safety, and the two have not been joined by measurement. Joining them is precisely the work that is missing.

A fourth consideration, which concerns the quality of light rather than its quantity

The passage above establishes how much light is needed for a person to feel safe. A separate body of work addresses what kind, and the Foundation brings it forward with its weakness stated first: the account the Foundation has is an explanatory article in The Conversation of 28 May 2019 by researchers describing their own work, catalogued at Appendix D.1. The underlying research, by Plan International Australia, the XYX Lab at Monash University and the engineering consultancy Arup, has not been obtained. No statistical detail is given in the article: no sample description beyond a count of sites, no measures of uncertainty, no method of analysis. The Foundation reports it as a signpost to work that must be obtained, not as a finding it relies on.

The subject is the perceived safety of young women in Melbourne, analyzed across more than eighty locations the women themselves identified as unsafe, with lighting measured at those locations.

The finding on quantity, and the reason the Foundation does not rely on it

The authors report that higher light levels were associated with being perceived as less safe, not more: that sites with higher light levels "are more likely to be perceived as unsafe sites" and that "the average light level across these sites was twice what was measured across safe sites".

The Foundation does not advance that as evidence that brighter lighting makes people feel less safe, and the Department should not read it so. The comparison is between places, not within a place before and after a change. The locations women identify as unsafe are disproportionately the busy, central, transit-adjacent places where harassment occurs, and those are also the places cities light most heavily. The association is exactly as likely to arise from that as from any effect of light on feeling. This is the same objection the Foundation makes at Appendix C.119 to the Vienna correlations, and it applies here with the same force and against its own interest. The Foundation records the finding and declines to use it.

The findings on the character of the light, which are the useful part

Three propositions in the article do bear on the question this comment puts, and the Foundation sets them out as reported.

The first is about uniformity and glare. The authors report that "consistent and layered lighting – where there are multiple light sources and where surfaces with different reflective values are taken into consideration – makes women feel most safe", and that this "reduces the 'floodlit effect', the sharp drop-off of light beyond the path, and the potential for glare and contrast to blind and disorientate". The two named mechanisms, glare and contrast, are the subject of Part V.C and Part VI.B.1. What is described is a lighting design that is dimmer in the bright places and better distributed, and it is reported as the design that reassures.

The second is about spectrum, and it is the first source the Foundation has found that addresses it: that "the human visual spectrum reacts better to warm light", that the data from the young women "showed how sensitive they are to cool white light with regard to feeling safe in cities", and that "Spaces with warmer colour temperatures are perceived as safer places". The article records that urban light-emitting diodes are mostly 4000 kelvin cool white or above.

The third qualifies the second and the Foundation gives it equal weight, because it corrects a position this comment might otherwise have taken. The same research found that the women did not want the old orange lamps back. The article reports that the lowest color rendering came from sodium luminaires "that make everything look overly yellow", and that the women "preferred a high-quality LED light that enabled them to distinguish shapes and colour, helping to create a sense of safety".

So the reported preference is not for amber light and not for a return to low-pressure sodium. It is for a warm correlated color temperature combined with good color rendering, which is a property narrow-band amber sources do not have. The Foundation states that plainly because the distinction matters to any recommendation it makes: a person who cannot distinguish shapes and colors does

not feel safe either, and a spectral recommendation framed simply as less blue would not capture what this research reports. What it reports is a combination — lower correlated color temperature, high color rendering, better uniformity, less glare — and the Foundation adopts that formulation rather than a simpler one.

And a measurement point, reached from a third direction

The authors close on the instrument, and the Foundation records it because the same observation now arrives from three unrelated fields. They write that illuminance, the light falling on a surface, "is the only unit of measurement required to comply with the P Categories of the Australian Standards", and that on their results other metrics "such as luminance (light bouncing off a surface and hitting the observer's eye) should be considered too".

Part V.B.2 makes that argument from optics. Part VI.J.6 makes it about the criterion governing electronic billboards, which is expressed in illuminance at a distance and cannot constrain what reaches the retina. Here it is made by lighting engineers about a national roadway and public space standard, on the ground that illuminance does not describe what the eye actually receives. Three fields, three instruments, one quantity missing from all of them.

What a police force told its own oversight body

Everything above in this subsection is research. This is not. It is an operational report by a police force to the authority that oversees it, and the Foundation brings it forward for that reason rather than for its method, which is weak.

Essex Police, 108/16 Update on Part-Night Lighting, version 2.4, reported to the Office of the Police, Fire and Crime Commissioner for Essex for the meeting of 30 November 2017, approved 16 November 2017, author Matt Robbins on behalf of the chief officer. Marked official. Described at Appendix D.1.

Essex County Council switched its street lights off between one and five in the morning across twelve districts, after piloting from 2007, with the arrangement formally introduced on 30 March 2015. The force compared crime, anti-social behavior and killed-or-seriously-injured collisions in the districts that adopted it against two districts that did not. Its executive summary states:

> "There is no evidence of a relationship between PNL and levels of crime, ASB or KSIs in areas where PNL was adopted, when compared with control areas that never took up the initiative. The findings from this report support previous research conducted by Essex Police, as well as that of a national, independent study."

The national study referred to is the multi-authority study discussed above, to which the report records that Essex Police contributed data.

Why the Foundation does not treat this as evidence

The method is a comparison of raw percentages between two periods, with two unmatched districts serving as controls. There is no regression, no adjustment for anything, no confidence interval and no test of significance. It is the uncontrolled before-and-after design that the studies above were written to criticize, and the Foundation applies that criticism here as it has applied it to the Vienna comparison and to the business case that prompted the Leeds work.

The report's own figures bear that out. Over the shorter comparison window crime between one and five in the morning rose 8.2 percent in the districts that switched off and 18.4 percent in those that did not; over the longer window the same measure rose 18.5 percent in the switched-off districts and 10.3 percent in the others. The two windows point in opposite directions and the report does not reconcile them. It also records that crime rose at every other hour of the day as well, and that crime had risen across Essex and nationally.

Its own list of caveats is more damaging still, and the Foundation reproduces the decisive one. The force states that it cannot tell from its records which offenses happened outdoors: many offenses

included in the analysis "may therefore have been committed within premises". A street lamp cannot affect a crime committed indoors. The force also records that it does not know which streets within each district were switched off, so that offenses in town centers, where the lights stayed on, are inside the figures. And the collision counts are too small to carry percentages: two against six, three against nine, with the report twice noting that low numbers skew the comparison.

The Foundation therefore takes no number from this document. What it takes is the position of the body that produced it.

The two things it does establish

The first is institutional. A police force, examining its own data about its own county, across several analyses over several years, told its own commissioner that it could find no relationship between switching street lights off and crime, and recorded that "There are no current plans for future analysis in this area given the findings from multiple analyses over different time periods". That is not a finding about light. It is the operational position of the kind of body most likely to assert a link, stated in a document written for internal purposes rather than for publication.

The second is an absence, and it is the reason this document belongs in a comment to this Department. The report carries a standard set of headings for the implications of what it describes. Under equality and human rights it records no identified impact. And under health and safety it records, in full:

> "There are no identified implications with regards health and safety."

An entire county changed the lighting of its public realm. The police force examined the consequences and reported to its oversight body under a heading expressly directed to health. The entry is empty. The Foundation does not suggest that the force should have found something; identifying the health consequences of changing the optical environment of a county is not the function of a police force and it has no competence to do it. The point is that the heading existed, the question was formally asked, and no body with the competence to answer it was anywhere in the process. That is the condition this comment describes: decisions about the optical radiation to which whole populations are exposed are taken by authorities whose remit is traffic, crime and cost, with the health box ticked empty because there is nobody to fill it in.

The other half of the safety claim, which is road collisions

This subsection is titled crime and safety and has so far concerned only crime. The same investigators applied the same method, to the same city, over the same period, to road traffic collisions, and the Foundation records the result because collision reduction is the other justification offered for converting street lighting to white sources, and because it is the justification that bears on Part VI.D.

The account below is taken from a short feature by the same two authors in Significance, the magazine of the Royal Statistical Society and the American Statistical Association, described at Appendix D.7. The Foundation states its character: it is signed commentary summarizing the authors' own research, not the research itself, and the underlying papers have not been read.

In Leeds, across the same 456 weeks and 107 areas, nearly 14,000 collisions in daylight and over 5,000 in darkness were reported. The confidence interval for the effect of the relighting on the daylight adjusted darkness collision rate runs from about a 20 percent reduction to about a 10 percent increase. Null. Combined with a companion study of the relighting of Birmingham, the authors report that the interval narrows and "moves in the direction of harm", to a 16 percent reduction to a 12 percent increase.

And the multi-authority study already described in this subsection returned the same answer on collisions as on crime. Its white light conversion covered 15,833 kilometers of road across 62 local authorities, and the authors report its collision interval as a 7 percent reduction to a 9 percent increase. In their words, that study "found all its results to be null, despite its extensive data, both for

lighting reductions and for whitening, for all the investigations of lighting's effect on both RTCs and crime".

The authors state the limit of their own result and the Foundation adopts the statement rather than overreading them: "Not being able to detect any effect is, of course, not the same as there being zero effect. Also, of course, the result is consistent with either a little benefit or a little detriment."

Why the Foundation puts this before a health agency

The authors offer an explanation for how a conversion of this size proceeds on evidence this thin, and it is the reason this subsection exists in a comment to this Department. They write that lighting research is often done by people with a technical background but without professional statistical support, and draw the comparison themselves:

> "such work, although having potentially large consequences for both public finances and the environment, does not get the same level of checking as much of that done, for example, in health care. Also, some of those public servants assessing lighting proposals are likely to be ill-equipped to make satisfactory judgements on any purportedly scientific evidence with which they are presented, as they are unlikely to have sufficient scientific/statistical background to spot flaws."

The comparison is to health care, and it is the authors' own. The Foundation does not contend that street lighting should be regulated as a medical device. It contends that the optical emission of these products is electronic product radiation within the meaning of the statute discussed at Part II, that Congress assigned the biological consequences of such radiation to this Department, and that the passage above describes exactly what happens to a technical question about optical radiation when no body with that mandate is engaged with it.

Their conclusion is one sentence and the Foundation rests this subsection on it: "The more recent results from the large-scale, better-quality research mentioned above may suggest that the high levels of lighting currently used may not be justified."

Where this subsection hands over

The same authors identify what the costs are that the absent benefit fails to offset, and in doing so they name the two properties this comment has been concerned with throughout. They write that the costs of lighting are not only financial, that the effects on biodiversity are considerable, and then:

> "White light is comprised of all the colours of the rainbow. Other organisms with which we share our planet have different responses to the various wavelengths of light radiation. The blue component of white light is thought to be particularly damaging because it signals daytime."

And on intensity, in a sentence that answers the commonest reply to any complaint about modern luminaires: "Although the design of modern lamps allows the directionality of emitted light to be better controlled, the increasing brightness means more light is scattered from surfaces into the environment." Better optical control does not compensate for more output, because what is controlled is the direction of the beam and not the light that leaves every surface the beam lands on.

Spectrum and intensity: the two quantities. The authors are writing about other organisms, and Part V.I takes up that question. The Foundation's submission is that the same two quantities govern the effects on people set out in the rest of this Part, and that the agency charged with the second of those is this one.

The limits of what the Foundation claims, stated plainly

A reader may be tempted to assemble the material in this subsection into a stronger proposition than it supports, and the Foundation forecloses that here. The evidence set out above establishes that the claimed safety benefits of brighter and whiter outdoor lighting have not been demonstrated. It does not establish that such lighting increases crime, and it does not establish that it increases

collisions. The correlational study at Appendix C.119 cannot bear that weight and the Foundation has said so there.

Nor does the Foundation assert that it knows the correct quantity or spectrum of outdoor light. There is reason to think an optimum exists below current practice: the perceived-safety evidence reported above suggests the subjective benefit saturates at low levels, while the biological and ecological costs described in this Part scale with intensity and with short-wavelength content. If both halves of that hold, then increasing output past the saturation point adds cost without adding benefit. The Foundation advances that as the reason the question should be studied and a limit set, not as a finding it has made. Identifying where the optimum lies, and in what quantities it should be expressed, is the work the Foundation asks the Department to put in hand at Part IX.

The collision study read at source, and what the city relied on

The preceding passage reports the road collision results from a magazine feature by their authors. The Foundation has now obtained the study itself and this passage replaces that account. Marchant P.R. and Norman P.D., To determine if changing to white light street lamps improves road safety: A multilevel longitudinal analysis of road traffic collisions during the relighting of Leeds, a UK city, Applied Spatial Analysis and Policy, volume 15 (2022), pages 1583 to 1608, open access, described at Appendix C.120. The protocol was lodged with the same three named custodians on 5 August 2016 and the analysis dataset is published in a public repository.

The figures, stated precisely

Across the same 456 weeks and 107 areas, 13,977 collisions in daylight and 5,302 in darkness were recorded. The measure is the daylight adjusted darkness collision rate ratio, which is the factor by which the ratio of darkness to daylight collisions is multiplied by a given amount of relighting.

- For each one hundred replaced lamps, the ratio is 0.990 with a ninety-five percent confidence interval of 0.971 to 1.010, being a 3 percent reduction to a 1 percent increase.
- For a typical area, which received about seven hundred lamps, the ratio is 0.934 with an interval of 0.816 to 1.070, being an 18 percent reduction to a 7 percent increase.
- Modeled instead on the fraction of the relighting completed, full relighting of an area gives 0.920 with an interval of 0.776 to 1.09, being a 22 percent reduction to a 9 percent increase.

The authors noticed an anomalous pattern in the official collision data for 2012 and 2013 and repeated the analysis on a series truncated at the end of 2011, which they describe as the more trustworthy. That gives 0.993 with an interval of 0.971 to 1.015 per hundred lamps, and for a typical area an 18 percent reduction to an 11 percent increase. Their own summary of the range is that it “resides somewhere between a 20% reduction to a 10% increase”. Every interval includes no change.

Combined with the companion study of Birmingham in a fixed-effect meta-analysis, a typical area gives 0.952 with an interval of 0.838 to 1.082 using the full Leeds series, and 0.971 with an interval of 0.842 to 1.119 using the truncated one. The second of those is the figure reported in the preceding passage as a 16 percent reduction to a 12 percent increase, and the Foundation notes that the full-series combination gives a 16 percent reduction to an 8 percent increase. Both are in the paper and the comment should not quote one without knowing which it is.

The multi-authority study gave a collision rate ratio of 1.01 with an interval of 0.93 to 1.09 for conversion to white light across 15,833 kilometers of road, against about 2,800 kilometers in Leeds. For the region containing Leeds alone it gave 0.96 with an interval of 0.81 to 1.15.

What the city put forward, and what those documents actually said

This is the material the Foundation most wishes to place before the Department, because it is a documented account of how a public body came to spend a large sum on an optical intervention, and it is checkable.

The city's bid asserted: "Nationally, there is evidence that good street lighting can reduce night-time road accidents by between 15 and 35% (source – Institution of Lighting Engineers, also TRL reports 586 and 929)." The authors examined both reports.

Of the first, Sabey and Johnson (1973), a controlled before-and-after study of trunk road sites, they write that it is "surprising that this study was referenced by Leeds in its bid to acquire new street lighting, as it showed variable effect on safety and none were statistically significant for the roads on which there were 30, 40 and 50 miles per hour (mph) speed limits". Only roads with a seventy mile per hour limit showed a statistically significant effect. The authors add that roads of fifty miles per hour and below "form the bulk of those in Leeds and indeed other UK cities".

Of the second, Scott (1980), the authors state that its design is cross-sectional, comparing different roads having different lighting levels, and that such a design "allows many confounding factors to mislead". The Foundation notes that this is the same objection it records at Appendix C.119 against the Vienna correlations, applied here to a study relied on for the opposite conclusion.

And then the fact that the Foundation regards as decisive about that second report. A systematic review of street lighting for preventing road traffic injuries was carried out under the auspices of the Cochrane Collaboration. It identified 145 potentially relevant studies and included seventeen. It found no randomized controlled trials at all; all seventeen were controlled before-and-after studies; the collision counts in them were mostly under one hundred; none was at the scale of a city; and the review records that "the methodological quality of the included studies was generally poor". The present authors then state:

> "Note the Cochrane Review did not include the study report 929 (Scott, 1980), used to justify the Leeds relighting scheme, because of its poor methodological design."

So of the two technical reports named in the bid, one showed no statistically significant effect on the class of road that makes up most of the city, and the other was excluded from the systematic review of this very question on grounds of poor design. The Foundation does not suggest that anyone misled anyone. It observes that this is what the evidentiary basis for a major optical intervention looked like when somebody with statistical training went back and read it, and that nobody with such training had been required to read it at the time.

The authors reach the same conclusion in their own terms: "the evidential basis, for the claim that changing street lighting would improve road safety, was weak".

Three things in the paper that qualify it, which the Foundation records

First, the authors disclose two departures from their own protocol: the focus on the daylight adjusted darkness rate is described as a variation from the outcomes the protocol specified, though the specified outcomes are also reported, and an analysis at a smaller spatial scale that the protocol contemplated was not done, for want of time. The Foundation has praised the procedural discipline of this group's work and it reports the deviations in the same breath. They are disclosed in the paper, which is the point of lodging a protocol.

Second, the authors identify a suspect pattern in official national collision data for 2012 and 2013 and handle it by analyzing both the full and the truncated series rather than choosing one. The Foundation reports both above for the same reason.

Third, and this is a finding about darkness that runs in an uncomfortable direction, the paper reports that while daylight collisions across the city fell markedly over the period, collisions in darkness stayed roughly constant, so that the darkness to daylight ratio was rising throughout, independently of any lighting change. The authors suggest increased night-time road use or increased risky behavior at night as possible causes and do not resolve it. The Foundation records it because a comment arguing that darkness is not dangerous must not pass over a measured, unexplained rise in the relative collision burden of darkness. Nothing in the paper attributes that rise to lighting, and nothing in it shows that more or whiter lighting would have arrested it.

What happened where lights were switched off

Every study so far in this subsection asks whether adding or whitening light reduces crime, and finds that it cannot be shown to. This one asks the question from the other end, on data fine enough to answer it street by street, and the Foundation gives it the space it does because its central result is the strongest empirical finding against the proposition this subsection examines.

Tompson L., Steinbach R., Johnson S.D., Teh C.S., Perkins C., Edwards P. and Armstrong B., Absence of Street Lighting May Prevent Vehicle Crime, but Spatial and Temporal Displacement Remains a Concern, Journal of Quantitative Criminology, volume 39 (2023), pages 603 to 623, open access, described at Appendix C.121. The authors are of the University of Waikato, University College London, the London School of Hygiene and Tropical Medicine and other bodies. Funded by the National Institute for Health Research under the same grant as the multi-authority study discussed above. The authors declare no conflict of interest.

What was done

Ten years of police recorded crime from the Thames Valley force area, April 2004 to September 2013, comprising 283,275 offenses: residential burglary, robbery, theft of vehicles, theft from vehicles and violence. The street network was divided into 33,804 segments. Of those, 815 had their lights switched off between midnight and six, 1,315 were dimmed, and 958 had orange sodium lamps replaced with white light. Crimes were classified to night or day by civil twilight. Analysis was by conditional Poisson regression in a controlled interrupted time series, so that each segment serves as its own control and anything constant about a street drops out.

Two features make this the most sensitive test in this subsection. The unit is the street segment rather than an administrative area, and the authors modeled the streets immediately adjoining each treated street separately, which is what allows displacement to be seen at all. The multi-authority study at Appendix C.118 could not do this; these authors note that it was confined to area-level data and could not separate night from day.

The result

Switching the lights off at midnight was associated with less crime, not more. On the streets where it was done, after adjusting for daytime crime, night-time crime of all kinds fell, with a rate ratio of 0.74 and a confidence interval of 0.63 to 0.87, and theft from vehicles fell further, 0.56 with an interval of 0.41 to 0.78.

Measured across the whole day rather than at night only, the same streets show total crime at 0.81 with an interval of 0.75 to 0.88, burglary at 0.75 with an interval of 0.65 to 0.85, and violence at 0.83 with an interval of 0.71 to 0.97. And the adjoining streets, over the whole day, also showed reductions: total crime 0.83 with an interval of 0.76 to 0.89 and violence 0.75 with an interval of 0.64 to 0.89.

Taking the treated streets and their neighbors together, which is the measure of what the intervention did to the local network as a whole, the authors report a net reduction: total crime 0.83 with an interval of 0.79 to 0.88, burglary 0.85, theft from vehicles 0.90, and violence 0.79 with an interval of 0.70 to 0.88.

The Foundation states the proposition carefully. On these data, in this force area, over ten years and across thirty-three thousand street segments, turning the street lights off for the second half of the night was followed by less recorded crime, and the reduction survived when the surrounding streets were counted in.

The finding in the title, which the Foundation does not omit

The study is named for its qualification and the Foundation gives it equal prominence. One offense moved. Theft from vehicles fell sharply on the unlit streets and rose on the adjoining lit ones, with a rate ratio of 1.55 and an interval of 1.14 to 2.11, and the authors report that the reduction and the

increase were equal in magnitude. Night-time crime of all kinds on adjoining streets rose by about eighteen percent, 1.18 with an interval of 1.02 to 1.38, driven by that one offense.

Dimming shows the same thing displaced in time rather than space: night-time vehicle crime fell relative to daytime, but theft from vehicles across the whole day rose, and the net figure for dimming on treated and adjoining streets together is an increase, 1.16 with an interval of 1.04 to 1.29.

So the honest statement of this study is not that darkness prevents crime. It is that the effect depends on the offense, that for one offense the problem moved next door, and that for the network as a whole the balance was nonetheless favorable.

The mechanism the authors identify, which is the point of this subsection

The reasoning is about what a thief needs in order to work. Quoting a study of rural electrification, the authors note that "lighting illuminates objects (i.e., objects of value)". An offender walking a dark street cannot see which cars hold anything worth taking, cannot judge the security of a vehicle, and cannot remove fittings or search an interior without producing a light of his own, which announces him. They conclude:

> "The findings of this study suggest that the mechanism by which street lighting has been proposed to reduce crime—increased visibility at night—may be one that can also increase vehicle crime. This speaks to the inherent specificity in the opportunity structure of different crimes; environmental features make some types of crime more likely whilst simultaneously making other types of crime less likely."

That is the sentence the Foundation places before the Department. The mechanism asserted to justify lighting the public realm — that visibility deters offending — is shown by these authors to work in both directions, because the offender needs to see as much as the guardian does. It is not a reason to make the country dark. It is a reason why the proposition that more light is more safety cannot be assumed, and must not be the ground on which a health authority declines to examine the emission.

What this study says about white light specifically

Three findings, and the Foundation reports all three because the third runs against it.

- At night, which is when an optical effect would have to appear, there was no evidence that white light was associated with a change in any crime type examined.
- On streets adjoining those converted to white light, night-time crime overall fell slightly, 0.87 with an interval of 0.77 to 0.99, driven by violence at 0.74 with an interval of 0.61 to 0.91.
- Measured across the whole day, white light was associated with a reduction in total crime, 0.91 with an interval of 0.83 to 0.99, driven by burglary at 0.72 with an interval of 0.62 to 0.83; and the net figure for burglary on treated and adjoining streets together is 0.84 with an interval of 0.77 to 0.92.

The third is a crime reduction associated with white light and the Foundation does not minimize it. It does draw attention to what the authors make of it, because the explanation decides what follows for this comment. A benefit appearing across the whole day and not at night cannot be a visibility effect, since the lamps are off in daylight. The authors therefore attribute it to community cohesion: that replacing the lamps is read by residents as investment in the neighborhood, which prompts the informal social control that reduces crime. They had predicted in advance that a visibility mechanism would show itself at night and a cohesion mechanism would show itself equally by day and night, and the pattern they found is the second.

If that is right, the benefit attaches to the fact of the municipal improvement and not to the spectrum of the lamp. A signal of investment could be sent by any visible improvement, at any correlated color temperature, at any luminance. Nothing in this result requires the short-wavelength content whose

biological effects the rest of this Part describes. The Foundation does not assert that the authors' explanation is correct; it asserts that on their own data the white light benefit did not appear in the place where an optical mechanism would have put it.

The limitations, including one the Foundation regards as serious

The authors record that the lights chosen for switching off were selected under published exemption criteria: lights at major junctions, in town centers with closed-circuit television or night-time activity, where lighting was needed to reduce road accidents, and where crime might increase through reduced lighting, were all exempt. The authors rely on this to show that the changes were not made in response to crime, which supports treating them as exogenous.

The Foundation records the other side of the same fact. The streets that had their lights turned off were, by the design of the criteria, the streets least likely to suffer from it. The authors acknowledge the related possibility that part-night lighting may have been applied to streets with the lowest pedestrian traffic after midnight, and that the switch-off may itself have deterred people from walking or parking there, reducing the opportunity for crime by reducing the targets. They were unable to test it. The result above should therefore not be read as showing what would happen if a city switched off every light, which is not what was done and not what the Foundation proposes.

The same question asked of three hundred thousand broken lamps

The comment has recorded twice that the only randomized evidence in this field found a benefit from adding light, and has qualified it by noting what was installed. The lead author of that study has since examined the question the other way round, on a scale that dwarfs everything else in this subsection, and the Foundation sets out what he found.

Chalfin A., Kaplan J. and LaForest M., Street Light Outages, Public Safety and Crime Displacement: Evidence from Chicago, described at Appendix C.123. The first two authors are of the University of Pennsylvania and the third of the University of Chicago. The Foundation has read the manuscript posted by the first author's department and notes that a version appears to have been published subsequently under a different title.

The design, which is the reason the Foundation reports it at length

Street lights fail and are repaired. The authors use nearly three hundred thousand outages in Chicago over an eight-year period, affecting nearly fifty thousand street segments, giving about one hundred and forty million observations. Because the date on which an outage begins is known only when a resident reports it, but the date of repair is recorded precisely, they compare crime in the days immediately before a repair with crime in the days immediately after. The result is close to a regression discontinuity in time, and it tests the effect of a sudden, involuntary, local loss of light.

The scale permits two things no other study here can do. It separates major outages, where more than two lamps on a segment are dark, from minor ones. And it has the power to measure what happens on the streets within five hundred feet. The authors also run placebo tests on daytime crimes and on indoor night-time crimes, neither of which should respond to a street lamp, and report that neither does.

What happened where the lights went out

On the street where the lamps were dark, during a major outage, index crimes rose by two percent, violent crimes by one and property crimes by one, none of it statistically significant, with a confidence interval for index crimes running from minus three to plus six percent. The authors state the reading themselves:

> "The most reasonable interpretation of these results is that street light outages do not appreciably impact crime in the short-term on affected street segments."

Where one or two lamps only were out, there was nothing at all: the authors report coefficients "uniformly small and of mixed sign" for both the affected street and its neighbors, and conclude that "ambient lighting has a non-linear effect on crime". Losing a little light did not register.

The Foundation asks the Department to weigh the source of that null. It is not from a critic of street lighting. It is from the author of the one experiment in this field that found a crime reduction from adding light, working on a hundred and forty million observations, and reporting that removing light from a street did not appreciably change crime on it.

What happened next door, which the Foundation reports with equal prominence

Crime rose on the surrounding streets. Index crimes on segments within five hundred feet rose about three percent during an outage, violent crimes about two and property crimes about three, each significant at the conventional level because of the size of the data. Robberies on adjacent segments rose about seven percent, with a confidence interval of 0.6 to 13.4 percent. Motor vehicle theft is the exception to the pattern: it rose about nine percent on the dark street itself and about six percent next door, though neither quite reached significance.

The authors conclude that street light outages "compromise public safety in ways that can have downstream effects on an entire community", and calibrate the magnitude: a six to seven percent rise in robberies and vehicle thefts is, they say, what one would expect from reducing a city's police force by between five and fifteen percent. The Foundation reports that without qualification. It is an adverse finding and it is from a large and careful study.

The mechanism, and the distinction on which this passage turns

The authors explain the pattern by the movement of people rather than by the behavior of offenders alone. A robbery requires a victim to be present. If a street goes dark, people avoid walking down it, so there are fewer people to rob there and more on the next street. A vehicle theft requires no victim to be present, and a car parked in daylight cannot move when the lamp above it fails, so vehicle theft rises where the darkness is. The authors put it as the general principle that the effects of place-based measures "can be mediated and indeed shaped to a considerable degree by the behavior of potential victims".

The Foundation draws the distinction that follows, and it governs how this study and the one at Appendix C.121 should be read together. Displacement of this kind requires a gradient. What moved people and offending in Chicago was not darkness but the difference between one dark street and a lit street fifty yards away; and in the English study the same thing happened, theft from vehicles moving from the unlit street to the lit one beside it. Those authors said so in terms, observing that where the coverage of a lighting change is more extensive such spillover is less likely, because an offender would have to seek out an unfamiliar area instead of walking round the corner.

A broken lamp on one street is therefore not a model of a lighting standard. It is a model of an anomaly. What these two studies establish together is that a sharp local differential in lighting moves crime toward the lit side; what neither of them tests, and what no study the Foundation has found tests, is a uniform reduction in luminance or in short-wavelength content applied across a whole jurisdiction, where there is no better-lit street to move to. That is the measure this comment is concerned with, and the Foundation says plainly that it is untested rather than claiming support these studies do not give it.

A finding about who suffers outages, which the Foundation records because it must

The authors report that higher-crime areas of Chicago suffer more street light outages and that those outages take longer to repair than in lower-crime areas, and conclude that "municipal neglect contributes to unequal crime rates that are experienced by different neighborhoods".

The Foundation places that here deliberately. Nothing in this comment should be capable of being read as an argument for leaving broken street lamps unrepaired in poor neighborhoods, and the Foundation disclaims that reading in terms. Its position concerns the optical characteristics of

lighting that is installed and working — how bright, what spectrum, what modulation — and not whether municipalities should maintain their equipment. A city that chose a lower luminance and a longer wavelength would still owe every neighborhood the lighting it has specified, maintained to the same standard. The Foundation's objection to unequal exposure, set out at Part VIII, runs the same way: the people least able to avoid a badly-chosen lighting environment are the people who most need the choice to be made carefully.

The one study of this question a health department commissioned

The subsection closes with the study the Foundation regards as the most important document in it, for a reason that has nothing to do with its crime findings. It was commissioned by a health department, it is the only study in this subsection that was, and in its published conclusions it identified the gap this comment exists to address. It did so in 2015.

Perkins C., Steinbach R., Tompson L., Green J., Johnson S., Grundy C., Wilkinson P. and Edwards P., What is the effect of reduced street lighting on crime and road traffic injuries at night? A mixed-methods study, Public Health Research, volume 3, issue 11 (September 2015), pages v to 107, doi:10.3310/phr03110. Described at Appendix C.124. Known in the field, and earlier in this subsection, as the LANTERNS study.

Three facts about its provenance bear on the use the Foundation makes of it. It was funded by the Public Health Research programme of the United Kingdom's National Institute for Health Research, now the National Institute for Health and Care Research, under project number 11/3004/02. Its copyright notice records that the work was produced "under the terms of a commissioning contract issued by the Secretary of State for Health". And the authors declared no competing interests. So far as the Foundation has been able to establish by its own searching, this is the only study of the consequences of a change to the lighting of the public realm ever commissioned by a health ministry of any country.

The scale, which is the largest in this subsection

Every local authority in England and Wales was approached. Of the 174, the project reached 140 and obtained usable data from 62, covering more than thirty thousand kilometers of road on which lighting had been changed. By December 2013 the participating authorities had installed white light on 15,833 kilometers, part-night lighting on 12,101 kilometers, dimming on 10,519 kilometers and permanent switch-off on 946 kilometers.

The collision series ran from 2000 to 2013 and contained 859,935 collisions, of which 161,049 occurred at night. The crime series ran from December 2010 to December 2013 and contained 581,837 burglaries, 475,657 vehicle thefts, 67,470 robberies and 730,280 offenses of violence. Anti-social behavior and criminal damage, 2,882,758 and 486,367 offenses respectively, were excluded from analysis because some forces reported them incompletely.

The design is the one this subsection has been holding others to. It is a panel analysis with fixed effects, so that anything constant in a street or area over time contributes no information and cannot confound the result; night-time collisions are adjusted by the change in daytime collisions on the same roads; and all four interventions were entered in a single model so that they could not confound each other.

Road collisions: four nulls and one adverse regional signal

The figures below are rate ratios for night-time collisions after adjustment for the change in daytime collisions, which the authors describe as their most robust measure.

- Permanent switch-off: 0.97, interval 0.82 to 1.15.
- Part-night lighting: 0.95, interval 0.84 to 1.07.
- Dimming: 1.00, interval 0.91 to 1.10.

- Conversion to white light: 1.01, interval 0.93 to 1.09.

Restricting the analysis to collisions in which someone was killed or seriously injured, which are the collisions most reliably reported, left the estimates unchanged and less precise. Stratifying by area deprivation produced no association in any stratum.

One regional estimate runs against the national picture and the Foundation reports it where a reader will see it. In London, conversion to white light was associated with an increase in night-time collisions, 1.30 with an interval of 1.03 to 1.65, which the authors describe as weak evidence. The national estimate for the same intervention shows nothing. The Foundation does not present the London figure as establishing that white light increases collisions, and notes that in a study reporting estimates for every region of England and Wales across four interventions, one interval excluding no effect is what chance alone would produce. It records the figure because it is the only quantitative signal the Foundation has located anywhere that converting street lighting to white light was followed by more collisions, and because the authors did not dismiss it either.

Crime: what the study found, including the parts against the Foundation

The crime estimates are expressed for an area in which the intervention reached every kilometer of road, which no area approached, so they must be scaled down before they mean anything. The authors supply the arithmetic: dimming at 0.84 for full coverage corresponds to a two percent reduction where a tenth of road length is dimmed, with an interval running from a four percent reduction to no change at all.

- Part-night lighting: 0.96, interval 0.86 to 1.06. No evidence of an association.
- Permanent switch-off: 0.11, interval 0.01 to 2.75. The Foundation reports this figure only to say that it carries no information. An interval spanning a ninety-nine percent reduction and a near-tripling is a statement that 946 kilometers of permanent switch-off were too few to measure anything, and the authors say so.
- Dimming: 0.84, interval 0.70 to 1.02.
- Conversion to white light: 0.89, interval 0.77 to 1.03.

The last two are the findings in this subsection that run most directly against the Foundation's position, and the Foundation states them as the authors stated them rather than as the intervals alone would permit. The authors characterize both as weak evidence for a reduction in crime. They add that the estimates were directionally consistent: across the offense categories examined, every estimate for dimming and every estimate for white light pointed toward less crime. Two specific estimates are reported, each stopping just short of excluding no effect: part-night lighting with robbery at 1.48, interval 0.99 to 2.21, and dimming with violence at 0.78, interval 0.60 to 1.01.

The Foundation does not represent the white light figure as a null. Elsewhere in this comment it has insisted that an interval crossing one means the effect is not established, and that holds here: 0.77 to 1.03 does not establish a reduction. But the point estimate is a reduction, the authors called it weak evidence of one, and a comment that reported the interval while suppressing the characterization would be doing the thing this comment criticizes others for doing.

The finding that makes the crime results hard to use in either direction

The study found strong heterogeneity between police forces. Of the thirty-one forces analyzed separately, there was strong evidence that part-night lighting, dimming and white light were associated with decreases in crime in some forces and strong evidence that the same three interventions were associated with increases in others. The authors read this as showing the importance of context, and offer two candidate mechanisms that would operate in opposite directions: that switching lights off may signal municipal decline and so generate disorder, and that darker streets may make some offenders feel less conspicuous.

The Foundation draws the conclusion that follows for a federal agency. A national average assembled from estimates that are strongly positive in some jurisdictions and strongly negative in others is not a number on which a nationwide standard can be built in either direction. It is a reason to stop asserting that outdoor lighting levels have a determinate effect on crime, which is the assertion this subsection was written to examine.

The distinction that explains the literature, from the report's own account of it

The report's introduction summarizes the systematic review on which the case for lighting as crime prevention principally rests, and that summary contains what the Foundation regards as the single most useful analytical point in this subsection. The review found a reduction in crime in those studies that examined changes across the entire day, daylight hours included. In the four studies that examined night-time crime alone there was, in the report's words, "no evidence of an impact of changes to street lighting on crime". The report adds that a major limitation of the review was the use of inadequate control areas in the underlying studies: only two used multiple controls, and in some the control area adjoined the treated area.

A street light cannot illuminate anything during daylight. A benefit that appears by day as well as by night is therefore not a visibility benefit, whatever else it may be. The central result in the literature relied on by authorities asserting a relationship between lighting and crime is accordingly a result that cannot have been produced by the mechanism they assert.

That is the second time this subsection has reached that conclusion from independent data. The Thames Valley study above found white light associated with a reduction in burglary measured across the whole day, 0.72, and no night-time effect at all, and its authors attributed the result to community cohesion rather than to visibility on exactly this reasoning. Different data, different decades, different authors, the same place arrived at. The Foundation submits that the convergence is the most defensible proposition in this subsection: whatever crime benefit has been detected in association with improved street lighting, it has not been detected in the hours of darkness, and it is therefore not a benefit of the light.

The consequence for this Department is direct. If the benefit does not depend on the light, it cannot be traded against the biological effects of the light. A municipality that wishes to signal investment in a neighborhood has other ways to do it, and none of them requires short-wavelength content at the retina of every resident for every hour of every night.

Three things in the report that cut against the Foundation, stated before the use the Foundation makes of it

First, perceived safety fell where lights were switched off, and it was measured. The report includes a household survey in one Shropshire area, sampling five hundred households in streets with part-night lighting and five hundred in streets without, returning 483 responses. Of residents in part-night streets, 15.6 percent felt very safe walking alone in their neighborhood after dark, against 26.2 percent in the unaffected streets, an odds ratio of 0.52 with an interval of 0.32 to 0.84. That was the only item in the survey on which the two groups differed significantly, and it is a real cost. The Foundation reports it because Part V.G of this comment treats affective response as a health matter and cannot treat it as one only when the sign is convenient.

Second, the authors identify a confound in their own crime results, and the Foundation adopts their statement of it rather than softening it. They could not account for other crime prevention or road safety measures introduced at the same time, such as closed-circuit television, policing operations or improved road markings, and they write that it is likely such confounding accounts for part of the crime associations they observed. That cuts against the reductions attributed to dimming and to white light, and the Foundation says so for that reason.

Third, the authors record a limitation that bears on the collision nulls and not in the Foundation's favor. They had no measure of exposure. If fewer people walked, cycled or drove on streets where the lighting was reduced, a reduction in casualties could reflect fewer people present rather than no

increase in risk, and any increase in hazard to those who remained could have been masked. They state that they could not test this. The Foundation therefore does not claim that reducing lighting is shown to be safe for a pedestrian. It claims that at the scale of a nation, reductions in lighting were not followed by the increase in casualties that had been predicted.

An internal inconsistency the Foundation does not resolve

Two passages in Chapter 3 cannot both be relied on. The analysis by deprivation reports that the stratum-specific estimates "were not materially different from the overall estimates, and each was imprecise", and states expressly that there were insufficient data for switch-off. The discussion of generalizability then reports that the stratified analyses suggest switch-off was associated with an increase in burglary and vehicle crime in more deprived areas and in city and town centers, while part-night lighting was associated with decreases in less deprived areas. The Foundation can see no way to reconcile a finding about switch-off with a statement that the data for switch-off were insufficient, and it declines to use either passage. It records the inconsistency because the second of them, which is the one that would appear in a summary, is the one the report's own results section does not support.

What the Foundation asks the Department to read, which is in the published conclusions

Everything above concerns crime and collisions. The reason the Foundation places this report last is that its authors, having been commissioned by a health department to study the consequences of changing street lighting, wrote into their published conclusions that the question they had been asked was not the question the public was raising. The abstract's conclusions state that the study found little evidence of harmful effects on road collisions or crime, and then continue:

> "However, the public were also concerned about other health outcomes."

And they close with a recommendation:

> "Research is needed also on other public health impacts of light at night."

The qualitative chapter records what those other concerns were. Among the effects members of the public raised were benefits in sleep with less light pollution; and in urban areas where authorities were installing white light rather than switching lights off, the report records that the concerns raised were more likely to relate to light pollution and to the impact on sleep from existing lights. People given the opportunity to comment on a change to the lighting of their own streets raised, unprompted, the biological subject matter of this comment.

The report measured none of it. Its outcomes throughout are recorded crime and recorded road casualties, which Chapter 3 describes as "two important public health outcomes". No chapter measured a visual, physiological or biological endpoint of light exposure. What the public said about sleep was collected as perception, in interviews and in a survey, and the report is explicit that this is what it is.

Why that is a finding and not a shortcoming

The Foundation makes no criticism of these authors. They were commissioned to answer a question about crime and casualties; they answered it with more rigor than anything else in this subsection; and they then told their funder, in the published conclusions, that a different question needed research. That is what a competent research team is supposed to do. The Foundation's point concerns what happened next.

Part V.M has now placed before the Department a county police force that recorded no health implications because it had no means of identifying any; a city council that assigned a monetary value to a crime benefit and none to a biological one; and a national health research program that identified the public health impacts of light at night as a research need and published that finding in 2015. Three bodies, three levels of government, one country. In each the health question was

reached, and in none was it answered, because in none of them was there a body with both the mandate and the competence to answer it.

The Foundation submits that the Department of Health and Human Services is that body in the United States; that paragraph 360ii(a)(2) of the Public Health Service Act directs the Secretary to plan and conduct exactly the research this report named as needed; and that eleven years have passed since a health ministry put the need in print.

One statement in the report the Foundation does not adopt

The report characterizes the evidence that light at night affects health as weak, citing proposed links to circadian disruption and sleep and, in its own word, theoretical links to anxiety, depression and cancer incidence. That was written in 2015 and the Foundation does not adopt it. Parts V.C through V.G of this comment set out the literature as it now stands, including work on melanopic photoreception that postdates this report, and Part V.K treats the three expert assessments. The Foundation relies on this report for what it establishes about the institutional record and about crime and collisions. It does not rely on it as an authority on the state of the health science, and asks the Department not to, because the report does not claim to have reviewed that science and its characterization of it has been overtaken.

VI. PRODUCTS

This Part sets out what is actually in the exposure environment. It asks the same four questions of each class: what the product is, who is exposed to it and under what conditions, which agency if any asserts jurisdiction over it, and whether any federal emission limit applies. Subsection A states the principle on which the classes are ordered and the characteristics by which they differ. Subsection U reserves a summary of the regulatory position by class, and subsection V treats the tariff classification, which is the one place where this Department already describes these products at the border.

A. Product Taxonomy and Exposure Characteristics

The classes in this Part are ordered by the conditions under which people meet the products, and the Foundation states the principle expressly because the ordering is not obvious and is not what a reader might assume.

What the ordering is not

It is not by the number of units deployed. The Foundation has no properly sourced deployment figures for any of these classes and does not state any, which is a limitation it records rather than conceals: the figures in circulation come from trade sources and press material, and Part V.J.4 sets out why the Foundation declines to build on sources of that kind. Appendix C records one volunteer survey of the composition of the night environment in a single country over a single autumn, and there is no American counterpart to it. So the comment cannot say which of these classes accounts for the most exposure, and it does not try.

It is not by technology either. Every class in this Part uses the same emitter. That is the premise of the whole comment and it is why the characteristics at Part III rather than the product categories are the thing the Foundation asks the Department to bound.

What the ordering is

Three groups, and then four classes that cut across them.

First, the classes a person meets involuntarily in the public way and cannot decline: motor vehicle lighting at subsection B, emergency and warning lamps at C, roadway and area lighting at D, signage and dynamic message displays at J, aircraft and obstruction lighting at O, residential exterior

lighting and light trespass at P, rail and marine lighting at Q, traffic control signals at R, and the accent lighting on unattended equipment at S and on mobile devices at T.

Second, the classes a person meets because they have to be in the place: interior lighting in schools, workplaces and healthcare settings at subsection E, and retail and commercial interiors at F, which a person can leave but which Part VII.F records people ceasing to enter.

Third, the classes a person chooses and controls: consumer lamps and household products at subsection G, displays and personal devices at H in their personal use, and lighting on bicycles and personal mobility devices at N, which the user chooses and other road users do not.

And four classes defined by something other than the setting. Subsection I is defined by purpose, being lighting installed to deter rather than to illuminate. Subsection K is defined by the deliberate use of change as the point of the product. Subsection L is defined by a property of the product, which is that it emits radiofrequency energy as well as light. Subsection M is defined by the exposed person rather than by the product, and Part III.F and Part IX.L set out why that is a category this comment needs.

The characteristics by which the classes differ

Part III identifies sixteen characteristics of an emission that require boundaries. Those are properties of the light. This Part turns on a second set, which are properties of the encounter, and the Foundation lists them because they are what makes two products with identical photometric output different in their effect on a person.

Whether the exposure is voluntary. Whether the person can look away, and whether looking away costs them something, as it does for a driver. How long it lasts, and whether it recurs daily by necessity. The distance, and whether the source subtends a small angle against a dark field, which Part V.D identifies as the condition the ordinary metrics do not reach. Whether the installation belongs to the exposed person or to somebody else, which is the distinction Part VIII turns on. Whether the source moves, which Part III.D.9 treats. And how many emitters are in the field of view at once, which Part III.D.8 treats and which Question 15 of the notice raises.

The relationship to this Department's own classification

The Foundation's taxonomy is not the Department's. The Department already classifies these products, by product code, and Appendix F sets out the codes: twenty-three assigned and thirteen the Foundation proposes. The two schemes do not correspond one to one, and the Foundation does not suggest that the Department adopt this Part's ordering. Appendix F maps each class in this Part to the code or codes that reach it, and Part VI.U reserves the statement of regulatory position by class. Where a class in this Part has no code, Appendix F says so, and that is the more useful fact.

B. Motor Vehicle Lighting

This is the product class on which the Foundation has done the most and about which the federal record is longest, and the Foundation states at the outset what distinguishes it from every other class in this Part. It is the only one for which a federal standard exists that sets numerical limits on emission. Federal Motor Vehicle Safety Standard No. 108 governs the photometric performance of vehicle lamps, it is administered by the National Highway Traffic Safety Administration, and Part II.H.5 and Part IV.C describe the Foundation's dealings with that agency at length.

The consequence is that the question this comment puts to the Department is sharper here than elsewhere. In the other classes the Foundation asks what should be done where nothing is done. Here a federal instrument exists, it is enforced, and the agency administering it has twice told the Foundation in writing that the expertise relevant to the health questions resides in this Department. What Part VI.B describes is not a vacuum. It is a division of labor that has never been performed on one side.

The Foundation also states a boundary it has observed throughout this comment and observes here. Part II.H.3 records that the Foundation does not ask any agency to regulate light pollution, that the Environmental Protection Agency has no authority to do so under the law as written, and that the Foundation agrees. Nothing in this subsection asks this Department to regulate skyglow or the appearance of the night sky. Where this subsection uses evidence gathered by researchers whose subject is light pollution, it uses it for what it shows about the quantity of radiation emitted and received, which is the subject of 21 U.S.C. § 360ii, and for nothing else.

1. Headlamps and high-intensity forward lighting

What the products are needs no description. What has not been established anywhere in the federal record, and what this subsection establishes first, is whether their emission is changing.

The trend, measured

The Foundation has found one quantitative study of the question, described at Appendix D.8. It analyzes the photometric data published by the Insurance Institute for Highway Safety for its headlight ratings: 287 car models from 27 manufacturers over the years 2016 to 2025, comprising 3,386 records and 13,544 individually measured lights, weighted by brand sales share. On that sample the luminous intensity of the headlamps of the average car grew over the period by:

18 percent for high beams combined, a compound annual growth rate of 1.9 percent a year;

35 percent for low beams combined, a compound annual growth rate of 3.4 percent a year;

22 percent for the mean of the two, a compound annual growth rate of 2.2 percent a year.

Combining the intensity trend with the growth in the number of vehicles, the author estimates the total emission from vehicle headlamps to have grown at 3.6 to 3.7 percent a year in the United States and the European Union, and at 10.6 percent a year in China.

Why the low beam figure is the one that matters

The low beam grew at nearly twice the rate of the high beam. The low beam is the beam in use in town, the beam that faces oncoming drivers, and the beam that a pedestrian at a crossing receives. The high beam is used on unlit road and is dipped when a vehicle approaches. The quantity that has risen fastest is therefore the quantity to which people are actually exposed, and the author draws the same inference, observing that the rate was larger for the low beams and that this suggests a faster growth of vehicle-induced emission in urban areas.

What this does and does not establish

It is the only measurement of the trend the Foundation has been able to find, and the Foundation states its weaknesses in full. It is a preprint and has not been peer reviewed. Its author describes the results as having been obtained “from a limited sample of cars and using very strong additional simplifications, so they should be taken with a grain of salt”, and offers them “as a first approximation and as a stimulus for further research on this topic”. His own considered statement is narrower than his abstract: that the results are “strongly suggestive of a steady and non-negligible increase of the vehicle headlight emissions during the last ten years”.

It contains no spectral data of any kind. It reports luminous intensity and luminous flux and nothing about wavelength, correlated color temperature or short-wavelength content. No part of this comment cites it in relation to blue light, and the propositions at Part V.B.3 and Part V.F rest on other sources entirely.

And it contains nothing about health. Its subject is light pollution, and its author’s purpose is to assess the contribution of vehicle lighting to skyglow. The Foundation takes from it one fact only, and that fact is about emission: the quantity of optical radiation emitted by the headlamps of an average vehicle rose measurably over the last decade, and rose fastest in the beam aimed at other road users.

Why that fact belongs before this Department

Because paragraph 360ii(a)(4) directs the Secretary to study and evaluate emissions of, and conditions of exposure to, electronic product radiation. A measured increase of 35 percent in a decade, in the emission a person meets head-on from a product class numbering in the hundreds of millions, is a condition of exposure within the ordinary meaning of those words. The Foundation does not ask the Department to find that the increase is harmful. It asks the Department to notice that the increase was measured by a retired astronomer in Galicia from a public American dataset, and that no federal body has asked what it means for the people exposed.

The dataset, which the Foundation asks the Department to notice separately from the study

The underlying data are not the author's. They are published by the Insurance Institute for Highway Safety, a research organization funded by automobile insurers, which has measured and rated the headlamps of new vehicles sold in the United States since 2016 and publishes the results. The measurement capacity for this question therefore already exists, in this country, maintained continuously for a decade, outside both the agency that regulates the lamps and the Department that holds the radiation authority.

That is the clearest instance in this comment of the point Part II.H makes about liaison. Paragraph 360ii(a)(3) directs the Secretary to maintain liaison with and receive information from other agencies, professional organizations and others concerned with electronic product radiation. A decade of photometric measurements of the forward lighting of the American vehicle fleet exists and is public. What has never been done is to ask of it the question this Department is charged with asking.

What the people exposed report, measured at scale

The measurement above is of emission. It says nothing about what that emission does to the person who receives it. In April 2024 ten European motoring organizations placed before the United Nations body in which the international vehicle lighting regulations are developed a study of that second question. The Foundation describes it at length because nothing of comparable scale has been put before any body in the United States — the nearest American counterpart, the evaluation by the American Automobile Association described at Part VI.B.2, rated glare with a panel of five — and because the document says several things about the approval standards themselves that this comment has elsewhere had to establish from first principles.

The document is informal document GRE-90-20, Glare on Road Traffic: European consumer study 2024, Revision 1, dated 26 April 2024, submitted by the expert from the Fédération Internationale de l'Automobile to the ninetieth session of the Working Party on Lighting and Light-Signalling, held at Geneva from 29 April to 3 May 2024, under agenda item 12. It runs to sixty-eight pages, of which the report proper occupies pages 3 to 10 and five attachments the remainder. The same study was presented to that session on 2 May 2024 by Burkhard Boettcher of the Allgemeiner Deutscher Automobil-Club in informal document GRE-90-40. The participating clubs were the Automobile Club du Luxembourg, the Allgemeiner Deutscher Automobil-Club, Avto-moto zveza Slovenije, the Koninklijke Nederlandse Toeristenbond ANWB, the Bosanskohercegovački auto-moto klub, IAM RoadSmart, Norges Automobil-Forbund, the Österreichischer Automobil-, Motorrad- und Touringclub, the Touring Club Royal de Belgique and the Touring Club Schweiz.

The study was conducted in two arms using the same questionnaire. In the first, four clubs joined the German club in commissioning a market research company to survey a structured, supervised and demographically balanced sample of about one thousand drivers in each country. In the second, five clubs invited their own members to complete a six-page questionnaire through club magazines and social media, and about twenty-two thousand members responded. The report describes the difference between the two in its own words: in the representative arm, "not only do those who feel blinded give their opinion, but a structured and supervised survey of a good 1,000 drivers in each

case, taking into account the demographic balance". The fieldwork was conducted up to the end of 2023.

The representative arm interviewed 4,312 people in Germany, Austria, Switzerland and Belgium, with a further 447 in Luxembourg reported separately. On that sample the report states its conclusions for the four countries as follows:

> "71 % find the glare intolerable or annoying";
>
> "32 % almost always or regularly feel dazzled";
>
> "51 % of respondents pinch their eyes shut or even close them briefly";
>
> "58 % have problems perceiving objects in the vicinity of the dazzling light source";
>
> "30 % stated that they continued to see an image of the light source for a limited time after passing it (afterimage), or even felt pain".

The report marks the fourth and fifth of those items with an asterisk and explains the mark: "Indication of physiological glare and restriction of perception/vision". That distinction is the one the Foundation regards as the document's most important contribution, and it is taken up below. Seventy-five percent of the representative sample considered it necessary, in the report's words, "to review and update the regulations on reducing glare from vehicle lighting".

Why the Foundation relies on the representative arm, and what the authors did about the obvious objection

The second arm was self-selected, and a self-selected sample of people invited to say whether a thing bothers them will overstate how much it bothers the population. The authors anticipated the objection and recorded it before reporting their results: "The expectation was that people complain more when offered the opportunity." They then reported what happened: "That is also somewhat observable. The results of this study were unexpectedly in line with those in the ADAC report."

The figures bear that out in direction and in magnitude. Every number in the self-selected arm is higher than its counterpart in the representative arm — eighty percent against seventy-one, fifty against thirty-two, sixty-four against fifty-eight — but none is higher by the margin that would be expected if the self-selected respondents were a different population rather than the same population more sharply motivated to answer. The Foundation nevertheless cites the representative figures throughout, treats the self-selected arm as consistent rather than as independent corroboration, and notes that the report's own executive summary quotes the self-selected figures in its headline statements.

The finding on age, which does not support the Foundation's position

The survey reached a conclusion on age that runs against what Part V.C.5 of this comment argues from optics, and the Foundation states it here rather than leaving it to be found. The report's conclusions say: "The assumption that glare is predominantly a problem for older people due to the ageing of the eye and the associated visual impairment was not confirmed by the survey. On the contrary, the proportion of younger drivers who feel dazzled is significantly higher." Earlier, in its statement of motivation, the report puts it more strongly still: "However, age does not play such a major role; the often-heard argument that older people in particular suffer from glare (and perhaps should stop driving) is completely debunked by the study."

Three things must be said about that, and the first is that the Foundation does not dispute the measurement. What is measured is the frequency with which a respondent reports feeling dazzled. That is not a measurement of susceptibility, and the report does not claim it is; its own executive summary concedes the physiology in the same breath as the finding, recording that "youngsters seem to experience the same discomfort as elderly people, despite elderly people having more physical reasons for this".

The second is that the report supplies the confound without connecting it to the age result. Among its summary findings is this: “Some people feel their freedom is limited because they no longer drive their car in the dark.” A person who has given up driving at night has given up the exposure, and will report less of it. Whether that accounts for the age gradient the survey found is not something the survey tested, and the Foundation does not assert that it does. It states the possibility because the alternative is to let a self-report finding stand as though it were a finding about the eye.

The third is that the report’s own cited authority runs the other way, and the report misstates it. Its statement of motivation tells the reader that “it is known that the recovery of the driver’s eyes after glare can take up to 9 seconds”, attributes the figure to the Royal Society for the Prevention of Accidents, and computes from it that a driver covers seventy-five meters at thirty kilometers an hour, one hundred and twenty-five at fifty, and two hundred and fifty at one hundred. The arithmetic is correct. But the reference list at page 9 discloses what the body text omits, describing the same source as finding that “Between the ages of 15 and 65, the time it takes to recover from glare increases from 1 to 9 seconds.” The nine seconds is a sixty-five-year-old’s recovery time, and the distances computed from it in the body of the report are a sixty-five-year-old’s distances presented as everyone’s. The Foundation records the error rather than relying on either version of the figure, and notes that the underlying gradient, if the characterization is accurate, is an age-related physiological finding sitting unreconciled in the same document as a conclusion that age was not confirmed as a factor.

One demographic result in the representative arm does align with Part V.C.5. Respondents who use a visual aid while driving reported being dazzled more often than those who do not. The Foundation draws no more from that than the report does, which is to say nothing beyond the observation itself. Part V.C.5 rests on the optics of scatter in the aging eye and on the sources cited there, and no part of this comment cites this survey for the proposition that susceptibility rises with age. It is cited for what it measures: that a large majority of drivers of every age report that their vision is impaired by the forward lighting of other vehicles.

The measurement the approval standard does not make

The passage that follows is the reason this document is in the comment at all. Under the heading Possible causes and effects, the report states:

> “The requirements for approval of vehicle lights are set in illuminance values of the light beam and the light distribution. The (human) eye instead ‘measures’ luminance and contrast. Due to the construction of the eye, it copies a sharp picture of the light source in all details onto the retina. The higher the luminance of the light source and the sharper the contrast in the light source, the more side effects occur in the eye.”

Alongside that passage the report prints a diagram of the eye, sourced to Seibersdorf Laboratories, AUVA-Report Nr. 53 Optische Strahlung, with a caption stating the geometric consequence: “The angular extent α characterises the size of the source on the retina. The smaller α, the smaller the image of the source on the retina. As the luminance must be increased for the same light performance on the road with a smaller angle α, it is also higher on the illuminated part of the retina.”

That is the proposition this comment argues at Part V.B.8 and Part V.C.2, stated as settled by a party to the international regulatory process: that a standard written in illuminance at a measurement point does not constrain the quantity that determines what happens at the retina, and that shrinking the emitter while holding road performance constant drives that quantity up.

The report then supplies a measurement of the shrinkage. It prints a photograph of the emitting surface of a modern low beam headlamp photographed against a grid, captioned: “Illustration of the light emission of a modern LED lowbeam headlight with very high luminance: each box measures 5x5 mm. The light emission area perceived by the eye is only around 5 cm^2 in total.” The source given is ADAC e.V. For comparison, the emergency warning lamp measured at Appendix D.4 and discussed at Part VI.C.1 was found to emit from 10.4 square centimeters across three diodes. The

two products are unrelated and serve different purposes, and the Foundation draws from the comparison only the fact they have in common, which is that the emitting area of a high-output vehicle lamp is now measured in single-digit square centimeters.

The clubs draw an inference from that geometry which the Foundation records as their proposal and not as a finding, since they state it in the first person: "The brightness is caused by the smaller dimensions of headlight units. We think there should be a minimal dimension for these lights to stop this." Whatever its merits as vehicle engineering, a minimum emitting area is a performance characteristic of a radiation-emitting product of precisely the kind section 360kk contemplates, and it is a characteristic no American instrument addresses.

The significance of the passage for this comment is that it is the second time the Foundation has been told the same thing by a body that regulates vehicle lighting. Part II.H.5 records the letter of 13 February 2024 in which the Acting Chief Counsel of the National Highway Traffic Safety Administration wrote that "FMVSS No. 108 does not directly regulate what you describe as peak luminance as measured in nits or the spectral power distribution of the headlamp light source". The European approval regime and the American one are differently drafted and differently administered, and this comment does not treat them as interchangeable. What they have in common is the gap, and neither of the bodies that administers them holds a public health mandate.

What the clubs asked the international regulator to do

The report's recommendations open with a conclusion about the adequacy of the approval regime: "The results of the survey indicate that the current approval requirements within the framework of the UN ECE approval procedure are insufficient to protect road users from glare." Seven recommendations follow. The third of them, printed in bold in the original, is the one the Foundation places before the Department:

> "The luminance of light sources must be limited, both at a distance and at close range, in order to reduce glare and exclude the risk of injury to the eye at close range (e.g. in stationary traffic, children crossing in front of standing vehicles, etc.; compliance with and review of German § 30 StVZO Para. 1)."

A sixth recommendation asks for the research that would support such a limit, calling for further studies "to investigate the causes of glare in more detail, to determine limit values for illuminance and luminance and to justify them on the basis of scientific findings on the glare effect in the eye". The presentation of the same study recommends in addition that the Working Party "should recommend WP.29 the establishment of a taskforce on glare (prevention)".

The Foundation states plainly what that recommendation is and is not. It is a recommendation by a consumer organization to a regulator. It binds no one, it was not adopted by the Working Party, and the word must in it is the language of advocacy rather than of law. Its weight lies in who said it and to whom: an organization that represents the national motoring clubs of a hundred and forty-seven countries told the body in which the international vehicle lighting regulations are developed that the luminance of vehicle light sources must be limited in order to exclude a risk of injury to the eye, and no such limit exists in those regulations, in Federal Motor Vehicle Safety Standard No. 108, or anywhere in Part 1040 of this Department's regulations.

The close-range injury question, which is not a glare question

One paragraph of the report leaves the subject of glare altogether, and the Foundation treats it separately for that reason. It appears at the end of Possible causes and effects, immediately before the conclusions:

> "There are indications that light sources with high luminance and a high proportion of blue light at close range can cause damage to the eye. There are still few studies on this, as today's luminance levels have only recently become available thanks to the latest LED technology. Unlike long-wave light, blue light produces chemical reactions on the retina that can lead to damage. However, it must be taken into account that the main beam of light can be viewed

> directly in front of the headlamp, either by passers-by when the vehicle is stationary or during maintenance work on the vehicle. The risk of injury must be safely excluded."

Glare is an effect on visual performance. It is temporary, it is measured in contrast and recovery time, and it is the proper business of a highway safety agency. The paragraph above is about something else: photochemical alteration of retinal tissue by short-wavelength optical radiation. That is the mechanism the blue light hazard weighting function describes, it is the subject of the exposure limits treated at Part V.B.2 and Part V.B.3 and of the instruments catalogued at Appendix D.2, and it is the subject matter of the electronic product radiation control provisions of the Federal Food, Drug, and Cosmetic Act.

The exposure geometry the paragraph describes is also different, and it is the geometry this comment has argued is unaddressed. The persons named are not drivers meeting a beam at a closing speed. They are a pedestrian standing in front of a stationary vehicle and a technician working on one. Both are stationary, both are close, and neither is protected by the aversion and averting behavior on which the continuous-source exposure limits implicitly rely. Part V.C treats that assumption and the conditions under which it fails.

The sentence the Foundation asks the Department to read twice is the second one. "There are still few studies on this, as today's luminance levels have only recently become available thanks to the latest LED technology." That is the structural argument of this entire comment, stated by a motoring organization to an international regulator in 2024: the exposure changed, the research record did not follow it, and the absence of findings is being read as an absence of risk.

The Foundation does not ask the Department to find that vehicle headlamps injure the retina at close range. The report does not establish that, says it does not, and the Foundation will not convert an indication into a finding. What the Foundation asks is narrower and follows from the statute. Paragraph 360ii(a)(4) directs the Secretary to study and evaluate emissions of, and conditions of exposure to, electronic product radiation. A question of photochemical retinal injury from a mass-market radiation-emitting product, raised in an international regulatory forum in 2024, acknowledged there to rest on few studies, and directed to a body with no health mandate, is a question that paragraph places with this Department. No agency of the United States has asked it.

What this document is, and the weight the Foundation places on it

It is an informal document submitted to a working party by an interested party, and each of those words carries a qualification. An informal document is a submission to a session, not an instrument of the body and not adopted by it. The submitting organization represents motorists, and a motoring organization's interest in less glare from other people's headlamps is a consumer interest that this comment states rather than conceals. The study was not peer reviewed, its questionnaire and respondent-level data are not published with it, and its figures are summary figures reported by its sponsors.

The authors say the first of those things themselves, and say it before reporting anything: "This survey is not a scientific study on the effects of glare on the road. Unfortunately, there is hardly any, and if there is, it is somewhat older." The Foundation records that sentence both as the authors' own characterization of their work and as a further instance of the proposition at Part II.G, that the literature on this exposure is thin and dated.

Three claims in the document the Foundation does not adopt. The first is the assertion that "US research shows that there is a link between glare from lights and road accidents", which names no study in the body and is followed by an argument from plausibility rather than from evidence. The second is a figure appearing only in the reference list, where a secondary source is described as reporting that glare from oncoming high beams accounts for twelve to fifteen percent of all traffic accidents in the United States; the Foundation has not obtained that source, has not verified the figure, and does not rely on it. The third is the statement that light output "has increased tenfold",

which appears in a quoted respondent comment and is an impression rather than a measurement. The measured trend in this subsection is the one at the beginning of it.

The Foundation also records, because candor requires it and because it bears on how the document should be read, that the study is not an attack on the technology. Its executive summary states that "This study is not an indictment of new types of vehicle lighting, such as LED lighting; this is widely used and has many advantages", before concluding that "the current regulations are not adequate" and calling for "an examination as to whether the current UNECE rules regarding vehicle lighting are suitable for the newest generation of beamers and lights and their functionality". That is the Foundation's position as to the American rules, and it has been the Foundation's position throughout this comment.

What survives every one of those qualifications is not the survey. It is the statement about metrology. Whether seventy-one percent or eighty percent of European drivers find glare intolerable is a matter on which a consumer survey can be challenged. Whether an approval standard written in illuminance constrains the luminance of the source is not a matter of opinion, is not affected by who asked the question, and has now been answered the same way by the clubs that submitted this document and by the agency that administers Federal Motor Vehicle Safety Standard No. 108.

The variable the standard does not control

Two things have been established in this subsection so far. The emission of these lamps is rising, and the people who receive it report that it impairs them. There remains the question that stands between the emission and the person, which is where the radiation is pointed. In October 2023 the agency that regulates these lamps published a measurement of how accurately they are pointed on new vehicles, together with a statement of what the federal standard requires on the subject. The statement is the more important of the two.

The report is Voyzey N., Mazzae E. N. and Andrella A., Assessment of Headlamp Aim for New Vehicles, Report No. DOT HS 813 481, published by the National Highway Traffic Safety Administration in October 2023 and performed at that agency's Vehicle Research and Test Center at East Liberty, Ohio. It is described at Appendix C.101. Fifteen vehicles of model years 2022 and 2023 were measured soon after delivery and before any other testing.

What the agency states the federal standard requires

Twice, in identical terms in its executive summary and its introduction, the report states:

> "There are currently no requirements in Federal Motor Vehicle Safety Standard (FMVSS) No. 108, Lamps, reflective devices, and associated equipment (49 CFR § 571.108, 2011), for aiming headlamps on a vehicle."

The guidance the testing was conducted against is a voluntary practice of the Society of Automotive Engineers, and the report disposes of its federal status in a footnote: "SAE J599 is not an incorporated reference standard to FMVSS No. 108." So the only aim criteria in existence in the United States are voluntary, and they are not incorporated into the standard that governs these lamps.

Where the chain breaks, and why it bears on everything this subsection has said

The Foundation sets out the architecture using only statements the agency has made in its own documents, three of which are now before the Department. In the Federal Register notice of 8 December 2022 the agency wrote that "the integral beam photometry requirements are for the lamp, not the light source". In the letter of 13 February 2024 it wrote that the standard "does not contain performance requirements for a light source that is part of an integral beam headlamp, but instead specifies performance requirements for the complete headlamp". In the research report of October 2023 it wrote that there are no requirements for aiming headlamps on a vehicle.

Read together those three statements describe a chain with a break in it. The light source is not regulated; the lamp is. The lamp is certified against photometric values specified at angular positions defined with respect to the lamp itself, which is to say in the lamp's own coordinate frame, on a bench, before it is installed in anything. The lamp is then fitted to a vehicle. Where that vehicle points it is governed by no federal requirement at all. The frame in which compliance is established belongs to the lamp. The frame in which a human being is exposed belongs to the road. Nothing in the standard fixes the relationship between the two.

That is the precise answer to the position the agency took in its letter of 13 February 2024, which Part II.H.5 records: that peak luminance and spectral power distribution are "indirectly regulated through the headlamp performance requirements". Indirect regulation through photometric requirements is regulation in the lamp's coordinates. Whether any of it reaches a person depends on a variable that the same agency, four months before that letter, reported to be outside the standard entirely. The Foundation states the chronology and does not characterize it.

What the measurements showed

Aim was measured by the procedure of SAE J599: the lower beam was shone on a matte screen twenty-five feet from the vehicle and the vertical position of the beam's cutoff was located relative to the height of the headlamp's optical center. Every vehicle was measured with no load and again with a 165-pound load in the driver seat. All fifteen were measured visually and five of them also with an imaging photometer, the two methods agreeing to an average magnitude of 0.12 degrees.

Judged against the voluntary SAE criteria, most lamps passed. Judged against the aim target specified by the vehicle's own manufacturer, fewer did. Of the ten vehicles whose manufacturer specifications could be obtained, and taking the condition with a driver load aboard, nine of ten driver-side lamps and five of ten passenger-side lamps were within the manufacturer's tolerance on visual measurement. On photometric measurement of the smaller subset the passenger-side figure was one of five.

The direction of the error is the part that matters here, and the report tabulates it. Taking the ten vehicles with manufacturer targets and no driver load, six of ten driver-side lamps and six of ten passenger-side lamps were aimed above the manufacturer's target rather than below it. The largest upward deviation recorded was 0.50 degrees. Upward is the direction the report's own rationale associates with glare to oncoming drivers.

What half of one degree is, and the arithmetic is the Foundation's

On the twenty-five-foot test screen, 0.50 degrees is about two and a half inches, which is why an aim error of this size reads as trivial in a laboratory. The exposure does not occur at twenty-five feet. The same angular displacement raises the beam by about 0.44 meters at fifty meters and by about 0.87 meters at one hundred meters. A deviation invisible on the test screen is most of a meter of vertical displacement at the distance at which oncoming drivers, cyclists and pedestrians actually meet the beam.

The Foundation states the limit of that arithmetic as plainly as the arithmetic itself. It does not establish that any particular beam entered any particular person's eyes, which depends on the mounting height of the lamp, the profile of the road and the geometry of the encounter. What it establishes is that the quantity left uncontrolled is not a small one where the exposure happens.

And the report addresses only the static case. A vehicle on a road pitches: under braking, under acceleration, over a crest, across a depression, and with every change of load. Each of those displaces the beam in the same coordinate frame the standard does not reach. The submission described earlier in this subsection makes that its central mechanical claim, stating that "The main problem of glare in traffic is the pitching movements of the vehicles and thus the significantly higher illuminance levels at the eye than those permitted by law in point B50L or zone 3", and naming among the conditions that should be taken into account "uneven road surfaces, bends, crests,

stopping times at junctions". Neither the static aim state nor the dynamic displacement about it is within Federal Motor Vehicle Safety Standard No. 108.

Two further disclosures in the report

The first concerns what can be known. For five of the fifteen vehicles the manufacturer's aim target could not be stated, because, in the report's words, some manufacturers "do not publicly disclose their aim target and tolerance information" and such information is recorded in the report as Confidential Business Information. The aim specification of a radiation-emitting device operated on public roads is, for a third of the sample, a trade secret. The Foundation notes the consequence for any study the Department might undertake under paragraph 360ii(a)(4): a third of the conditions of exposure in this sample could not be established from public information by the agency that regulates the product.

The second concerns what the fleet now is. Of the fifteen vehicles, fourteen were fitted with light-emitting diode headlamps, in projector or reflector optics, and one with a halogen projector. That is not a statistical sample of the fleet and the Foundation does not present it as one. It is a photograph of what a federal laboratory found when it bought fifteen new vehicles for unrelated research in 2022 and 2023.

The capability that exists, and the question nobody has put to it

The report records that "An imaging photometer was acquired during the course of this work", and identifies it. The agency that regulates these lamps now holds, at a federal test facility, an instrument that images and measures the light a headlamp emits. It was used to locate the position of a gradient in a beam pattern. It has not been used, so far as any public record shows, to measure what that beam delivers to the eyes of a person standing or driving in front of it.

That is the liaison point of paragraph 360ii(a)(3) in its plainest form, and it is the second instance of it in this subsection. The first was the decade of headlamp photometry held by the Insurance Institute for Highway Safety. This is the second: the instrument, the facility, the vehicles and the technical staff all exist inside the Department of Transportation. What does not exist there is the mandate to ask what the measured radiation does to the person who receives it. That mandate is here.

What this report does not establish, stated because the Foundation relies on it

It does not measure glare, and the Foundation says so before anything else because the title and subject matter invite the opposite assumption. The word appears twice in twenty-eight pages, in one sentence repeated: "High headlamp aim can result in an abundance of glare for drivers of oncoming and preceding vehicles." That is the stated reason for caring about aim. It is not a finding, and no measurement in the report bears on it. There was no human subject. No illuminance was measured at anyone's eye. No biological endpoint of any kind was assessed. The entire reference list of the report consists of two items, the standard itself and SAE J599, and contains no scientific literature on glare or on vision.

Nor is it a survey of the fleet. Fifteen vehicles were measured, and they were vehicles the laboratory had purchased for other research rather than a sample drawn to represent anything. The deviations recorded are deviations from manufacturers' own aim targets and from a voluntary practice, not from any safety limit, because no safety limit exists. The authors describe the work accurately as "a good initial assessment".

The Foundation therefore cites this report for three propositions and no others: that the federal standard contains no headlamp aim requirement; that when a federal laboratory measured the aim of fifteen new vehicles, the majority deviated upward from the manufacturer's own target; and that the measurement capability for this class of question exists within the Department of Transportation. The first of those is the one that matters, and it is a statement the agency made about its own standard.

What the design target set actually contains

The three movements above describe a rising emission, a population that reports being impaired by it, and a geometry that no federal requirement fixes. The question that remains is what an engineer designing one of these lamps is actually required to achieve. That question has a documentary answer, because designers publish their work.

The Foundation takes as its example Hsieh C.-C., Tsai C.-L., Hung C.-C., Lin H.-H. and Li T.-C., Design of Multi-module LED Headlamp of Vehicle Under Federal Motor Vehicle Safety Standard, Sensors and Materials, volume 35, number 7 (2023), pages 2433 to 2448, described at Appendix C.102. It is a peer-reviewed optical engineering paper by five authors at three Taiwanese institutions, reporting the design, simulation and construction of a light-emitting diode low beam headlamp built expressly to satisfy Federal Motor Vehicle Safety Standard No. 108. It is chosen because it is explicit about its target: the authors state that they used "the low-beam headlamp regulations in FMVSS 108 as the verification standards in this study", and they cite the Electronic Code of Federal Regulations section for Standard No. 108 as their source.

The target set, as the designers reproduce it

The paper reproduces the photometric requirement as a table of eighteen numbered test points. Each row gives an angular position, a required luminous intensity in candelas, and the corresponding illuminance in lux. The positions are expressed in degrees up, down, left and right of the lamp's axis, written in forms such as 10U-90U, 0.6D-1.3R and 1.5D-2R. The measurement is made at a stipulated distance of sixty feet, which the authors give as 18.3 meters, at a test voltage of 12.8 volts plus or minus 20 millivolts, and the illuminance column is derived from the intensity by the inverse square of that distance.

Two things about the structure of that table matter to this comment, and neither is apparent without counting the rows.

The first is the coordinate frame. Every one of the eighteen positions is an angle measured from the lamp. Compliance is therefore established in the lamp's own frame, at a fixed distance, on a bench, at a regulated voltage, before the lamp is fitted to any vehicle. That is the architecture the preceding movement described from the agency's own statements, and here it is visible in the requirement itself.

The second is the asymmetry between floors and ceilings. Of the eighteen test points in the lower beam table, eleven specify only a minimum intensity, five specify only a maximum, and two specify a range. Sorted by direction the pattern is sharper. Of the ten test points at or above the horizontal, five carry a maximum, and those five are the whole of the lower beam constraint on light thrown toward the eyes of other road users. The Foundation confines that statement to the lower beam, because the standard does cap the upper beam: Part VI.B.2 records that the maximum permitted intensity of a United States upper beam is 150,000 candelas, against 430,000 in Europe. Of the eight lower beam test points below the horizontal, six carry a minimum and no maximum at all. Among those six are the two brightest requirements in the table:

- test point 11, at 0.6 degrees down and 1.3 degrees right, requires at least 10,000 candelas, and specifies no upper limit;
- test point 14, at 1.5 degrees down and 2 degrees right, requires at least 15,000 candelas, and specifies no upper limit.

The two ceilings that do exist below the horizontal are at test point 13, which admits a range of 1,800 to 12,000 candelas, and test point 17, which caps intensity at 12,500. Neither applies at the points where the beam is required to be brightest.

That asymmetry closes a loop opened at the beginning of this subsection. The measured growth of low beam intensity over the last decade, thirty-five percent on the sample described above, required no exemption and broke no rule. At the points where the beam is brightest the standard sets a floor

and nothing else. A lamp twice as intense as its predecessor at those points is as compliant as the lamp it replaced. The Foundation has made the same observation about emergency warning lamps at Part VI.C.1, where the federally funded study of those devices found specified minimums and no maxima. The pattern is not confined to one product class.

What the designers optimized, and what they did not

The paper is a complete record of a design effort, and its figures of merit can be listed exhaustively. The authors optimized luminous intensity in candelas at each of the eighteen test points; illuminance in lux; the height and shape of the left and right cutoff lines; luminous flux in lumens, raised from 228.9 to 334.6 by replacing a shade with an asymmetric floorboard; electrical power, reduced to 16 watts against a 55 watt halogen lamp; light utilization efficiency; the suppression of scattered light above the cutoff; the physical dimensions of the assembly; and the rotation angles of the constituent modules. The reported result is that the system "satisfied illuminance regulations" while requiring, in the authors' words, "only 16 W with 70% less energy, while still meeting the regulations in FMVSS 108".

Not one of those quantities is biological. That is not an impression; it is a property of the document that can be checked by anyone in a minute. In sixteen pages the word eye does not appear. Neither does vision, nor visual, nor retina, nor comfort, nor human, nor health. The word luminance does not appear. Neither does wavelength, nor spectral, nor blue, nor color temperature. The word safety appears four times, three of them inside the name of the standard and the fourth inside the title of a cited conference. The word glare appears twice: once in the introduction, describing earlier work by others, and once in a single sentence of the authors' own, reporting that after a condenser was added to recover light that had been scattered above the cutoff, "drivers of approaching vehicles on the opposite lane do not suffer from any glare caused by scattered light from headlamps".

That sentence deserves its own observation, because it is the only place in the paper where a human being appears. The change that produced the benefit was made to recover wasted light and raise efficiency. The absence of glare is reported as a consequence of that change, not as a criterion the design was required to meet. There was no glare specification to meet, and so there is none in the paper.

Why this is not a criticism of the authors

The Foundation states plainly that nothing in the preceding paragraphs is a reproach to these engineers, and it would decline to make one. They set out to design a lamp conforming to the federal standard and they did so, competently and transparently, and published the result where it can be read. A designer who wished to constrain the luminance of the source, or its short-wavelength content, or the irradiance delivered to a retina at close range, would find no number in Standard No. 108 to design to. There is no such requirement to satisfy, no test point at which it is evaluated, and no unit in which it is expressed. The absence in the paper is a faithful reflection of the absence in the standard.

Which is the proposition this comment has been putting to the Department from Part I, arrived at here from the direction of the drawing board. It is also, word for word, what the agency administering the standard told the Foundation on 13 February 2024: that Standard No. 108 "does not directly regulate what you describe as peak luminance as measured in nits or the spectral power distribution of the headlamp light source". Here is an independent design team on another continent working to that standard, and neither quantity appears anywhere in sixteen pages of their work. The agency's description of its own standard is confirmed by the conduct of the people who build to it.

What this paper does not establish

It is one paper by one group describing one design, and the Foundation does not present it as a survey of industry practice. It is a research design simulated in optical software and built as a prototype, not a production headlamp, and its measured peak illuminance of 700 lux at four meters

fell short of the 1,071 lux its simulation predicted, which the authors attribute to assembly tolerance and reflector finish. It reports no biological measurement, no exposure assessment and no human subject, and the Foundation cites it for no proposition about injury. It is cited for what it is: a published, checkable record of what the federal standard asks a headlamp designer to deliver, and of what it does not ask.

Nor does the Foundation present the paper's table as the regulation. The table is the authors' reproduction of requirements they attribute to the Electronic Code of Federal Regulations as accessed in June 2023. The Foundation relies on it as a designer's rendering of the target set and has recorded.108 before this comment is filed.

The condition the test does not include

One further gap belongs in this subsection, and it concerns not what is measured but where. The photometric requirement described above is evaluated at a stipulated distance of 18.3 meters, in a laboratory, at a regulated voltage, through clear air. Fog, rain and falling snow appear nowhere in it. The conditions under which forward lighting is most needed and least effective are not part of the test by which it is certified.

The Foundation has found one experimental study that varies the spectrum of a real headlamp under a scattering medium while holding the quantity of light constant, and it is described at Appendix C.103: Sefer T., Ayaz R., Ajder A. and Nakir I., Performance investigation of different headlights used in vehicles under foggy conditions, Scientific Reports, volume 13, article 4698 (2023). The Foundation states its limitations before its findings, because they are severe.

What the study is, and what it is not

It is a bench experiment, not a road study and not a driving study. Three production headlamps — a halogen lamp measured at 3031 kelvin, a light-emitting diode lamp at 5122 kelvin and a xenon lamp at 5098 kelvin — were directed into a box measuring one meter by eighty centimeters by one meter, painted matte black inside, into which fog was introduced by a theatrical fog machine. Targets were yellow and red cubes of five centimeters. Twelve participants aged 21 to 36 pressed a counter when they saw a cube. The illuminance at the target was equalized across the three lamps to within five lux, so that only the spectrum differed.

The fog was far denser than any road condition. The paper reports transmittance of about twenty percent at thirty seconds, rising to fifty-three or fifty-four percent after fifteen minutes. On the assumption that the optical path was of the order of one meter, which the box dimensions imply but the paper does not state, that corresponds to an extinction coefficient of roughly 1.6 per meter and, by the Koschmieder relation, to a meteorological visibility of about two and a half meters at the start of a run and about six meters at the end. The arithmetic and the assumption are the Foundation's. The paper's own introduction defines fog as reducing visibility below one thousand meters. The conditions tested are therefore two to three orders of magnitude denser than the phenomenon the study is about, and the detection times, which run from six seconds to nearly three minutes for a cube about a meter away, cannot be read as driving performance.

Twelve participants is a very small sample. The paper also reports a difference in detection time between its six female and six male participants of between 1.72 and 3.65 times, and places that figure in its abstract. The Foundation does not rely on that finding and does not reason from it. Within a single condition the detection times of the twelve participants span a factor of more than eight, which is variation of a size that no comparison between groups of six can survive, and the paper offers no analysis capable of separating a group effect from it.

The result, and the mechanism, which is not the one usually assumed

Two quantities were measured, and they disagreed. On transmittance through the fog, the xenon lamp performed best: "the transmittance values under xenon headlights are approximately 2–3% higher than halogen and LED headlights in almost every measurement". On relative target

luminance, the xenon lamp was also highest for both target colors. But on detection by human observers, at equal illuminance, the order reversed: the authors report that "the target detection times of the participants are the shortest at the halogen headlight, the second at the xenon headlight, and the third under the LED lights".

The Foundation draws attention to the direction of that result, because it is the opposite of what a scattering account would predict and the paper is sometimes read as supporting one. The higher color temperature sources did not deliver less light through the fog. The xenon lamp delivered more. The same study's own survey of the literature records a measurement to the same effect, that "shorter wavelengths (blue and green) are 1.5 times less scattered than longer wavelengths (yellow-green, amber/ochre, and red)". Fog droplets are large compared with the wavelength of visible light, and the scattering is correspondingly weak in its dependence on wavelength, which is why fog appears grey rather than blue.

The authors attribute the result instead to an effect in the eye: "it is seen that detection times under halogen headlights are lower than detection times under xenon and LED headlights. This is because of the white wall effect in the eyes of the participants as a result of the white light reflection in a foggy environment." The light scattered back toward the observer forms a luminous veil, and the veil destroys the contrast of the target against its background. More light reaching the eye produced worse seeing.

Why the divergence is the point

That is the proposition this subsection has now met four times from four directions. The approval standard is written in illuminance; the European clubs told the international regulator that the eye responds instead to luminance and contrast. The agency administering Standard No. 108 wrote that it does not directly regulate peak luminance or spectral power distribution. A published design to that standard contains no biological quantity anywhere in it. And here, where both the instrument and the observer were measured in the same experiment, they disagreed: the source that got the most light through the medium was not the source under which people saw best.

The authors state the methodological consequence themselves, and it is the sentence for which the Foundation principally cites this paper:

> "Since transmittance is insufficient alone to evaluate vehicle headlights' performance under fog conditions, the luminance of the target objects should also be considered. However, the luminance camera measures the luminance of fog instead of the target's luminance due to the fog in front of the object in the luminance measurements. Therefore, user-based tests that consider color temperature and luminance parameters should be conducted for a more realistic performance evaluation in foggy conditions."

A photometric measurement made in clear air at 18.3 meters cannot represent that. It is not a defect of the measurement, which does what it was designed to do. It is a limit on what can be inferred from it, and the limit is invisible unless someone measures the person as well as the lamp.

What the authors recommend, and the quantity it names

Their closing recommendation is spectral: "the use of LED light sources with low correlated colour temperatures may give more successful results, as with halogen light sources". The Foundation notes which quantity that is. Correlated color temperature is a crude summary of spectral power distribution, and spectral power distribution is one of the two quantities the agency administering Standard No. 108 told the Foundation in February 2024 that it does not directly regulate. It is also among the quantities the European submission asked the international regulator to address. Three independent sources in this subsection arrive at the same missing number from three different problems: glare, injury at close range, and visibility in fog.

The Foundation draws no conclusion from this study about any particular product. The lamp it tested measured 5122 kelvin, and the Foundation does not assert that the effect observed scales to

the higher color temperatures found in some production headlamps, because the study tested one lamp at one value and provides no basis for extrapolation. What it asks the Department to notice is narrower: that the spectral composition of forward lighting appears to affect what a person can see under conditions the certification test does not include, that this was demonstrated by measuring people rather than instruments, and that no federal body is positioned to pursue it.

The instrument that measures the effect on a person, and where it is kept

Five things have now been established in this subsection: that the emission is rising, that the people exposed report impairment, that the geometry which decides where the emission goes is federally unregulated, that the design target set contains no biological quantity, and that the certification test excludes the conditions in which forward lighting is most needed. One question remains, and it is the practical one. If the Department were directed tomorrow to evaluate what this radiation does to the people who receive it, with what would it do so?

An apparatus for exactly that purpose was built in 2009 at the Schepens Eye Research Institute of Harvard Medical School, and the paper describing it is Fullerton M. and Peli E., Development of a System to Study the Impact of Headlight Glare in a Driving Simulator, in Proceedings of the Fifth International Driving Symposium on Human Factors in Driver Assessment, Training and Vehicle Design, Big Sky, Montana, 22 to 25 June 2009, at pages 412 to 418. It is described at Appendix C.106.

The Foundation states what kind of paper it is before using it. It is a seven-page conference paper reporting the construction of a prototype. It presents no experiment on human subjects, no findings about any population, and no measured effect on anyone. Its only observation about people is anecdotal, that "Drivers testify to being unable to see the area around the car headlamps". It is cited here for what it built and for what its authors say about the state of measurement, not for any result.

What had to be built, and what that reveals about the source

The authors set out to present an oncoming headlamp to a driver in a simulator at the light level such a headlamp would actually deliver to the eye. They computed what that required from published measurements of American and European beam patterns, and found that for the range of approach distances that matter the display would have to reach luminances between roughly 687 and some thousands of candelas per square meter. They then recorded what displays could do: a cathode ray tube reaches 50 to 100 candelas per square meter, a liquid crystal display of that period 200 to 600, and only experimental high dynamic range displays with individually controlled diode backlights reached 10,000. Their conclusion was that "current display technology cannot yet achieve the necessary luminance to create realistic headlight glare directly on the screen".

The Foundation records that for what it says about the source rather than about the display. A vision research laboratory at a medical school, setting out to reproduce an everyday roadway exposure, found that no commercially available screen was bright enough. The exposure had to be synthesized with a separate diode array, combined into the scene through a fifty-fifty beam splitter, positioned in real time to track the simulated oncoming vehicle, and calibrated against the illuminance measured at the driver's head. The simulator was fitted with combined head and eye tracking so that where the driver looked could be recorded. That is the engineering required to put a headlamp in front of a person under conditions anyone can repeat.

The Department already has a night driving glare test, and these authors say what is wrong with it

This is the sentence for which the Foundation principally cites the paper, and it concerns the Department:

> The current 'standard' test that has been used in a number of FDA studies, the 'Night Driving Simulator' of Vision Sciences Research Corp. (VSRC, San Ramon, CA), does not accurately

> simulate glare in terms of the light intensity (headlights are only shown as part of the film capture).

Two things follow and the Foundation separates them. The first is that the Department is not without a night driving glare test. It has used one. The second is that a vision research institute of Harvard Medical School, writing in a peer-reviewed conference proceedings, states that the test does not reproduce the light. The headlamps in it are part of a filmed scene, which is to say that the luminance reaching the subject is the luminance of a projected film and not of a headlamp. The authors add that even a realistic source in a clinical test would not show the functional consequences, because such tests cannot measure reaction to realistic objects, steering stability, or the head and eye movements by which a person turns away from a light.

Which products the Department applies that test to, and which it does not

The paper also records why such a test exists at all, and the answer is the most consequential sentence in it for this comment:

> Effects of variations in design are of interest to manufacturers of ophthalmic devices, as they are required to satisfy FDA safety concerns and also want to verify that their products are not worsening the night-driving situation.

The Department therefore asks a question about headlamp glare already, and asks it of contact lenses, intraocular lenses and the other ophthalmic devices within its device authority. A manufacturer who places a lens in front of a retina must satisfy the Department that the lens does not make night driving worse. The light that the lens is tested against comes from a headlamp, and the manufacturer of the headlamp is asked nothing at all.

The Foundation does not suggest that the device requirement is misplaced. It is plainly right that a lens be tested against the conditions in which it will be worn. The observation is about the asymmetry. In the only place where the Department presently engages with this exposure, it regulates the receiver and leaves the emitter alone, even though the emitter is an electronic product emitting electronic product radiation within section 360hh(1)(A) and the receiver is a person's eye. The quantity being controlled is the same quantity in both cases. Only the party bearing the obligation differs.

What the authors found the literature did not contain

Writing in 2009 they stated that "To our knowledge the behavioral effects of headlight glare have never directly been examined, and no measure of eye and head movement during driving glare was found in the literature", and that previous behavioral studies "have used inaccurate glare simulations". The Foundation has not established what has been published since and has not checked it.

One further finding reported in their review bears directly on a passage earlier in this Part. They record that Theeuwes and colleagues, in 2002, "made the interesting discovery that drivers' impression of a glare source does not relate well to their on-road performance", and that clinical glare measures correlate only weakly with driving performance and are not reliable predictors of it. Part VI.B.2 reports an American evaluation of adaptive driving beam systems whose glare finding rested entirely on subjective ratings given by five observers on a nine-point scale. On the evidence these authors summarize, a subjective rating is not a measure of what the light does to a person's performance, and the Foundation asks that the evaluation at Part VI.B.2 be read accordingly.

A corroboration the Foundation records because it runs the other way from a source cited above

Part V.C.5 argues from optics that the light scattered within the eye, and therefore the veiling luminance that destroys contrast, is increased by changes in the ocular media. The European survey described earlier in this subsection found no age gradient in how often drivers report being dazzled, and the Foundation recorded that finding against its own position. These authors, at an eye research

institute, state the optical proposition directly: that changes in the ocular media brought about by age, by eye surgery, by cataract, or by the use of contact lenses, intraocular lenses and spectacles "can all worsen the 'veiling luminance' upon the retina responsible for disability glare". The two findings are about different things, one about reported annoyance and one about light scattered on a retina, and Part V.C.5 rests on the second.

The third instance of the liaison point in this subsection

Paragraph 360ii(a)(3) directs the Secretary to maintain liaison with and receive information from other agencies, professional organizations and others concerned with electronic product radiation. This subsection has now identified three capabilities that exist and one question that has not been put to any of them. A decade of headlamp photometry is held by the Insurance Institute for Highway Safety. An imaging photometer and a vehicle test facility are held by the National Highway Traffic Safety Administration. And an apparatus that presents calibrated headlamp glare to a driver while recording steering, reaction and gaze was built at a medical school in 2009, by investigators whose work the Department's own device program has reason to know.

What the Foundation asks on test procedure

That the Department state what test procedure it would use to evaluate the effect of vehicle forward lighting on a person, and if the answer is the night driving simulator its device program has used, that it state whether it accepts the criticism these authors make of it. Part II.H.3 establishes that paragraphs 360ii(a)(2) and (a)(5) direct the antecedent work of defining the quantity to be minimized and developing measurement methods referred to the point of human exposure. A performance standard that cannot be tested is not a standard, and the test procedure is therefore not a detail to be settled afterwards but part of what the statute directs the Secretary to develop. The Foundation observes that the Department has had, since 2009, a published description of an apparatus that does what such a test procedure would require, and that it was built three miles from a Department field office by investigators who were building it in order to satisfy the Department.

What the agency was told in 2008, and by whom

Everything above concerns the present. There is also a history, it is documented, and it is short enough to set out. It begins with the public, passes through Congress, and ends without a standard.

In 2001 the National Highway Traffic Safety Administration opened a public docket inviting comment on headlamp glare. The agency's own account of what arrived is one sentence: "Most responses received have been complaints." In 2005 Congress acted. Section 2015 of the Safe, Accountable, Flexible, Efficient Transportation Equity Act directed the Department of Transportation to conduct a study on:

> "the risks associated with glare to oncoming drivers, including increased risks to drivers on 2-lane highways, increased risks to drivers over the age of 50, and the overall effects of glare on driver performance", together with "any recommendations regarding measures to reduce the risks associated with glare to oncoming drivers."

The research was performed by the Lighting Research Center at Rensselaer Polytechnic Institute under contract to the agency and reported in Bullough J. D., Skinner N. P., Pysar R. M., Radetsky L. C., Smith A. M. and Rea M. S., Nighttime Glare and Driving Performance: Research Findings, Report No. DOT HS 811 043, September 2008, described at Appendix C.107. It is 118 pages and comprises seven studies. The lead author is the same investigator whose later work on emergency warning lamps appears at Part VI.C.1 and Appendix D.4.

The eight countermeasures, and how the agency's contractor rated them

The report assessed the countermeasures that the agency had set out in its 2007 report to Congress and rated each as having high, medium or low potential. Mounting height, optical design and low beam distribution were rated low. Cleaning and maintenance was rated medium. Two were rated high and one of the mediums is the one this comment has been looking for.

On aim, rated high:

> "It appears that some new vehicles and many in-use vehicles have mis-aimed headlamps that compromise visibility (when mis-aimed downward) and increase glare to other drivers (when mis-aimed upward). Periodic adjustment of aim should result in more consistent visual conditions."

The Foundation sets that beside the finding recorded earlier in this subsection and asks the Department to read the two dates. In 2008 the agency's contractor identified aim as one of the two highest-value countermeasures available and reported that mis-aimed headlamps were prevalent on new and in-use vehicles alike. In October 2023 the agency's own Vehicle Research and Test Center reported that there are no requirements in Standard No. 108 for aiming headlamps on a vehicle, and found that a majority of the new vehicles it measured were delivered aimed above the manufacturer's own target. Fifteen years separate those two documents and both are the agency's. The Foundation states the chronology and offers no characterization of it.

On color, rated medium:

> "'Bluer' sources such as HID headlamps do indeed increase discomfort, so restricting short-wavelength output could reduce discomfort, but would likely have little impact on visibility reductions from headlamps."

That is a federal contractor, reporting to the agency that regulates these lamps, under a study Congress directed, recommending that restricting short-wavelength output be considered. It is the proposition this comment puts at Part V.B.3 and Part V.F, stated in 2008, in a document the agency commissioned and published. No such restriction exists in Standard No. 108 today, and the agency wrote to the Foundation on 13 February 2024 that the standard does not directly regulate the spectral power distribution of the headlamp light source.

The fleet the study measured, which no longer exists

The recommendation on color was made about high-intensity discharge lamps, because those were the bluer sources then on the road. The Foundation has examined the report for its treatment of the technology that has since replaced them, and the result is the reason this document is in the comment.

In 118 pages, light-emitting diodes are mentioned twice. Neither mention is a measurement. Both are speculations about how the adaptive prototype the program developed might one day be built: that reduction of intensity "could be carried out through a modular approach of smaller sources (e.g., possibly light emitting diodes)", and that "light emitting diodes (LEDs) could be a useful light source technology for dynamically switching or dimming parts of a beam pattern". No diode headlamp was measured. No diode spectrum was assessed. No exposure from a diode source was evaluated, because in 2008 there was substantially none to evaluate.

The study's own exposure data confirm the composition of the fleet it observed. The authors record that in the field work "the presence of high-intensity discharge headlamps during the study was very rare and that almost all oncoming headlamps experienced by the subjects were halogen headlamps", and they state that this limits what can be concluded from their spectral measurements.

So the position is this. The last congressionally directed federal study of headlamp glare was completed in 2008. It was conducted on a fleet that was almost entirely halogen. Its spectral recommendation concerned a discharge source that has since been displaced. Part VI.B.1 has established that the luminous intensity of low beams rose by about thirty-five percent in the decade to 2025 and that fourteen of the fifteen new vehicles a federal laboratory bought in 2022 and 2023 carried diode headlamps. No equivalent federal study has been conducted on the fleet that now exists.

The instrument the agency already had, in 2008

The field study measured light at the driver's eye with a head-worn meter developed by the Lighting Research Center, the Daysimeter. The report records that "The head-worn device included a photopic illuminance detector and a short-wavelength ('blue') detector", and that the combination "allowed differentiation among light sources of differing spectral composition".

That is the fourth capability this subsection has identified and the most directly on point of the four. In 2008, under federal contract, a wearable instrument measured short-wavelength light arriving at the eyes of drivers on public roads. The quantity it measured is the quantity this comment asks the Department to evaluate. It was measured in order to distinguish halogen from discharge sources, and the finding it supported was about discomfort ratings. Nobody has since pointed it at a diode fleet and asked a question about the eye.

Three findings the Foundation records because they bear elsewhere in this comment

The first concerns age, and it is the agency's answer to the question Congress asked about drivers over fifty: "Glare reduces visibility more for older (>50 years) drivers because the eyes of older drivers contain more dead cells that increase the amount of scattered light compared to younger drivers, resulting in a brighter 'veil' over the scene." The report states separately that "Older drivers are more susceptible to headlamp glare in terms of disability glare and glare recovery." That is a federal finding supporting Part V.C.5, and the Foundation sets it beside the European survey recorded earlier in this subsection, which found no age gradient in how often drivers report being dazzled. The two are not in conflict. One measures scattered light on a retina and the other measures how often people complain.

The second concerns the difference between what people report and what happens to their vision: "Drivers' perceptions of glare (i.e., discomfort glare) are often different from the other negative effects of glare (i.e., disability glare and glare recovery), probably explaining in part the negative responses to 'blue' HID headlamps (because they elicit greater discomfort even when they do not diminish visibility more than halogen headlamps [i.e., at the same luminous intensity])." This is now the third independent source in this comment for the proposition that a subjective glare rating is not a measure of visual performance, and it is a federal one. It bears on Part VI.B.2, where the only American evaluation of adaptive driving beam rested on subjective ratings from five observers.

The third concerns the adequacy of the lower beam itself: "Present low beam headlamp patterns do not appear to provide sufficient visibility at many of the higher driving speeds for which they are commonly used, even when no oncoming vehicle headlamps are present." The Foundation records that because it is the tension running through this entire subsection, stated by the agency's own contractor: the beam is simultaneously too weak for the driver who uses it and too strong for the person who meets it, and no standard reconciles those two facts because no standard measures the second.

A finding that runs against a source cited earlier in this subsection

The European submission described above asserts that "US research shows that there is a link between glare from lights and road accidents", naming no study. The Foundation declined to adopt that assertion when it recorded the submission, and records here what the American research actually says. This report states: "Despite the very clear evidence relating glare to reduced visibility, there is little direct evidence linking glare to increased crash risk." It explains why, which is that unlike alcohol there is usually no way to determine whether glare contributed to a particular crash, and it adds that police reports sometimes mention glare and that an effect is not unreasonable to expect. The Foundation adopts the agency's formulation and not the submission's.

What this establishes, and what it does not

It does not establish that the agency did nothing. It conducted the study Congress directed, published it, measured aim and eye illuminance in the field, and built and demonstrated a prototype

adaptive system that anticipated by fourteen years the technology at Part VI.B.2. The Foundation records that work rather than passing over it.

What it establishes is the shape of the gap. The agency studied glare as a problem of visibility, comfort and crash risk, which is its mandate and the mandate Congress gave it. Within that study its contractor reported that bluer sources increase discomfort and that restricting short-wavelength output could reduce it. What was never asked, because it is not that agency's question to ask, is what short-wavelength optical radiation at those levels does to the tissue of the eye receiving it. That question belongs to the Department, the instrument to measure its input existed under federal contract in 2008, and the fleet has been replaced in the interval by sources with different spectral properties without the question being put at all.

The ophthalmological account, including the part of it that corrects the Foundation

The sources above are engineering, regulatory and survey documents. The Foundation closes this subsection with one written by ophthalmologists, because it answers the question the others leave open — what is actually happening in the eye — and because it contradicts a proposition the Foundation might have been expected to advance.

Mainster M. A. and Timberlake G. T., Why HID headlights bother older drivers, British Journal of Ophthalmology, 2002, described at Appendix C.108. The authors write from the Department of Ophthalmology at the University of Kansas, and the article is a perspective rather than a report of original experiment. It reviews the optics of headlamps, the physics of light scattering in the eye, and the clinical literature on glare and photostress, in order to explain why complaints about high-intensity discharge headlamps came predominantly from older drivers.

The correction

Their conclusion is stated in the abstract and the Foundation reproduces it without softening:

> "An analysis of automobile headlights, intraocular stray light, glare, and night driving shows that brightness rather than blueness is the primary reason for the visual problems that HID headlights can cause for older drivers who confront them."

The reasoning is optical. Light scattered by small particles is wavelength dependent and light scattered by large ones is not, and in the eye the two effects run in opposite directions: scatter from the cornea and lens falls with increasing wavelength, while scatter from fundus reflectance and transillumination rises with it. The authors state the result: "The net effect is that stray light reaching the fovea has little wavelength dependence. Thus, blue-white HID headlights should produce no more foveal stray light or disability glare than white headlights of the same luminance."

The Foundation records that finding as the authors state it and does not argue with it. No part of this comment contends that the short-wavelength content of a headlamp increases disability glare, and if any passage elsewhere could be read that way it should be corrected against this source. The quantity that governs disability glare is luminance, which is the quantity Part VI.B.1 has shown the federal standard does not regulate and which the European submission asked the international regulator to limit.

What the same authors say blueness does do

The correction is confined to disability glare, and the authors are equally clear about the other kind: "HID headlights also cause more discomfort glare than conventional halogen headlights of the same photopic or scotopic illuminance. This potential distraction is greater in 61–77 than 20–31 year old drivers."

That is a spectral effect at matched illuminance, which is to say an effect of the light's composition rather than its quantity, and it is larger in older people. It is the same finding the National Highway Traffic Safety Administration received from its own contractor six years later, recorded earlier in this subsection: that bluer sources do increase discomfort while having little effect on visibility. Two

independent sources in this comment, one clinical and one federal, reach the same split conclusion. The Foundation adopts it, and states the consequence: the case for attending to spectral content rests on discomfort, distraction and aversion, and separately on the photochemical questions treated at Part V.B.2 and Part V.B.3, which concern injury to tissue and not the scattering of light within the eye. It does not rest on disability glare.

The authors describe what discomfort glare consists of, and the list is the reason this comment treats it as more than annoyance: it "does not impair vision, but it can be startling or distracting to a driver, and cause blinking, squinting, ocular aversion, and fatigue". They add that "The physiological and psychophysical origins of discomfort glare remain uncertain." An effect whose mechanism is unknown, which produces aversion and fatigue in drivers, and which is worse in older people, is a biological question about a radiation-emitting product.

Photostress, which outlasts the exposure

The article supplies a third category this comment has not until now named. Beyond veiling and dazzle glare, which are optical and end when the light does, the authors describe scotomatic glare, which does not:

> "Scotomatic disability glare occurs when a brilliant light source decreases visual sensitivity ('puts a retinal area temporarily out of business'). Sensitivity is diminished while the visual system rapidly light adapts during glare exposure and then more slowly dark adapts after glare exposure. This 'photostress' may startle and disorient observers, producing afterimages that interfere with vision."

Its mechanism is stated: it "is caused primarily by rapid bleaching and subsequent slower regeneration of retinal photoreceptor photopigments". Its magnitude scales with the source: "Photostress recovery time increases with photostress source luminance", and "It also increases with ageing". The authors note that photostress "occurs during flash photography and momentary exposure to an inept lecturer's laser pointer beam".

Part V.E.7 concerns effects of light that outlast the exposure that produced them, and rests on a laboratory study in mice. Here is the clinically established human instance of the same class, named in the ophthalmological literature, scaling with source luminance, worsening with age, and occurring routinely on public roads. The Foundation asks that Part V.E.7 be read with it, and notes that the European survey reported earlier in this subsection found thirty percent of a representative sample reporting that they continued to see an image of the light source after passing it, or felt pain. That is photostress, reported by the people experiencing it.

Three findings about measurement and about age

First, on age, which bears on Part V.C.5 and on the European survey finding recorded against the Foundation earlier in this subsection: "Light scattering increases in people over 50 years of age"; "Older individuals have increased intraocular stray light, glare sensitivity, and photostress recovery time"; and disability glare is increased by cataract, by intraocular lens implantation and by posterior capsule opacification. This is the third source in this subsection stating the optical proposition, after the Harvard apparatus paper and the federal study of 2008.

Second, on the difference between a laboratory and a road: "Transient glare as occurs in a headlight encounter is worse than static glare from a light source of the same luminance, and this effect increases with ageing and media opacities." And in the conclusion: "Conventional clinical glare tests underestimate disability glare from moving light sources." Every photometric requirement described in this subsection is a static measurement. The authors state that static measurement understates what a moving source does, and that the understatement grows with the age of the person exposed.

Third, on a mechanism this comment asserted earlier and could not source. Part VI.B.1 records, in treating a study of headlamp spectra under fog, that scattering by fog droplets is weakly dependent

on wavelength and that this is why fog appears grey. These authors state it: “Large particle or Mie scattering is not wavelength dependent, but light is preferentially scattered in the forward direction”, and “Fog doesn’t change the apparent colour of automobile headlights because large fog droplets scatter all visible wavelengths equally effectively.”

What the authors say about regulation, in 2002

Two sentences, written twenty-four years ago. On the state of the remedies: “Practical solutions for the highway glare problem have been studied for decades. Countermeasures have never been implemented seriously because of consumer disinterest, manufacturer resistance, and lack of legislative resolve.” And on who decides: “Governmental regulations determine which headlights we encounter.”

The Foundation offers no gloss on either. It observes only that the article was published in 2002, that the countermeasures it describes include adaptive beam systems which were not lawful in the United States until a rulemaking more than nineteen years later, and that the discharge lamps it was written about have since been replaced by a source its authors did not discuss.

What this article does not establish, and what the comment does not take from it

It is a perspective article and reports no original experiment, no measurement of any lamp and no study of any population. Every quantitative claim in it is drawn from the literature it reviews. It predates light-emitting diode headlamps entirely and says nothing about them; the sources it compares are tungsten, tungsten-halogen and xenon discharge, and it gives their correlated color temperatures as approximately 2800, 3200 and 4200 kelvin against about 5600 for the midday sun, observing that discharge lamps are “not as blue as ordinary sunlight, but they are brighter and bluer than conventional halogen bulbs”. The Foundation does not extrapolate from those figures to any diode product, and nothing in this article supports a conclusion about one.

Nor does it address injury. Its subject is the scattering of light within the eye and the bleaching of photopigment, both of which are reversible optical and photochemical processes of normal vision. It makes no claim about damage to tissue, and the propositions at Part V.B.2 and Part V.B.3 rest on other sources entirely.

The measurement that puts numbers on it

The account above is clinical and describes mechanisms. One American study measured the magnitude, in the units in which the eye works, and the Foundation closes the subsection with it because of what its figures show and when they were obtained.

Olson P. L. and Aoki T., The Measurement of Dark Adaptation Level in the Presence of Glare, Report No. UMTRI-89-34, University of Michigan Transportation Research Institute, November 1989, described at Appendix C.109. The Foundation states the sponsorship before the findings. The work was carried out under the University of Michigan Industry Affiliation Program for Human Factors in Transportation Safety, whose members at the date of the report are listed in it as GE Lighting, GTE Products Corporation, Ichikoh Industries, the Inland and Fisher Guide Divisions of General Motors, Koito Manufacturing, Stanley Electric and Valeo Automotive. It is lamp and vehicle lighting industry funded research, and the last of those companies to be named and the fifth are manufacturers whose correspondence the National Highway Traffic Safety Administration has relied on in its own interpretations.

What was measured

The quantity is the adaptation level of the driver’s eye, which is not a property of the lamp but of the person. It was obtained indirectly. Subjects were exposed to glare, the glare was extinguished, and the time until they could detect a target light source was recorded. That time was then read against a curve established in the laboratory, where subjects were adapted to surfaces of known luminance and the same recovery was timed. The field test was conducted facing standard United States low and high beams at about 150 feet.

The measured recoveries were a mean of 3.63 seconds after low beam glare, with a standard deviation of 0.59, across fifteen subjects, and 5.14 seconds after high beam glare, standard deviation 0.94, across fourteen. Read against the laboratory curve those correspond, in the authors' words, to adaptation levels of "about 5 and 20 ft-L". The Foundation notes the inference and states it as a limitation: the adaptation levels were not measured directly but derived from recovery times through a calibration.

The size of the shift

The value of the study is that it places the driver on a scale alongside everyone else on the road. Taking the companion figures the authors report from their earlier work at the same site, the adaptation levels are:

a pedestrian standing on the unlit road, about 0.005 foot-lamberts;

a driver on that road with low beams of their own, about 0.3;

the same driver on high beams, about 1.7;

a driver on low beams meeting another car on low beams, about 5;

the same encounter where the oncoming car is on high beams, about 20.

The authors state the span: meeting another car on low beams raises the driver to a level "a full three log units above that of the pedestrian standing on an unlighted road", and if the oncoming car is on high beams the level "will increase fourfold" again.

The arithmetic that follows is the Foundation's. A foot-lambert is about 3.43 candelas per square meter, so the five levels are approximately 0.017, 1.0, 5.8, 17 and 69 candelas per square meter. Meeting an oncoming low beam raises the driver's adaptation level to roughly seventeen times what their own low beams produce. Meeting an oncoming high beam raises it to roughly sixty-seven times their own low beams, and to about four thousand times the level of the pedestrian they are trying to see.

The authors add the observation that matters most for what the eye is then doing. Of the two glare-condition levels they write that "both of these levels are in the cone vision (photopic) zone". Night driving is a mesopic task. An oncoming headlamp pushes the driver out of mesopic vision into the regime the visual system uses in daylight, while the thing the driver must see remains an unlit road.

The recovery, and what it costs in distance

The authors convert their recovery times into the quantity that matters on a road:

> "recovery from high beam glare requires a little over five seconds, during which time the vehicle will travel almost 500 feet at 65 mph. Recovery from low beam glare is not much better. At 65 mph, the vehicle will travel about 350 feet before visual capability returns to maximum. When meeting a fairly steady flow of oncoming traffic, this means that a driver's vision is seldom as good as it could be in the absence of such traffic, due to a combination of disability glare and upward adjustments in dark adaptation."

The Foundation draws two things from that passage. The first is that the United States has a measured figure for glare recovery after a headlamp encounter, and it is this one. The European submission described earlier in this subsection relies instead on a figure of up to nine seconds attributed to a British road safety body, which the Foundation has recorded is the value for a sixty-five-year-old and which that submission used without the qualification. These measurements, of 3.63 and 5.14 seconds, are American, are from a vehicle research institute, and are reported with their standard deviations.

The second is the authors' conclusion, which is not about any single encounter. On a road carrying oncoming traffic, the driver is not impaired at intervals and restored between them. The driver is, in their words, seldom as good as they could be. The exposure is not the event. The exposure is the condition.

The pedestrian, again

One paragraph of the discussion bears directly on Part VI.B.2, where the Foundation records that the only American evaluation of adaptive driving beam took a vehicle as its observation point:

> "One of the interesting things is that the pedestrian, without special illumination, can see some things better than the driver can with the illumination of the vehicle's headlamps, simply because of the difference in adaptation level. This is not to suggest that headlights are more of a hindrance than a help, but undoubtedly some things out of the range of the headlamps can be seen by the pedestrian, but not the driver."

The pedestrian and the driver are at adaptation levels differing by three log units, and the Foundation observes that only one of them is inside the vehicle whose lamps determine both. The person outside the car is the person this comment has had to keep returning to, and the measurement above is one of the few places in the American record where that person's visual state is given a number at all.

What it does not establish

It is thirty-seven years old. The beams it measured were standard United States sealed-beam and halogen systems of 1989, and the comparison between facing low and high beams is a comparison between two conditions of that fleet. Nothing in it bears on a light-emitting diode headlamp, and the Foundation makes no inference to one. Fifteen subjects were tested on low beam and fourteen on high, the report gives no breakdown by age, and the adaptation levels are inferred from recovery times rather than measured. It was funded by the lighting and vehicle industry. And it reports no health endpoint of any kind: its subject is visual performance, not injury.

The limitation that matters most is the first. Part VI.B.1 has established that the luminous intensity of low beams rose by about a third in the decade to 2025 and that the fleet is now substantially diode. The adaptation level a driver reaches when meeting a modern vehicle has not been measured by anyone, and the Foundation has been unable to find any American study since 1989 that has attempted it.

Why it belongs before the Department

Because paragraph 360ii(a)(4) directs the Secretary to study and evaluate emissions of, and conditions of exposure to, electronic product radiation, and this is a condition of exposure expressed in the quantity the exposed person actually experiences. It is not an emission figure, which every other federal document in this subsection reports. It is a measurement of the state the radiation puts a human visual system into, how far that is from the state the task requires, and how long it takes to come back. One such measurement exists. It was made in 1989, by a university institute, with money from the companies that make the lamps, on a technology that has since been replaced.

What the Foundation asks

That the Department treat the luminance, spectral content and direction of vehicle forward lighting as electronic product radiation within the meaning of section 360ii, and that it do the three things that paragraph directs: study and evaluate the emission and the conditions of exposure under paragraph (a)(4); maintain liaison under paragraph (a)(3) with the agency that regulates the lamps, which has twice written to the Foundation that the relevant expertise is here; and determine under section 360kk whether a performance standard is required. The Foundation notes that the three quantities such a standard would have to address — the luminance of the source, its short-wavelength content, and the direction in which the radiation is delivered under the conditions in which vehicles are actually driven — are the three that the agency administering Standard No. 108 has stated it does not directly regulate, and that two of them are what the European submission described above asked the international regulator to limit. This is the clearest case in the comment for joint work rather than referral, because neither agency can reach it alone. The National Highway Traffic Safety Administration holds the vehicle, the standard, the test facility and the instrument. This Department holds the mandate to ask what the radiation does to the person who receives it.

The statute contemplates exactly that division, and paragraph 360ii(a)(3) is the provision that joins it.

2. Adaptive driving beam systems

What the product is

An adaptive driving beam system is an upper beam headlamp that does not switch off. It remains in upper beam operation continuously above a set speed, and instead of dipping when it meets another vehicle it subtracts a portion of its own beam, holding a moving shadow over the vehicle it has detected while the remainder of the pattern stays at upper beam intensity. The shadow tracks the other vehicle as the two approach and pass.

The Foundation puts this product class in a subsection of its own, rather than within the treatment of headlamps, for two reasons. The first is that its defining feature is not the quantity of its emission but the continuous reconfiguration of that emission in space, which is a condition of exposure unlike any other in this Part. The second is that the agency that regulates it has written into its own definition of it three criteria about what happens to the people it shines on, and has no means of evaluating two of them.

The definition, and the three criteria in it

The National Highway Traffic Safety Administration describes an adaptive driving beam as:

> "a type of adaptive front-lighting system that automatically enables upper beam headlamps and adapts their beam patterns to create a shaded area around oncoming and preceding vehicles to improve long-range visibility for the driver without causing discomfort, distraction, or glare to other road users."

The Foundation asks the Department to read the final clause. The performance the agency ascribes to this technology is defined by the absence of three things in other people: discomfort, distraction, and glare. Not one of the three is a photometric quantity. Discomfort and distraction are states of a person, and distraction in particular is a matter of attention rather than of vision. Glare, in the form in which it is customarily measured, is a subjective rating.

That is the position this comment has described throughout Part II.H. The agency has committed itself, in defining the product, to a proposition about what the radiation does to the human beings it reaches. It has no mandate to study that question, no research program directed to it, and no method in its standard for evaluating it. The expertise the agency itself has twice identified as residing in this Department is the expertise the agency's own definition presupposes.

What has been measured, including what runs against the Foundation's position

The principal American evaluation of these systems is Comparison of European and U.S. Specification Automotive Headlamp Performance, published by the American Automobile Association in April 2019 and described at Appendix C.104. Four vehicles were tested, two United States specification and two European, from two manufacturers, on a closed course. The Foundation reports its findings in full, including those that do not assist the Foundation, and the second group is the larger.

On illumination, the systems did what they are built to do. The association found that the adaptive system "maintained high beam operation in all areas except those intentionally shaded by the system to minimize glare", while in the same circumstances "the U.S. specification vehicles were forced to reduce headlamp operation to low beam in order to minimize the likelihood of producing glare to oncoming and preceding vehicles". The resulting increase in roadway lighting "could be as much as 86 percent".

On glare, the findings run against the position the Foundation might have been expected to take, and the Foundation states them without qualification. All four vehicles "scored in the low perceived glare range of the evaluation scale, ranging from 'Satisfactory' to 'Just Acceptable'". One

manufacturer's adaptive European vehicle rated better than its United States counterpart and the other manufacturer's rated worse. On the scenario the association identified as the worst case, it reported that "Roadways with hills were the most common driving scenario where other drivers were subjected to potential glare by an ADB capable vehicle", that all headlamp systems then available produce glare when cresting hills, and that in that situation "it occurred less frequently with ADB capable European specification headlamp systems than with auto-dimming U.S. specification systems".

The Foundation therefore does not assert, and asks the Department not to infer, that adaptive driving beam systems produce more glare than the systems they replace. The only American measurement of the question found the opposite, and a comment that ignored it would deserve to be disregarded.

What that measurement was, and what it was not

It was five people giving a number. The association used the de Boer scale, a nine-point subjective rating on which one denotes unbearable glare and nine just noticeable, and the rating was given after each pass by the same five researchers who had conducted the illumination testing. All five were men, of ages given as twenties through fifties, and they were the association's own staff rather than naive participants, so they knew which vehicle was which. Participants were "instructed to direct their gaze straight down the test lane rather than focusing on the approaching headlamp beam".

That is a competent engineering evaluation and the Foundation does not disparage it. It is simply not an answer to the question the agency's definition raises. A rating of seven on a nine-point discomfort scale by five informed observers establishes that five informed observers found the experience tolerable. It does not measure distraction, which was not assessed at all. It does not measure disability glare, contrast threshold, recovery time, or any physiological variable. And it involves no exposure of any duration: each researcher rated a single pass of a vehicle at thirty-five miles an hour.

The exposed person the test did not include

The observation point in the glare test was a parked car with its lower beam headlamps lit, and the test vehicle approached it at thirty-five miles an hour on a closed course. That is the stimulus these systems are built to detect. The thing being measured was how well the system shades the object it was designed to recognize.

A pedestrian is not that object. Neither is a cyclist, a person waiting at a bus stop, a person standing in a driveway, or a person at the window of a house on a bend. The system withdraws its upper beam from vehicles it detects and holds it everywhere else, which means that for everyone who is not in a car the technology represents an increase in exposure and not a decrease. The submission described at Part VI.B.1 makes the point in terms, reporting that "ADB systems are not detecting all road traffic participants, for example at crossings".

The association's own framing supplies the scale of the question it did not ask. Its abstract records, citing the agency, that approximately 25 percent of automotive travel occurs at night but that nearly 52 percent of driver fatalities and 71 percent of pedestrian deaths occur in dark conditions. The population most exposed to vehicle forward lighting after dark, and most at risk in the dark, is the population the evaluation did not place at the observation point.

The condition of exposure that is new

Every other product in this Part emits a pattern that is fixed, or that changes on a cycle. An adaptive driving beam emits a pattern that reconfigures continuously in response to what its sensors detect. Vehicles enter and leave the shaded region; the shadow travels across the scene as the geometry changes; and on crests, bends and at junctions, which the association identifies as the conditions

where these systems fail, the pattern changes abruptly. A person standing outside a vehicle receives, in place of a steady beam or a single dip, a high-intensity field that is rearranging itself.

The Foundation states carefully what it does and does not claim about that. It does not claim that this produces any neurological or psychological effect, and it is aware of no study that has looked. What it claims is narrower and is a claim about the record rather than about the body: that no measurement protocol identified anywhere in this comment characterizes a high-intensity source whose spatial pattern changes continuously, that the instruments and criteria set out at Part V.D were written for modulation in time rather than reconfiguration in space, and that the attention effects treated at Part VI.J.7 and the persistence effects at Part V.E.7 were established for stimuli of a different kind. The question is open because it has not been asked.

Which agency asserts jurisdiction, and what the test is

The National Highway Traffic Safety Administration does, under Federal Motor Vehicle Safety Standard No. 108, and the position has changed within the period this comment covers. The association reported in April 2019 that "Section 9.4 of the standard expressly prohibits simultaneous operation of high and low beam headlamps, thereby excluding adaptive driving beam headlamp systems from vehicles sold in the U.S." The agency has since conducted a rulemaking permitting these systems.

What the test is, in either regulatory posture, is photometric. The standard asks whether the lamp delivers specified intensities at specified angles and, for these systems, whether the shaded region is adequately dark where a detected vehicle is. It does not ask what the pattern does to a person, and the agency that administers it told the Foundation on 13 February 2024 that "NHTSA's focus is on automotive safety, but the agency recognizes that separate expertise resides in sister agencies that are health-focused, such as the Food and Drug Administration."

What the Foundation asks

Not that adaptive driving beam systems be prohibited, and not that the Department find them harmful. The Foundation asks three things that follow from the statute and from the agency's own definition. First, that the Department treat the question whether this technology causes discomfort or distraction as a question within paragraph 360ii(a)(4), since it concerns the conditions of exposure to electronic product radiation and since the agency regulating the product has made the absence of both a defining feature of the product. Second, that under paragraph 360ii(a)(3) the Department ask that agency what evidence exists for the clause, because the Foundation has found one evaluation resting on five observers and no study of distraction at all. Third, that any inquiry take as its exposed person someone who is not in a vehicle, since that is the person these systems do not detect and the person the only American evaluation did not test.

3. Daytime running lamps

What the products are

Forward-facing lamps operated continuously while the vehicle is in motion by day, at an intensity below that of a lower beam headlamp but far above that of a position lamp. They are not required equipment in the United States and are not prohibited, which places them in the category Part VI.C.1 describes as additional lamps and subjects them to the structure that subsection sets out.

Who is exposed, and under what conditions

Oncoming drivers, pedestrians and cyclists, by day, from every vehicle so equipped, continuously rather than on actuation. The daytime condition is what distinguishes this class from the rest of Part VI.B. The conditions Part V.D.1 and Part V.C.3 identify as the ones under which glare does its work, which are darkness and a dark adaptation field, are absent. What is present instead is a small, high-luminance source in the visual field at all times, and Part V.B.2 sets out why source luminance rather than luminous intensity is the quantity that governs the appearance of such a source.

Which agency asserts jurisdiction, and whether any emission limit applies

The National Highway Traffic Safety Administration, through Federal Motor Vehicle Safety Standard No. 108, described at Appendix D.2. The Foundation has identified no maximum luminance for a lamp of this class, and no limit on its spectral content or on the uniformity of its emitting surface. Part VI.B.1 sets out the structure of the standard as it applies to forward lighting and the Foundation does not restate it.

What the Foundation asks as to this class

One thing only, and it is a question of necessity rather than of safety, which is the question paragraph 360ii(a)(2) directs the Secretary to ask. Part III.A sets out the two questions a boundary has to answer, of which the second is whether the emission is necessary. A lamp operated by day, for conspicuity, at an intensity selected without reference to any criterion of exposure, is the clearest case in this Part for asking whether the quantity emitted exceeds what the function requires. The Foundation does not assert that it does, has no measurement of it, and asks that the question be put to measurement at Part IX.C.

4. Tail lamps, brake lamps, and turn signals

What the products are

The rear and side signaling lamps: tail lamps, stop lamps, turn signal lamps and hazard warning lamps. Unlike the forward lamps at subsections 1 to 3 these are signaling devices rather than illuminating ones. Their function is to be seen rather than to light the road, which means their output is not constrained by any task requirement and can be raised without affecting what the driver of the equipped vehicle can see.

Who is exposed, and under what conditions

The driver immediately behind, at the closest sustained range of any exposure in this Part other than the interior lighting of the vehicle itself: a following distance at night, for the duration of the journey, with the lamps in the center of the visual field and no means of looking away. A report at Appendix A.3 describes an oncoming turn signal of this class presenting a source so small and so bright that the reporter could not look at it, and Part VII.B.1 collects the accounts of ocular pain, glare and afterimage in which lamps of this class appear.

Two characteristics compound in this class and Part III treats each separately. The first is the geometry: these lamps have been reduced to arrays of small, discrete, high-luminance points, so the luminance of the emitting surface has risen while the luminous intensity of the lamp may be unchanged, which is the distinction Part V.B.2 sets out. The second is the temporal characteristic: a stop lamp appears abruptly, and a turn signal and hazard lamp modulate deliberately, so Part III.E.2 on rise and decay times reaches this class directly. The Foundation has located no specification of rise and decay times for any lamp in it.

Which agency asserts jurisdiction, and whether any emission limit applies

The same standard and the same agency. The Foundation states one distinction in this class's favor, because the comment should not claim that no maximum exists anywhere in vehicle lighting: the standard prescribes photometric requirements for these lamps in candela, and the Foundation records at Part VI.B that this is the only product class in this Part for which a federal standard sets numerical limits on emission. What the Foundation has not identified is any limit on the luminance of the emitting surface, any limit on the spatial uniformity of the array, or any specification of the rise and decay times of a signal.

What the Foundation asks as to this class

That the luminance of the emitting surface be measured for representative lamps, since the quantity the standard regulates is not the quantity that governs how the lamp appears, and that the rise and decay times of stop and signal lamps be measured and considered. Part IX.C for the measurement,

Part IX.I.5 for the question whether abrupt digital transitions are necessary to the signaling function.

5. Aftermarket lamps and light bars

What the products are

Lamps fitted after manufacture and not required by any standard: auxiliary driving and fog lamps, roof and bumper light bars, rock and underbody lighting, replacement bulbs of a different source technology fitted into housings designed for another, and the decorative lighting applied to the exterior of a vehicle.

Why this class is different from every other in Part VI.B

Because the federal instrument that governs vehicle lighting largely does not reach it, and Part VI.C.1 sets out the mechanism. For lamps the standard requires, it prescribes photometric performance. For additional lamps it does something different, which is to ask whether the added lamp impairs the effectiveness of the lighting equipment the standard does require. That is a test about the interaction between lamps on one vehicle. It is not a test of what the added lamp emits, and a lamp of unlimited intensity can satisfy it so long as it does not degrade the others.

The replacement-bulb case deserves separate mention because it is the most common. A housing designed around a filament source has its optical design built around the position and extent of that source. A substitute source of different geometry placed in the same housing produces a beam pattern the housing was not designed to produce, and Part V.B.2 sets out why a smaller, brighter source in the same reflector raises luminance and scatters light outside the intended pattern. The Foundation records that this is a matter of optics rather than of compliance, and does not state what the regulatory position of such a substitution is.

Who is exposed, and what the record contains

Oncoming and following drivers, pedestrians and cyclists. This class appears in the incident record more often than its share of the vehicle fleet would suggest, and Part VII.B.1 and Part VII.E collect the accounts, including the accounts of drivers ceasing to drive at night which Part VII.E.3 treats.

What the Foundation asks as to this class

That the impairment test be recognized for what it measures, which Part VI.C.1 sets out, and that the characterization at Part IX.C extend to lamps of this class, since they are electronic products emitting electronic product radiation whether or not any vehicle standard reaches them. The Foundation makes no request to the agency that administers the vehicle standard, for the reason Part VIII.H gives: this comment does not ask this Department to enforce or interpret another agency's regulation.

6. Automated vehicle lighting, and the question of technical feasibility

Why a technology not yet deployed belongs in this taxonomy

Every other subsection of this Part describes a product that exists and an exposure that is occurring. This one does not, and the Foundation gives its reason at the outset. Section 360kk(a)(2) directs the Secretary, in prescribing a performance standard, to consider among other things the reasonableness and technical feasibility of the standard as applied to a particular class of electronic products. Technical feasibility is not a fixed property. It is a fact about the state of the art at the time the question is asked, and in this product class it is about to change in a way it has not changed since the headlamp was invented.

The source, and what kind of document it is

Stone T., Santoni de Sio F. and Vermaas P. E., Driving in the Dark: Designing Autonomous Vehicles for Reducing Light Pollution, Science and Engineering Ethics (2019), described at Appendix C.105.

The authors are at the Delft University of Technology, in industrial design and in the ethics and philosophy of technology. The paper is open access under Creative Commons Attribution 4.0.

It is a work of philosophy, and the Foundation states that before using it. It reports no measurement of anything. It contains no health data, and the Foundation has checked rather than assumed: in seventeen pages the words glare, headlamp, retina, eye, blue light, circadian and melatonin do not appear at all. Its three references to human health are passing citations to secondary literature. No proposition in this comment about any biological effect rests on it, and none could.

The claim the Foundation takes from it

The paper's thesis is that a vehicle navigating by ranging sensors and stored maps does not require visible light in order to move safely, and that this makes the lighting of roads and vehicles a design choice rather than a necessity. The authors put it in terms of what such a system would require: a continuous investment in "systems that require little or no lighting to navigate at night", and they state that this "can potentially allow autonomous systems to drive in total darkness". The object of the exercise is stated as plainly: "designing autonomous vehicles to function without both streetlights and headlights".

The authors are candid that this is a proposal rather than a prediction and that it would require changes of regulation and of habit. They imagine the reaction themselves: "One can imagine some initial hesitation to being a passenger in an autonomous vehicle travelling 120 km/hr with no lights above, no headlights, and no brake lights!"

Why that is a statutory fact and not a preference

For the whole history of the motor vehicle the emission of a headlamp has been inseparable from the function of the vehicle. The driver needed the light in order to see, and so every question about limiting the emission ran immediately into the objection that the limit would disable the product. That objection is the reason the standards in this field are written as floors. Part VI.B.1 sets out the consequence: at the points where the beam is required to be brightest, Standard No. 108 specifies a minimum and no maximum.

A vehicle that navigates by light detection and ranging, radar and stored maps does not need the light to see. If such vehicles are deployed, the visible emission of their forward lighting is severed, for the first time, from the function of the vehicle. Whatever emission remains is there for other reasons: to make the vehicle conspicuous to people outside it, to reassure the people inside it, to satisfy a standard written for a driver, or because that is how vehicles have always looked. Those may be good reasons. They are not the reason the emission was previously unavoidable.

The Foundation puts the consequence in the statute's own terms. Part II.H.3 establishes, from paragraph 360ii(a)(2), that the Secretary is directed to develop techniques for minimizing unnecessary electronic product radiation, and that the categories engineering practice calls light pollution — glare, light trespass, uplight and over-illumination — are that statutory subject named in another vocabulary. Each of those is radiation that serves no illumination purpose or defeats one. In the vehicle class the necessity of the illumination purpose has never before been open to question. Here it is.

And the question that follows is the one section 360kk(a)(2) requires the Secretary to ask: what is technically feasible for this class. A limit on the luminance or the spectral content of forward lighting that would have been infeasible for a vehicle whose driver depends on the beam is not obviously infeasible for a vehicle that does not. The Foundation does not assert that any particular limit is feasible. It asserts that the feasibility analysis is about to rest on different facts, and that nobody has begun it.

What the Foundation does not take from this paper, and says so

Most of the paper is devoted to articulating the values that the authors say darkness serves, and they set out eight of them in a table. Several are outside anything this comment asks for, and the

Foundation names them rather than letting a reader suppose otherwise: stellar visibility, described as preserving conditions for access to the firmament; wonder and beauty; connection to nature; and heritage and tradition. Those are reasons a society might choose to light less. They are not reasons within the authority this comment addresses, and the Foundation does not advance them.

The boundary the Foundation observes is the one stated at Part II.H.3 and again at Part VI.B. It does not ask this Department to regulate the appearance of the night sky, and it does not ask any agency to take up the aesthetic or cultural case for darkness. What paragraph 360ii(a)(2) reaches is radiation that is unnecessary, measured at the point where it meets a person. The present subsection uses this paper for one thing only: the demonstration that in this product class the word unnecessary is about to acquire a different scope.

The timing argument, which is the paper's methodological claim

The authors' reason for writing now is that the technology is not finished. Their abstract states that "autonomous vehicles are currently still a technology in development, and not one that has acquired its definitive shape, meaning the design of both the vehicles and the surrounding infrastructure is open-ended", and the argument of the paper is that values are to be incorporated during that phase rather than retrofitted after it.

The Foundation adopts that observation and not the ethical framework built on it. Part I.C.7 sets out what happened the last time a lighting technology reached the market faster than the understanding of its effects. The emission characteristics of diode lighting were fixed by manufacturing and by standards written for the sources it replaced, and the questions this comment puts are being asked about a fleet already in service. Automated vehicle lighting is at the stage diode lighting was at before that happened. The cost of asking the feasibility question now is a study. The cost of asking it in fifteen years is the cost of every retrofit in Part VI.

What the Foundation asks

Two things, and both are modest. First, that in any study undertaken under paragraph 360ii(a)(4) of the emission of, and conditions of exposure to, radiation from vehicle forward lighting, the Department treat automated vehicles as a class whose technical feasibility under section 360kk(a)(2) differs from that of driver-operated vehicles, and record what that difference is. Second, that under paragraph 360ii(a)(3) the Department raise the question with the National Highway Traffic Safety Administration while the design of these vehicles remains open, since that agency is conducting the rulemaking that will fix it and has told the Foundation twice that the health expertise is here.

C. Emergency, Warning, and Flashing Lamps

1. Police, fire, and emergency medical service lamps

What the product is

The class comprises the warning lamps fitted to police vehicles, fire apparatus and ambulances: roof-mounted light bars, grille and visor lamps, mirror-mounted and surface-mounted lamps, and the rear directional devices fitted to apparatus working in the roadway. The emitters are light-emitting diodes in substantially every current product, and the operating pattern is the point of the device. These lamps do not modulate as an artifact of their drive electronics, which is the subject of Part V.D. They flash because flashing is the function for which they were specified, at rates and in patterns chosen by the purchaser from those the manufacturer offers.

The Foundation draws the distinction at the outset because it governs everything in this subsection. Part V.D concerns modulation nobody wants, and every source relied on there treats it as a defect to be minimized. Here the modulation is the product. No source in Part V.D addresses a device whose purpose is to flash, and the Foundation does not transfer their conclusions to one.

Who is exposed, and under what conditions

Three groups, and the conditions distinguish them. Occupants of the vehicle and responders working beside it are exposed at close range for the duration of an incident, which may be hours at a roadway scene. Other road users are exposed while approaching, passing or waiting, typically for seconds to minutes, at distances from a few meters to several hundred. Residents and pedestrians near an incident are exposed for its duration without any means of withdrawing, which at a residential address or an apartment frontage may be prolonged and repeated.

The conditions are those the sources at Part V.D.1 and Part V.D.2 identify as the ones their metrics and instruments do not reach. Exposure is predominantly at night, against a dark field, from a small bright source at distance, to an observer whose eyes are moving across a wide scene. The authors of the experiment at Appendix C.90 exclude exactly those conditions from their one frequency recommendation. The stroboscopic measure is stated by its own specialists to be inapplicable in dark environments and outdoor lighting. The field instrument described at Appendix D.3 is specified for about 100 lux. Whatever is known about flashing light in interiors, this class is operated where the measurement framework stops.

Which agency asserts jurisdiction, and what the test is

The National Highway Traffic Safety Administration asserts jurisdiction over motor vehicle lighting through Federal Motor Vehicle Safety Standard No. 108, described at Appendix D.2. The structure of that standard is the fact this subsection turns on, and the Foundation sets it out carefully because the distinction is easy to state loosely and the comment gains nothing by doing so.

For the lamps the standard requires, it specifies activation: “Each lamp must be activated as specified, in the combinations specified, and in response to the inputs specified in Table I and Table II”. It specifies photometric performance as luminous intensity in candela at defined angular test points, as Part VI.B records. And it treats steadiness as the normal condition of required lighting: a taillamp is defined as one of the “steady burning low intensity lamps used to designate the rear of a vehicle”, daytime running lamps are required to operate “in a steady burning state”, and headlamp obstructions are assessed “When activated in the steady burning state”. The Foundation states what it has not established rather than asserting more: whether Tables I and II specify steady burning for each required lamp, the Foundation has not read, and the comment therefore does not claim that the standard contains a general steady-burning clause.

A warning lamp on an emergency vehicle is not a lamp the standard requires. It is an additional lamp, and for additional lamps the standard does something different, which the agency has stated in its own words. In an interpretation letter of 6 May 2019, the agency’s Chief Counsel wrote: “Non-required (or ‘auxiliary’) lamps, while still regulated under FMVSS No. 108, are not required to meet specific performance requirements in the same way that the required lamps are”. What applies instead is the impairment provision at S6.2.1, under which no additional lamp may be installed “that impairs the effectiveness of lighting equipment required by this standard”; and of that test the same letter says that “The question of whether an auxiliary lamp impairs required lighting equipment is usually decided on a case-by-case basis”.

The Foundation asks the Department to read the impairment test for what it measures. It asks whether an added lamp degrades the performance of the other lamps on the same vehicle. It is a test about the vehicle. It does not ask what the lamp does to the eye of a person who sees it, and it could not, because nothing in the standard is expressed in a quantity that would answer the question.

Whether any federal emission limit applies

The Foundation has not identified one. The standard sets no ceiling on the luminous intensity of an auxiliary warning lamp, no limit on its flash rate, no limit on its modulation depth, no requirement as to its spectral content, and no limit that varies with ambient light. The only

instrument the Foundation has identified that addresses the intensity of such lamps is SAE J595, Directional flashing optical warning devices, which is a voluntary standard of a private body, is not federal, and is given effect only where a State equipment code adopts it. The negative claim is the Foundation's.

Two consequences follow, and the Foundation separates them because they are addressed to different things. The first is about this product class: a device whose entire function is to produce high-intensity flashing light is, federally, subject to one question, which is whether it interferes with the headlamps and tail lamps of the vehicle carrying it. The second is about the comment as a whole: Part V.E.1 sets out, from the authors of the governing recommended practice, that seizure risk runs from about 3 to about 70 hertz with a peak at 15 to 20, that risk rises with log luminance, that contrasts above 10 percent are potentially a risk, that central vision is more at risk than the periphery, and that "Deep red flicker and alternating red and blue flashes may be particularly hazardous". Not one of those parameters is addressed by any federal requirement applicable to this class.

The justification, and why the Foundation addresses it here rather than waiting

Any proposal touching these devices meets one answer, which is that responders need them to reach emergencies quickly. The Foundation takes that answer seriously, does not dispute that emergency response is urgent, and does not ask that any responder be deprived of a warning device. It records instead what the emergency services themselves have adopted as their position, because the question of operational necessity is theirs and not the Foundation's.

The document is described at Appendix D.1. It is a joint position statement of fourteen organizations, including the American College of Emergency Physicians, the International Association of Fire Chiefs, the National Association of EMS Physicians, the National Association of State EMS Officials and the National Volunteer Fire Council. The Foundation states its scope first: it concerns the operational decision when to switch lights and siren on, its safety concern throughout is the risk of collision, and it says nothing whatever about the optical characteristics of the lamps. It is cited for necessity and for nothing else.

What the sponsors state. That the devices do help in some cases: "In selected time-sensitive medical conditions, the difference in response time with L&S may improve the patient's outcome". That the time they save is small: "Over a dozen studies show that the average time saved with L&S response or transport ranges from 42 seconds to 3.8 minutes". That the occasions on which it matters are few: of responses to medical calls, "few (6.9%) of these result in a potentially lifesaving intervention by emergency practitioners". That the practice is nonetheless general: "L&S continue to be used in 74% of EMS responses, and 21.6% of EMS transports". And the finding the Foundation asks the Department to weigh longest.

> "Some agencies have used an evidence-based or quality improvement approach to reduce their use of L&S during responses to medical calls to 20-33%, without any discernable harmful effect on patient outcome".

The sponsors' own recommendation follows from that: lights and siren "should only be used for situations where the time saved by L&S operations is anticipated to be clinically important to a patient's outcome. They should not be used when returning to station or posting on stand-by assignments". And their closing statement: "In most settings, L&S response or transport saves less than a few minutes during an emergency medical response, and there are few time-sensitive medical emergencies where an immediate intervention or treatment in those minutes is lifesaving".

What the Foundation takes from this, and what it does not

It does not take, and does not assert, that these devices are unnecessary or should be removed. The sponsors say the opposite in selected conditions and the Foundation adopts their statement rather than trimming it. It does not take any proposition about optical hazard from a document

that addresses collisions. And it draws no inference about police practice: the sponsoring bodies are of emergency medicine, fire, ambulance and dispatch services, law enforcement appears in the statement only in one occupational statistic, and no police organization is a sponsor.

What it takes is narrower and is about the burden of justification. When this Department asks whether the emission characteristics of this product class should be subject to a performance standard, it will be told that the devices are operationally necessary. The answer to that is not the Foundation's opinion. It is that fourteen organizations of the services that operate them have adopted the position that their use should be confined to the occasions when the time saved is clinically important, that the time saved is between 42 seconds and 3.8 minutes, and that agencies which cut their use to between a fifth and a third of responses saw no discernible harm to patients. A requirement addressed to how bright these lamps may be, how fast they may flash, and how deeply they may modulate would not interfere with any use the services themselves regard as justified.

The color combination, which has not been raised anywhere in the regulatory record the Foundation has read

Every criterion discussed above is expressed in rate and intensity. None addresses color. The neurophysiological literature does, and what it says bears directly on this product class.

The review at Appendix C.96 sets out the interaction between color and flash rate for the induction of photoparoxysmal responses. It reports the conclusion of Parra and colleagues that "white lights flashing at higher frequencies (above 20 Hz) can induce epileptic seizures, but that for coloured stimuli (e.g., blue and red) the risk is greatest at frequencies around 15 Hz". Its summary table gives three bands: at 10 to 15 hertz color stimulation exceeds white light; at 15 hertz the entry is red-blue alternating stimulation; and at 20 to 30 hertz color and white are equivalent. Among colored stimuli the review reports that the combination of blue and green elicited the fewest epileptiform responses.

The reason that combination is identified is a documented mass incident. The review records that cases of seizure were reported in children watching a television broadcast in which, in its words, "an intense blue-red light flashed at a frequency of 15 Hz", and that later work attributed the effect to stimulation of the long-wavelength cones, with the qualification that the relationship is not clear because some individuals respond similarly to green.

The operational conclusion the review draws is addressed to researchers, and it is the sentence the Foundation asks the Department to read against the contents of this subsection. Because flicker testing itself carries a risk of inducing seizures, the authors write, "every effort must be made to avoid high-risk combinations, which include, for example, red-blue light flashing at 15 Hz".

Red and blue alternating is the color scheme of American emergency vehicle warning lighting. A stimulus that a peer-reviewed review instructs investigators to avoid presenting to consenting volunteers under ethical supervision in a laboratory is presented, without consent, without notice, without any measurement of record and without any limit in federal law, to whoever is on the road.

The Foundation states two limits on that comparison in the same place, because it will not put the point to the Department without them. The first is spatial. The broadcast incident involved a television screen at domestic viewing distance, which satisfies the visual angle condition that the photoepilepsy criteria require and which Part VI.I shows a vehicle-scale lamp does not satisfy beyond very short range. The same gate that fails for the deterrent strobe fails here, and for the same reason. The second is that the Foundation has no measurement of the flash rate or the chromaticity of any American emergency vehicle light bar. It has one measurement of one lamp, reported at Part VI.I, which was measured at 20.9 hertz and is blue.

What the Foundation therefore asserts is not that emergency vehicle lighting induces seizures. It is that the one variable the clinical literature identifies as raising risk at the lowest flash rates is the

variable this product class is defined by; that no instrument in American law addresses it; that no federal body has measured it; and that the question appears nowhere in the regulatory record this comment has assembled, including in the correspondence of the agency that publishes the flash rates.

The premise beneath this product class, and the one time it has been measured

Everything in this subsection proceeds from an assumption that is never stated in the instruments that govern these lamps: that a device which captures more of a driver's attention is for that reason safer, so that brighter and faster is better without limit. Part VI.C.2 records that the governing manual specifies flash rates and intensity classes and contains no criterion expressed in terms of effect on a person. The assumption is what fills that gap.

The Foundation has found one rigorous test of that assumption, and it is set out at Part VI.J.7 and Appendix C.97. A roadside intervention designed to capture attention was measured against eight years of crash data and was found to increase crashes, with the increase rising as the display became more arresting, and with the authors concluding that interventions can be too salient and so crowd out more important considerations.

That study measured message content and not emission, and the Foundation does not represent it as measuring a lamp. It is set beside this product class for one purpose: to establish that the premise on which the class is built is a testable empirical claim rather than a self-evident one, that it has been tested once, and that it failed. Whether it holds for a high-intensity flashing lamp is unknown, which is the condition this comment describes throughout and the reason it asks the Department to exercise paragraphs 360ii(a)(4) and (a)(5).

The criteria that exist for this hazard, and what the body that wrote them says about this product class

The comment has now obtained the document on which the secondary sources in this Part rely, which is the Epilepsy Foundation's updated review of visually sensitive seizures, described at Appendix C.98. It states the criteria directly:

> "In 2005, a panel convened by the Epilepsy Foundation of America concluded that a flash is a potential hazard if it is brighter than 20 candelas per square meter, occupies at least 10% of the visual field, flashes or changes color at a frequency between 3 and 60 Hz, and endures for at least half a second."

Four conditions, conjunctive. The review adds that avoidance of these characteristics "is estimated to be protective for at least two-thirds of people with epilepsy", which is both a statement of the criteria's value and a statement of their limits.

What the same review says about this product class, which the Foundation places here rather than anywhere less prominent

The review addresses flashing emergency lighting expressly, and what it says is adverse to the position a reader might expect this comment to take:

> "Flashing police car lights only rarely provoke seizures, perhaps because the image rarely occupies a large part of the visual field."

The Foundation reports that sentence in full, in the subsection where it does the most damage, because a comment that buried it would deserve to be disbelieved about everything else. It is the considered view of the leading expert body in the field, published in 2022, with the author of much of the flicker literature this comment relies on among its signatories.

Three observations follow, and none of them is a denial.

The first is that the sentence is about seizures and about nothing else. The Foundation's case on these lamps, set out in this Part and at Part VII, concerns disorientation, migraine, visual

impairment, after-image and loss of access to public space. The review does not address any of those in relation to vehicle lamps, and the Foundation does not suggest that it does.

The second is that the stated reason is the one this comment has independently reached. The image rarely occupies a large part of the visual field. That is the third of the four criteria above, and it is the same quantity that Part VI.I finds a measured lamp failing to meet beyond about forty centimeters. The Foundation accepts the mechanism. What follows from accepting it is that the exposures where the criterion is met are the close ones: the traffic stop, the person on the sidewalk beside a stopped vehicle, the occupant of a car halted beside a light bar at night. Those are real and they are common, and the review does not say they are safe. It says the image rarely occupies a large part of the visual field, which is a statement about frequency of occurrence and not about what happens when it does.

The third is evidentiary. The sentence carries a single citation, appears in a passage on differential diagnosis rather than in the review's treatment of stimulus characteristics, and is qualified by the word perhaps. Section 8.6 of the same review states that the effect of light-emitting diodes on people with epilepsy would benefit from additional research, and records a literature search finding five results. The Foundation does not read a qualified sentence resting on one citation as a finding that this product class is safe, and neither, on the evidence of section 8.6, do its authors.

A regulatory precedent, from the same section, that the Foundation has found nowhere else

The review's section on regulatory issues records what other countries have done. Most of it concerns broadcast content. One sentence does not:

> "In the UK, devices that flash in public are limited to frequencies no higher than 4 Hz, and they should not be visible from stairways."

That is a numerical limit on a physical device in public space, not on content on a screen. It is the only instance the Foundation has found, in any jurisdiction, of a flash-rate ceiling imposed on the class of equipment this Part describes. The lamp measured at Part VI.I operates at 20.9 hertz. The Foundation draws two things from the existence of that rule. A limit of this kind is evidently capable of being written, since one has been written. And the objection that such a limit would be impractical, which the Foundation anticipates, is answered by the fact that a comparable economy has lived with one.

The review also records that "Frequency, brightness, binocularity, and large area are all key factors in contributing to seizure provocation", and that prevention "can take place at the level of government regulation, industry, families, and individual patients", naming government regulation first. The countries it identifies as having implemented regulation are the United Kingdom, Japan, Russia and Italy. The United States is not among them.

The premise tested directly, on this product class, in a study the federal government paid for

The preceding paragraphs set the premise beside a study of roadside message signs, and recorded that the extension from message content to a lamp was an inference. That inference is no longer needed. The premise has been tested on emergency vehicle warning lights themselves, at night, by researchers under contract to the United States Fire Administration. The report is described at Appendix D.4.

The authors state the regulatory position in their introduction, and the Foundation asks the Department to notice who is saying it:

> "standards that define the minimum photometric performance of flashing emergency lights (Society of Automotive Engineers, 2014, 2019; National Fire Protection Association, 2016), but no maxima, have not changed substantially since LED light sources have become widespread"

And the consequence of that asymmetry, in the same passage: “these flashing lights, designed to capture attention and warn drivers of changing conditions, have increased in intensity as the efficacy of LED sources has increased”. The authors then state the concern this Part has been built on, in their own words: “If lights are excessively bright, they could hinder drivers’ ability to see first responders working adjacent to their parked vehicle, or create unwanted visual discomfort, potentially reducing first responder safety.”

What the experiment found about intensity

Twenty licensed drivers drove a closed course past a simulated nighttime incident scene under fourteen combinations of intensity, color, modulation, flash rate and reflective marking, rating the visibility of the lights and the discomfort glare they produced. The low intensity condition was set at about one-third to one-half of the minimum specified by National Fire Protection Association Standard 1901 for large fire trucks. The high condition was about one-third above that minimum.

The finding, in the authors’ own summary:

> “higher intensity lights present more glare, but those higher intensities do not necessarily make lights more visible at night”

The statistics are asymmetric in the same direction. Intensity had a significant effect on rated visibility and a markedly stronger one on discomfort glare. Both intensity levels were rated between 1.5 and 2 on a scale whose maximum is 2, which is to say that both were already at the ceiling of visibility. The authors conclude:

> “Lights that meet existing minimum intensity requirements (like those from NFPA) for emergency vehicles may be brighter than needed for nighttime driving conditions, at least when the emergency vehicles were stationary as in the present study. Using lower intensities at night will reduce discomfort glare without reducing their visibility.”

The Foundation states the significance of that sentence precisely. Lamps operating at one-third of the consensus minimum were nearly as visible as lamps above it, and substantially less glaring. The minimum is therefore not a floor below which the device fails to warn. It is a floor set without reference to the point at which warning is achieved, and the only federally funded test of it found that the point is below the floor. The authors recommend that the question be taken further, asking “whether reducing intensity levels of flashing lights at night (or specifying maximum limits to intensity) is beneficial to the safety of first responders”.

What it found about color, which bears on the spectral argument of Part V

Color had a larger effect than intensity on both measures. Blue and red were rated most visible; blue and white most glaring; red and yellow least glaring. “The range between the least and most glaring color was about twice the range between the low and high intensity levels in this study.”

The authors attribute the glare result to spectral content: “light sources with greater short-wavelength (‘blue’) spectral or color content were consistently judged as more glaring than yellow or red lights of the same intensity”, and “Blue lights in particular of high intensities can elicit high levels of discomfort glare.” They also state, in passing and in support of the account at Part V.B.5, that “white LEDs are actually blue LEDs equipped with a phosphor coating that converts some of the blue light into yellow light with the mixture appearing white”.

Their preliminary recommendation follows from the two results together: “This suggests that red lights for stationary blocking operations would be judged as most visible but produce the least amount of glare, compared to the other colors tested in this study.” The Foundation records that this is a recommendation about which color to use and not about whether to flash, and does not present it as more.

What the study found against the Foundation, which is set out here and not left to a reader

Three results are adverse or null and the Foundation reports them in the same subsection as the favorable ones.

There was no moth-to-flame effect. “None of the results of the study contained evidence of a ‘moth-to-flame’ effect or its opposite. Study participants drove no closer to or farther from the lights regardless of their intensity or color.” The Foundation does not assert such an effect anywhere in this comment and records the finding because the claim is commonly made.

Flash rate and modulation had no statistically significant effect on anything the study measured: not on rated visibility, not on discomfort glare, not on the visibility of the road scene, not on lateral offset, and not on the distance at which drivers detected a responder. The Foundation states the scope of that null rather than minimizing it. Two profiles were compared, one of four thirty-millisecond pulses separated by twenty milliseconds followed by a two-hundred-millisecond pulse repeating seventy-five times a minute, and one of a single four-hundred-millisecond pulse repeating sixty times a minute. The outcome measures were subjective ratings of visibility and discomfort by twenty people. The study did not measure any neurological response, and nothing in it bears on the criteria at Appendix C.98 or on the recommended practice at Appendix D.2, which concern effects that a rating of discomfort would not capture.

And no variable had a significant effect on the rated visibility of the overall road scene.

One further result was unexpected and points the same way as the intensity finding. High-reflectivity chevron markings appeared to make responders harder rather than easier to see: “the presence of high-reflectivity chevron markings seemed to make it more difficult for drivers to see responders working around their vehicles at night, even when the responders wear safety vests”. The difference was about twenty-five feet and was not significant on its own, but produced a significant interaction with intensity, and the authors suggest that a maximum specification for reflective sheeting might be appropriate. The Foundation includes it because it is a second instance, in the same study, of a conspicuity measure applied without a ceiling and found to work against the thing it was meant to protect.

The authors close the introduction with the sentence this comment would otherwise have had to assert for itself: “There is a need for additional work to investigate the role(s) of lighting intensity, flash rates, color, and other factors in helping to prevent emergency responders from being involved in crashes and being struck while working on the roadway.”

Why the equipment is selected as it is, which the Foundation has nowhere else been able to source

This Part has described a product class governed by minimums without maximums, and has not until now been able to say what fills the space above the minimum. A technical paper presented to the SAE World Congress in 2019, described at Appendix D.6, states it:

> “Anecdotal evidence suggests that public safety agencies select emergency lighting systems with red or blue flashing lights based on their apparent brightness, with brighter lights judged as ‘better.’”

The authors call it anecdotal and the Foundation repeats the word. What the sentence describes is a selection criterion operating where no regulatory criterion exists: the standards set a floor, nothing sets a ceiling, and the choice within that space is made on apparent brightness by the purchasing agency. The same paper states the consequence the authors draw from it, which is the proposition the report at Appendix D.4 later tested:

> “With the advent of light emitting diodes (LEDs), emergency flashing lights are brighter and produce more highly saturated colors, thereby causing greater discomfort and disability glare. As a result, first response workers are at higher risk for being injured or killed in vehicle crashes because approaching drivers cannot see them.”

Two distinctions should be held in view. The first is that disability glare is not discomfort glare. Discomfort is a rating; disability is a measurable loss of visual performance caused by light scattered within the eye, treated at Part V.C.3. The study at Appendix D.4 measured discomfort. This paper asserts disability as the mechanism by which responders are struck, and the Foundation records that the assertion appears in an abstract it has read and in a paper it has not.

The second is authorship. The finding that blue flashing lights are perceived as brighter and more glaring than red at the same intensity is reported here and again in the study at Appendix D.4, and in this paper the word used is always. Those are two studies and not two laboratories: the lead author is the same and the group is the same. The Foundation presents them as one body of work by one group, consistent across two designs, and not as independent corroboration.

One further result is worth recording because it points away from more light rather than toward it. In the same experiment the detection of a figure standing beside the vehicle was affected by the intensity of the flashing lights, while the color of those lights did not matter, and "the presence of low-level white illumination at the side of model vehicle significantly improved detection accuracy". Steady low-level light beside the vehicle improved the outcome the flashing lights exist to serve. The Foundation does not state which way the intensity effect ran, because the abstract does not say and the paper has not been read.

An American police agency that reduced the intensity and nearly removed the flash, and what happened

The Foundation has argued in this Part that a limit on these lamps is capable of being written and that operating them differently is a matter of policy rather than of engineering. The objection it expects is that neither is practical. The answer is a state police agency that did it, at scale, and reported the result. The account is given in the magazine of the International Association of Chiefs of Police and is described, with its limitations, at Appendix D.3.

The sequence is this. In the summer of 2010 the Massachusetts State Police had eight serious rear-end collisions involving police vehicles, one of them fatal. The agency assembled a team of its own personnel, civilians, manufacturers' representatives and engineers to establish what was causing rear-end collisions with vehicles stopped on the interstate. They took into account, in the article's words, "previous studies that showed that people tend to stare at bright flashing lights and that showed impaired drivers tend to drive where they are looking".

They then tested, at a closed airfield, in daylight and at night, with subjects approaching a stopped police vehicle at highway speed. The reported result:

> "To the majority of drivers involved, the warning lights' intensity at night appeared to be far more distracting."

And: "Some subjects had to look away while approaching the car, while others could not take their eyes off the flashing blue, red, and amber glare." The conclusion drawn was that the intensity and flash rate appropriate to a daytime response are not those appropriate to a vehicle stopped on a highway at night, the agency's fleet administrator being quoted as saying they "needed to be different, and specific to the situation".

What they tested, and the finding that answers the premise

The range tested is itself the point: "from fast, bright dazzles to slower, more synchronized patterns at lower intensity. They went as far as to remove the flash element altogether and evaluate the steady non-flashing colors of light." What they adopted was a hybrid of a steady glow and a slow synchronized blue flash. Of that pattern the article reports:

> "The test subjects agreed that they were able to distinguish this hybrid flash pattern just as quickly and from the same distance as the fast, active bright pattern, but without the distractions that the bright lights caused at night."

Equal speed of detection and equal distance of detection, at greatly reduced intensity and with the flash all but removed. If that account is accurate, the premise that this Part has traced through the regulatory record does not merely lack support. It is contradicted by the operational testing of the agency that relies on the equipment.

The parameters they adopted, which the Department should compare with the parameters in service elsewhere

In the nighttime park mode the flash rate of the lower perimeter lamps was reduced to sixty flashes per minute and their intensity, in the article's words, "greatly lowered". The light bar went to a pattern the agency named Steady-Flash, "emitting a low intensity blue glow with a flicker every 2 to 3 seconds".

Sixty flashes a minute is one hertz. A flicker every two to three seconds is between a third and a half of a hertz. Set those beside the two other figures this Part has established. The United Kingdom limits devices that flash in public to no more than four hertz. The one lamp the Foundation has had measured, reported at Part VI.I, runs at 20.9 hertz. The Massachusetts State Police, for vehicles stopped at night, chose a rate below one.

The scale matters as much as the rate. The article records that as of April 2018 the agency had more than a thousand vehicles equipped with situational warning systems, and reports its fleet administrator as saying that rear-end collisions with parked police vehicles had been reduced dramatically. The Foundation presses the first fact and not the second. A thousand vehicles is a demonstration of feasibility. A collision reduction reported in an interview, without figures and without a published analysis, is not a demonstration of effect, and the comment does not treat it as one.

What the same article says about the standards

It names four bodies whose requirements govern these lamps: the Society of Automotive Engineers, the Federal Motor Vehicle Safety Standards, the Federal Specification for the Star of Life Ambulance (KKK-A-1822) and the National Fire Protection Association. It then states the structural problem this Part has described from three other sources:

> "When 10 or 20 of them are placed on an emergency vehicle parked at night along a roadway, the lights may actually be creating a condition that is less safe than a similar scenario with the older light sources, despite being compliant with the lighting standards. This is because the standards require only a minimum intensity level."

Compliance with every applicable standard, producing a condition the author believes to be less safe than the equipment it replaced, because the standards state a floor and nothing else. And one further absence, which the Foundation has not seen stated anywhere else: "Currently, none of the warning light intensity requirements from these organizations take ambient light into account, but a standard that changes based on ambient light and other conditions might ultimately reduce these rear-end collisions and distractions across the board."

That is a call, in the professional publication of American police leadership, for an intensity requirement that varies with the ambient light level. Part VI.K and Part V.D.1 set out the population and measurement evidence that the ambient level is the variable that matters most. The Foundation asks the Department to notice that the proposal is not its own.

What the Foundation does not take from this article

It is trade writing and not research. Its author is the managing partner of a fleet equipment business, so that the adaptive systems it recommends are products of the industry he works in. One of its technical sources is an inside sales manager of a warning light manufacturer. The Massachusetts testing is described qualitatively, with no protocol, no sample size, no measurements and no published report, and the previous studies it relies on are not named. The

Foundation does not cite it for the proposition that bright flashing lights cause rear-end collisions, and does not cite it for any health effect of any kind.

It is cited for three things only: that an American state police agency tested the question and changed its practice; that the parameters it adopted are a matter of record; and that the inadequacy of a minimum-only standard is stated plainly in the profession's own publication.

What practitioners are told, and one proposition that reverses the premise entirely

The sources above are regulatory, scientific and commercial. There is a fourth literature, written by practitioners for practitioners, and the Foundation treats one example of it at Appendix D.3. It is not research, it cites much of its content to unnamed studies, and the Foundation uses it for a narrow purpose. But it contains a statement about the perception of flashing light that no other source in this comment makes, and that if correct reverses the premise on which the whole product class rests:

> "Flashing lights are not perceived as quickly as steady-burn lights, but once seen, they attract and hold the attention of the viewer. Flashing lights require higher levels of light output to compete with similar steady-burn lighting."

A flashing lamp is detected more slowly than a steady one and must be brighter to be seen as readily. If that is so, then the escalation this Part has described is not an improvement over steady burning that was purchased at the cost of glare. It is a cost incurred to recover a disadvantage created by the decision to flash. The Foundation does not assert that proposition on the authority of a trade article; it records that a practitioner audience was told it, that the article attributes it to no source, and that it is the single most consequential empirical claim in this subsection if it can be substantiated. The research priority is recorded at Part V.L.

The same article quotes a maxim attributed to Stephen Solomon, a name that recurs in this literature: "Fewer lights, flashing slower & less brightly" are more effective.

The practitioner recommendation, which is the Foundation's own

Its eighth recommendation is to add steady-burn lights, on the ground that "ultra-bright or exaggerated displays of flashing lights on vehicles do not necessarily increase scene safety" and that "Excessive lighting may in fact actively contribute to increasing the accident rate around incident scenes." It describes the practice at multi-vehicle scenes of one or two vehicles continuing to flash while the remainder "switch down to steady-burn only".

The Foundation records the convergence without overstating it. The operational literature recommends steady burning at scenes. The Massachusetts State Police adopted something close to it, as Part VI.C.1 describes above. And Part VI.C.1 also establishes that steady burning is what the federal standard requires of auxiliary lamps by the agency's own long-standing interpretation. Three independent routes, from practice, from a police fleet, and from federal interpretation, arrive at the same operating state.

Night adaptation, with figures

On flashing white lamps, the article states that "At night just a short exposure to bright flashing white lamps can obliterate night adaptation in nearby drivers within seconds, thus producing temporary night blindness", and that it is "crucial that all flashing white lights are programmed to illuminate only during daylight hours". On side-mounted lamps at eye level it is more specific: a driver glancing at such a lamp "will have his night vision adaptation eliminated in less than a second - followed by secondary after-flash effects. It may take up to 20 minutes for the driver to regain their night vision. Older drivers are particularly susceptible to bright light sensitivity and loss of night-vision."

Those figures are uncited and the Foundation flags them as such. They are nonetheless the magnitudes the operational literature works with, they are consistent with the dark-adaptation

physiology described at Part V.C.3, and the susceptibility of older drivers is the finding of Part V.C.5.

A standards sequence, and a product warning

The article describes a sequence the Foundation asks the Department to note, because Part II is built on sequences of this kind. The practice of fitting flashing lamps at the waistline of emergency vehicles accelerated after National Fire Protection Association Standard 1901 was published in 2009, and similar provisions were carried into the draft of Standard 1917 for ambulances. The article then states:

> "Information has been submitted to the NFPA suggesting that placing an 'optical warning device ….between 18 in. and 62 in. (460 mm and 1600 mm) above level ground' may cause temporary blindness in nearby drivers. The latest recommendation in the draft standard places waist-height lamps exactly at the eye-level of seated drivers in an average sedan."

A standards body informed that a mounting position may cause temporary blindness, and a draft that places the lamp at the eye height of the person said to be at risk. The Foundation has not verified that account and says so at Appendix D.3. If it is accurate it belongs with the material at Part II.K on the committee process.

And one sentence that, if it can be substantiated, bears on every disclosure question in this comment: "most warning lamps are delivered with a written warning stating that eye damage will occur if the lamp is viewed at close range". The Foundation has not confirmed it, has obtained no product manual, and does not rely on it. It is recorded because a manufacturer's own hazard warning on an emission aimed at the public would be material to Part VII, to Part VIII and to the disclosure request at Part IX.F, and because it is capable of being verified by anyone with access to a product.

Where this article and the controlled evidence disagree

The article asserts the Moth Effect, the tendency of a driver to fixate on a warning light and steer toward it. The controlled experiment described at Appendix D.4, conducted under contract to the United States Fire Administration, found no such effect in either direction. The Foundation follows the controlled experiment, does not assert the Moth Effect anywhere in this comment, and records the disagreement here so that no part of this Part is read as relying on it. The same article is candid about the related Wake Effect, stating that it "has proven difficult to quantify in research despite the accumulation of large amounts of anecdotal evidence" and that despite the difficulty in proving it the existence of the problem "is widely accepted". Widely accepted is not demonstrated, and the Foundation does not treat it as demonstrated.

2. Rectangular rapid-flashing beacons and pedestrian crossing devices

What the product is

A pedestrian-actuated warning device at a crosswalk, consisting of a pair of rectangular light-emitting diode indications mounted beside the crossing sign and facing approaching traffic, which flash in a rapid pattern when a pedestrian actuates them. The class also includes the in-roadway warning lights and the overhead beacons used for the same purpose at uncontrolled crossings.

Who is exposed, and under what conditions

Three groups, and the first is the one the Foundation asks the Department to notice. The pedestrian who actuates the device stands within a few feet of it, below it, and for the duration of the crossing. The device exists to protect that person, and that person receives the most intense exposure to it of anybody. Drivers approaching receive it at distance, at night against a dark field, which is the condition Part V.D.1 and Part V.D.2 identify as the one their metrics and instruments do not reach. And residents of the dwellings adjacent to the crossing receive it whenever it is actuated, from a fixed

installation they did not choose, which is the position Part VI.P describes for light trespass generally.

Which agency asserts jurisdiction, and what the instrument provides

The Federal Highway Administration, through the Manual on Uniform Traffic Control Devices, which States adopt or amend. Part II.H.6 sets out that agency and Part VIII.B records that California's manual is discussed in the disability context. The manual specifies flash rates and intensity classes for these devices. It contains no criterion expressed in terms of the luminance of the emitting surface, the spectral content of the emission, or the rise and decay times of each pulse, and Part VI.C.1 sets out the premise the Foundation identifies in instruments of this kind: that a device which captures more of a driver's attention is for that reason safer.

One further federal instrument reaches the place rather than the device. Part II.H.11 records that the United States Access Board published its final rule on accessibility guidelines for pedestrian facilities in the public right-of-way thirteen days before the correspondence described there, and these devices are installed in exactly those facilities. The Foundation draws no inference from the proximity of the dates.

Whether any federal emission limit applies

None that bounds the quantities above. The intensity classes are specified as minima to be met rather than as maxima not to be exceeded, which is the same direction Part VIII.D.4 identifies in the visible alarm and Part VIII.E.4 identifies in trade lighting guidance generally.

What the record contains about this class, which is more than for any other

This is the device at the center of the administrative record this comment reproduces, and the Foundation sets out the sequence without characterizing it. On June 29, 2022 Mr. Baker, individually, submitted a complaint under Title II of the Americans with Disabilities Act and section 504 of the Rehabilitation Act concerning these devices in three cities. On October 19, 2022 the Office of Civil Rights of the Federal Highway Administration dismissed it without investigation, stating that the allegations raised complex issues related to the regulation of all light-emitting diode lights that extend beyond that agency's authority. On June 15, 2023 the Minnesota Department of Human Rights found probable cause on a charge concerning such a device in one of those three cities. Part VIII.E.6 sets out both documents in full, Part IV.E.1 sets out the determination, and Part II.H.18 sets out the regulatory ground of the dismissal.

Part IV.E.1 also sets out the federal actions brought by Mr. Baker individually concerning these devices. The Foundation has brought none and is a party to none, and Part IV.A.2 records the distinction between the two capacities.

What the Foundation asks as to this class

That the luminance of the emitting surface and the temporal profile of each pulse, including its rise and decay times, be measured for representative devices as installed, at the position of a pedestrian actuating the device and at the position of an approaching driver. Part IX.C. That the question whether rapid digital flashing is necessary to the warning function be addressed rather than assumed, which Part IX.I.5 sets out as a question about necessity rather than about safety. And that whatever is found be communicated to the agency that writes the manual, which Part IX.E.4 asks generally and which this class makes concrete.

3. School buses, utility vehicles, and work zones

What the products are

Three groups with one characteristic in common, which is that each is a high-intensity flashing installation operated among people on foot. School bus warning lamp systems, comprising the amber and red lamps at the front and rear of the bus. The amber warning lamps and strobes fitted to

utility, maintenance, refuse, snow and tow vehicles. And the work zone installations: arrow boards, portable changeable message signs, and the flashing lamps on barricades and channelizing devices.

Who is exposed, and under what conditions

For the school bus, children, at the closest range of any exposure in this Part. A child boarding or alighting passes within a few feet of an actuated lamp, twice a day, every school day, for years. Part IX.L sets out why that population is treated separately: Part V.C.2.g records the measured age-dependence of ocular transmission in the short-wavelength band, and Part VI.E.2 sets out the three features that make children's exposure different in kind, which are the length of the compulsory exposure, the least filtering, and no capacity to consent or to avoid.

For utility and work zone installations, workers beside them for the duration of a shift, and road users passing them. The work zone case combines the characteristics Part III treats most separately: high luminance, deliberate modulation, multiple emitters in the field of view at once, and movement through space as the vehicle or the viewer moves.

Which agency asserts jurisdiction

Divided by group. School bus lamps are vehicle lighting and fall within Federal Motor Vehicle Safety Standard No. 108, described at Appendix D.2, together with state specifications for school bus construction. Warning lamps on utility vehicles are additional lamps in the sense Part VI.C.1 describes, and the structure of the standard as to additional lamps is the impairment test that subsection sets out. Work zone devices are traffic control devices under the Manual on Uniform Traffic Control Devices.

Whether any federal emission limit applies

The photometric requirements applicable to required lamps are minima. The Foundation has identified no maximum luminous intensity, no limit on luminance, no limit on modulation depth and no specification of rise and decay times for any installation in this group. Part VI.C.1 reaches the same conclusion for emergency vehicle lamps and sets out the two consequences at greater length.

What the Foundation asks as to this class

That the school bus case be addressed first and separately, for the reason given above: it is the clearest instance in this Part of an intense, deliberately modulating emission presented at close range to the population Part IX.L asks be addressed expressly, by a public entity, under a federal standard that sets a floor and no ceiling. Part IX.C for the measurement and Part IX.I for the instrument.

D. Roadway, Area, and Parking Lighting

This product class differs from the others in this Part in who chooses it. A householder selects a lamp, a motorist selects a vehicle, and an employer selects the lighting of a workplace. Roadway, area and parking lighting is selected by a public authority or a property owner, installed in the public realm, and directed at people who were not consulted and cannot switch it off. Part II.H.3 records that the Foundation does not ask this Department to assume the authority of States and municipalities over lighting design, and nothing in this subsection does. What this subsection addresses is the quantity of radiation those installations emit, and the basis on which that quantity was chosen.

What the products are

Overhead luminaires on poles along carriageways and footways; the same on parking lots, forecourts and campuses; floodlighting of yards and building exteriors; and the light-emitting diode retrofits that have replaced the high-pressure sodium and mercury vapor sources in most of them over the last fifteen years. The change of source is the reason this subsection is necessary. The review described below records what the replacement altered: the earlier sources offered limited choice of

spectral power distribution, were physically large and so gave limited optical control, and took minutes to reach output. Diode sources remove all three constraints, giving fine optical control, near-arbitrary control of spectrum and instantaneous switching.

Who is exposed, and under what conditions

Everyone outdoors after dark, and many people indoors. Drivers and passengers; pedestrians and cyclists; residents whose windows face a luminaire; people whose work is conducted under it. The exposure is nocturnal, it is chronic, it continues for the whole of the dark period, and unlike every other class in this Part the exposed person has no control over it whatever. Part V.G treats the circadian consequences of nocturnal exposure and Part V.C the visual ones. This subsection concerns the quantity.

Which body sets the quantity, and what the test is

No federal standard does. The quantities are set by consensus recommendations of standards bodies and adopted by reference in State and municipal practice: in the United States the Recommended Practice on Roadway Lighting of the Illuminating Engineering Society, and internationally the publications of the Commission Internationale de l'Eclairage and the European EN 13201 series. The test is photometric: an average illuminance in lux or an average road surface luminance in candelas per square meter, with uniformity ratios, for a lighting class selected from a table.

The review the Foundation relies on, and what it concludes

Fotios S. and Gibbons R., Road lighting research for drivers and pedestrians: The basis of luminance and illuminance recommendations, Lighting Research and Technology, volume 50, number 1 (2018), described at Appendix C.110. The first author is at the University of Sheffield and the second at the Virginia Polytechnic Institute, and the second has performed much of the American research in this field under Federal Highway Administration sponsorship. It is a review of where the recommended light levels came from. Its conclusion is stated in its abstract:

> "Recommendations for the amount of light do not appear to be well-founded in robust empirical evidence, or at least do not tend to reveal the nature of any evidence."

And at the end, more plainly: "While there appears to be little, if any, credible empirical support for light levels recommended in much current road lighting guidance, data are emerging that will allow standards to be better informed by empirical evidence."

What the American recommendation rests on

The authors trace it to a single study. The recommendations of the Illuminating Engineering Society, which they describe as originally implemented in 1972 and "still the basis of current standards in North America", derive from work by Box published in 1971 on the relation between illuminance and crashes along 203 miles of freeway.

What that study found is not what the standard implies. The authors report that "Box concluded that roads with the lower range of illuminances (0.3 to 0.6 horizontal foot candles (HFC), or 3.2 lux to 6.4 lux) had a lower night/day crash ratio than roads with a higher range of illuminances", and that he recommended the lower figure of 0.5 foot-candles accordingly. They then state the obvious difficulty and the explanation for it:

> "This result seems counter to intuition as a higher lighting level increased the crash rate ratio. It must be remembered that additional lighting can create additional glare and impacts the driver's adaptation level so while this result is not expected, it may be justifiable."

The Foundation asks the Department to read that against Part VI.B.1. The two mechanisms the authors invoke to explain why more light was associated with more crashes are glare and the driver's adaptation level. Those are the two quantities measured in 1989 by the vehicle research institute described at Appendix C.109, and the second is the one an oncoming headlamp raises by three log

units. The explanation offered for an anomaly in the roadway lighting literature is the mechanism established in the headlamp literature.

The authors then record two limitations that govern what the American standard can claim. The first is internal to the data: the six-lane road results do not exhibit a relationship between light level and crash rate at all, the linear fit returning a coefficient of determination of 0.02. The second is the one that matters most here: "these values were applied only to freeways; the levels for other roadway categories had no empirical backing. Despite these limitations, the 0.5 foot candle illuminance determined by Box has been carried through the standards and translated into luminance criterion."

So the quantity of optical radiation directed at people on American residential streets, in parking lots and along footways derives, through a chain of consensus documents, from a figure established for limited-access highways in 1971 and extended to every other category of road without, in the words of the authors reviewing it, empirical backing.

What the international recommendations rest on

The authors find the same absence and say so three times. Of the earliest British standard, whose minimum illuminances ranged from 0.1 to 21.5 lux, they record that those minima "were not intended to be considered as a figure of merit for the installation but only as a rating of its size and had no theoretical basis". Of the modern pedestrian classes: "the empirical evidence for these recommendations, if any, is unknown", and "there is no published explanation of the basis for these values". Of the facial recognition criteria, where the ratios between horizontal, vertical and semi-cylindrical illuminance are suspiciously round: "There are no known reasons for these criteria and the consistent ratios suggest they were not independently evaluated but are simply an arbitrary ratio."

And on the apparent agreement between the international and European documents, which a reader might take for corroboration, the authors supply the reason it is not. The similarity "is unsurprising since 'many of the members on the CIE committee are also members of the CEN committee', which is not the same as independent groups reaching similar conclusions". The Foundation records that observation because it bears wherever this comment meets a consensus document, and Part V.D.3 and Appendix D.2 contain several.

Why the levels rose

The authors address the trend directly, and their explanation is the one this comment has given for a different product class. Recommended maxima for subsidiary roads in the United Kingdom rose from 10 lux in 1992 to 15 lux in 2003, and measured average street lighting illuminance in Britain has tended to rise over time. The reason they give:

> "Changes in technology have moved towards lamps of greater efficacy and light levels may have increased, because there was an ability to do so, not because there was evidence of a benefit to be gained from higher light levels."

Part VI.B.1 reports that the luminous intensity of vehicle low beams rose by about a third in the decade to 2025. Here is the same movement in the fixed lighting of the same roads, given the same explanation by the people who review the standards: the emission rose because the technology permitted it.

The authors' own prescription, which is what this comment asks for

Two passages of this review ask for what the Foundation asks this Department for. The first adopts a framing the Department will recognize. Reporting the position of Lucas and colleagues, the authors write that the management and use of light is "similar to administering a drug: light has both benefits (positives) and unwanted side-effects (negatives) giving the need to control the dosage of the light so as to provide the maximum benefit whilst minimising the negatives".

The second states what they think the standards must come to contain:

> "The average illuminances and uniformity of current standards may no longer be sufficient and future standards may need to include maximum light levels, limitations for SPD and spatial distribution and exposure doses."

Maximum light levels. Limits on spectral power distribution. Exposure doses. Those are the three things this comment has asked the Department to consider for every product class in this Part, and they are proposed here by two researchers in the field, in the journal of the discipline, as what lighting standards will need. The Foundation observes that the third is not a concept the lighting standards possess. A dose is a quantity received by a person over time, which is the subject matter of paragraph 360ii(a)(4) and the organizing idea of this Department's radiation program.

One further finding, on the metric itself

The authors note that road lighting is specified in photopic quantities while the conditions under which it is used are mesopic, so that the recommended values are "derived from the CIE standard photopic observer and hence ignore any contribution from the rods (and short wavelength sensitive cones)". They add that the limitation "has become more important since the widespread introduction of LEDs", because diode sources make the spectrum adjustable. That is the proposition at Part V.B.3, reached from the direction of roadway practice: the photometric quantity in which the installation is specified does not describe the spectral content of what it emits.

What this review does not establish

It is a review and reports no original experiment. It is about visibility, safety and reassurance, and it contains no health endpoint: the side effects it names are energy, sky glow, light trespass and effects on the natural environment, and it treats the human consequences as matters of seeing rather than of biology. It does not assert that any light level causes any injury, and the Foundation does not cite it for any such proposition.

Its authors declare no conflict of interest. One of them discloses that much of the research he refers to was supported by government agencies including the Federal Highway Administration, by local agencies, and by "lighting companies and other interested parties". The Foundation records the disclosure and notes that the review's findings are adverse to the commercial interest of the last of those categories.

What the Foundation asks

That the Department notice three things about this product class. That the quantity of optical radiation emitted into the public realm at night is set by consensus recommendations which, on the assessment of two researchers who review them, have little if any credible empirical support. That the American figure at the root of those recommendations was derived for freeways in 1971 from data showing higher illuminance associated with a higher crash ratio, and extended to other road categories without empirical backing. And that the researchers who report this propose, as the remedy, maximum light levels, limits on spectral power distribution, and exposure doses, which are quantities within the subject matter of section 360ii and within no other federal authority the Foundation has been able to identify.

E. Interior Lighting in Schools, Workplaces, and Healthcare Settings

The settings in this subsection share a feature that distinguishes them from every other interior treated in this Part. The people exposed are present by requirement rather than by choice, for the longest continuous periods of any indoor setting, and in the case of the largest affected population they are children attending school under compulsion of State law.

1. What the products are

The dominant product is the recessed ceiling luminaire: the two-foot by four-foot and two-foot by two-foot troffer and its flat-panel successor, installed on a grid at a spacing and mounting height determined by a design illuminance. In American classrooms these were fluorescent for roughly four decades and are now predominantly light-emitting diode, either as complete replacement luminaires or as tube retrofits installed in the existing housings.

The retrofit pattern matters and the Foundation identifies it because it bears on what was evaluated. A tube retrofit changes the emitter, the spectral power distribution, the source luminance and the driver, while leaving the layout, the mounting height, the spacing and the design illuminance as they were. The design was not reconsidered. One component inside it was exchanged for another with different emission characteristics, and the quantity held constant across the exchange was illuminance in lux, which Part V.B.3 establishes is silent as to spectral composition and Part V.B.2 establishes is silent as to source luminance.

Three further classes are present in these settings. Linear suspended and surface-mounted luminaires, in corridors, gymnasia and newer construction. Task and accent lighting at reading tables and nurse stations. And displays: the interactive whiteboard and the projector, now standard in American classrooms, which are self-luminous surfaces at a viewing distance of a few meters and are treated as a product class at Part VI.H. In healthcare settings the class also includes examination lighting, overbed lighting and continuous corridor lighting.

2. Who is exposed, and under what conditions

Three populations, and the first of them is the reason this subsection exists.

Children are exposed for approximately six hours a day, on the order of 180 days a year, for thirteen years, under a luminous condition they did not choose, in a room they cannot leave, under a legal obligation to attend. The Foundation is not aware of any other exposure to an electronic product in American life that combines that duration, that involuntariness and that population.

That conjunction compounds with a fact established earlier in this comment, and the Foundation asks the Department to hold the two together. Part V.C.2.g sets out the age-resolved ocular transmittance figures stated by a European scientific committee: about 65 percent of light at 460 to 480 nanometers reaches the retina in children under nine years of age, against about 40 percent in adults aged 60 to 70. The population with the longest compulsory exposure to interior lighting is also the population whose crystalline lens filters the least of the short-wavelength content of that lighting.

Teachers and school staff are exposed occupationally, for the duration of a working day, across a career. Part II.H.10 and Part VI.F describe the occupational dimension and the consultation that § 360ii(a)(6) directs.

In healthcare settings the exposed population includes patients, some of them for extended inpatient stays, some of them supine and unable to avert the gaze or move away from an overhead source, and some of them in conditions that bear on photosensitivity. Part V.E. It also includes staff working night shifts, which is the exposure for which the International Agency for Research on Cancer has made the classification described at Part II.E.6.

3. What has been measured, and by whom

The largest American study of classroom lighting against a measured human outcome is not a federal study, is not a health study, and was not commissioned by any body with authority over emission. It was commissioned by an electric utility under a State energy-efficiency program. The Foundation sets it out at some length, both for what it found and for what it could not do.

The Heschong Mahone Group reported Daylighting in Schools: An Investigation into the Relationship Between Daylighting and Human Performance on August 20, 1999, for Pacific Gas and Electric Company on behalf of the California Board for Energy Efficiency Third Party Program, under contract 460 000 8215. Appendix D.4. The study covered more than 21,000 students in grades two through five and more than 2,000 classrooms, in Capistrano Unified in Orange County, Seattle Public Schools and the Poudre School District in Fort Collins. Classrooms were coded for window area and tint, for skylight presence and type, and for overall expected daylight, and the codes were regressed against standardized test performance.

Its reported headline associations are large. In the Capistrano district, where each student served as their own control because fall-to-spring score change was used, classrooms with the most daylight were associated with 26 percent faster reading progress and 20 percent faster progress in mathematics than those with the least. Across the three districts the report gives a range of 7 to 18 percent.

Why the Foundation does not rely on those figures

The Foundation states its reasons, because a comment that quoted a 26 percent figure from a 1999 consultancy report as though it were settled would deserve to be discounted entirely, and because this comment holds other parties to the same standard.

The study is correlational and says so. Its authors state that it cannot prove the cause for an effect.

Its authors describe their proposed mechanisms as informed guesses, and the Foundation notes that the executive summary speaks more strongly than the body of the report supports.

The same firm returned to the question for the California Energy Commission in work reported as Windows and Classrooms, which examined student performance against a wider set of indoor environmental variables. No figure from the 1999 report should be quoted in this comment until that later work has been read and its effect on these estimates stated.

The finding the Foundation does rely on, which points the other way

One result in the 1999 study is adverse to its own thesis, and it is the result this comment uses.

Classrooms with one particular skylight configuration, designated Type B in the report and described as clear acrylic, uncontrolled and mounted in a corner, were associated with 21 percent lower reading progress, with no significant effect in mathematics. The authors attribute the result to glare: direct sunlight splashing onto walls and desks. In the Fort Collins district the south-facing roof monitors were described as very bright, and the report records that the investigators did not learn the extent of the glare problems until after the analysis was complete.

The Foundation asks the Department to weigh what that is. It is a quantified association between a luminous condition that produces glare and a degraded, objectively measured performance outcome, in a population of American schoolchildren, produced by a study that was not designed to look for it and whose sponsor had no interest in finding it. More daylight was not uniformly better. The configuration that admitted light without controlling it was associated with worse performance than the configuration that admitted less.

That bears directly on Part V.D, which treats discomfort glare, and on the proposition this comment makes throughout: that the quantity of light delivered is not the measure of its effect, and that how it is delivered – from what apparent source size, at what luminance, in what part of the visual field – governs the outcome. A skylight and a diode luminaire are different products, and the Foundation does not equate them. The mechanism of a high-luminance source in the field of view of a seated child is the same in both.

What the study could not do, and why that is the more important point

Two of the report's own limitations are characterization failures, and they are the same two failures this comment identifies in the present record.

The first is spectral. The authors hypothesized color rendition as a mechanism, on the ground that daylight has a continuous spectrum while electric sources are uneven, and they could not test it. No spectral measurement of the classrooms was available to them.

The second is more basic. In Capistrano, the district whose design was strongest and whose results are most often quoted, the type of electric lighting equipment installed was unavailable to the investigators, so electric lighting could not be analyzed at all. In Fort Collins electric lighting was excluded from the analysis for the same practical reason.

So the largest American study of lighting and childhood performance was unable to say what the electric lighting in the rooms was, or what any of the light in the rooms was spectrally composed of. Twenty-seven years later, neither datum is available for American classrooms. Part IX.H asks for the second of them. Paragraph 360ii(a)(4) directs the Secretary to study and evaluate emissions of, and conditions of exposure to, electronic product radiation, and a classroom is a condition of exposure.

4. What federal requirement governs the optical output

As with every other class in this Part, the Foundation can identify none.

The Department of Energy regulates lamp efficacy in lumens per watt, and Part IV.G establishes that efficacy is silent as to what the selected technology emits. No federal requirement addresses the spectral power distribution, the source luminance, or the temporal modulation of a luminaire installed in a classroom. Part 1040 of title 21 prescribes a performance standard for no product in this class.

What exists is voluntary and non-federal, and it is addressed to task visibility rather than to biological effect. The Illuminating Engineering Society publishes recommended illuminance for educational facilities. State school facility standards and construction codes address illuminance, and in some States daylighting, as design criteria. None of them states a limit on what a luminaire may emit at a given wavelength, and none was set by a body with a health mandate.

The Foundation notes one consequence specific to this setting. Where a school district specifies lighting, it specifies it by illuminance, efficacy, correlated color temperature and cost. Those are the quantities available on the product literature, as Part II.H.13 describes. A district that wished to specify by source luminance or by short-wavelength content could not, because the information is not published. Part IX.F.

5. What the Foundation asks as to this class

That the luminous environment of representative American classrooms be measured as children actually encounter it: at the seated eye height of a child rather than at the work plane, in the directions a child actually looks, including toward the ceiling luminaires and the interactive display, and reported in spectrally resolved radiometric terms and in source luminance rather than in illuminance alone. Part IX.H.

That the spectral power distribution and source luminance of the luminaires and tube retrofits actually installed in American schools be characterized – the measurement the 1999 study could not obtain and that no federal body has obtained since.

That exposure be evaluated over the duration it actually occurs: the school day, the school year, and the thirteen years of compulsory attendance, rather than the single episode of under three hours for which the only existing exposure limit was constructed. Part V.C.2.c.

That the occupational exposure of teachers, school staff and healthcare workers be evaluated in consultation with the Secretary of Labor under § 360ii(a)(6) and with the National Institute for Occupational Safety and Health, which is a component of this Department.

That this setting be included expressly in the research and evaluation directed by § 360ii(a)(2) and (a)(4), and that the conjunction described at subsection 2 – longest compulsory exposure, least lenticular filtering, no capacity to consent or avoid – be addressed in the treatment of sensitive populations requested at Part IX.L.

F. Retail and Commercial Interior Lighting

The product class treated in this subsection is the luminaire, not the store. That distinction does real work here, and the Foundation states it at the outset rather than at the end.

1. What the products are

A large-format retail interior — a supermarket, a warehouse club, a general merchandise store — assembles several distinct classes of light-emitting diode product in one enclosed volume: recessed and surface-mounted troffers, continuous linear strips, high-bay and low-bay fixtures, track-mounted accent heads, refrigerated-case lighting, backlit and edge-lit signage and menu boards, and illuminated shelf, cooler-door and endcap displays. Each is an electronic product within 21 U.S.C. § 360hh(2) and each emits electronic product radiation within § 360hh(1)(A). Part II.B.

2. Who is exposed, and under what conditions

Two populations are exposed, and they differ in a way the statute treats as significant.

Customers are exposed episodically, for periods ordinarily measured in minutes to an hour. The exposure is not avoidable in the ordinary sense of that word, because these premises are where food, medicine and household necessities are obtained. The courses open to a person who cannot tolerate the environment are to send someone else, to use delivery where it is available and affordable, or to do without.

Employees are exposed for the duration of a shift, on a schedule not of their choosing, in a luminous environment they did not design and cannot alter. This is occupational exposure to electronic product radiation. Paragraph 360ii(a)(6) names the Secretary of Labor among the officers with whom the Secretary is directed to consult and maintain liaison, and Part II.H addresses that paragraph.

3. The characteristics that distinguish this setting

Four characteristics distinguish the retail interior from the other settings treated in this Part, and they compound rather than simply add.

The first is emitter count. The sources are present in the hundreds, and in the largest formats above that. Part V.D addresses the general problem that the published literature characteristically exposes a subject to one source while real exposure is to many; this is the setting in which the gap between the two is widest.

The second is directionality. Retail luminaires are frequently aimed. Accent heads, case lighting and shelf lighting are directed at merchandise rather than at a horizontal work plane, so a person moving through the space traverses a field of sources whose angular relationship to the line of sight changes continuously. Disability glare is a function of that angle, and Part V.C.3 sets out why.

The third is the one that separates this setting from every other interior, and the Foundation asks the Department to attend to it particularly. In an office, a classroom or a healthcare interior the design aim is uniformity, and recommended practice limits luminance ratios within the field of

view for that reason. In a retail interior the aim is the opposite. Contrast between accent and ambient illumination is used deliberately, to draw the eye to merchandise, and the recommended practice for retail contemplates luminance ratios well above those recommended for task environments. The variable that produces discomfort glare is, in this setting, the variable the design is optimizing for.

The Foundation does not offer that as an accusation. It is a description of a design objective that was settled when the available sources were physically large, diffuse and low in luminance, and that has been carried over without reexamination to sources that are small, intense and spectrally narrow. Part V.B.2 describes the change in source geometry. The objective is the same; the means of achieving it is not.

The fourth is spectral distribution. The correlated color temperatures selected for merchandise presentation, and the short-wavelength peak characteristic of phosphor-converted white LEDs, are addressed at Part V.B.1 and Part V.B.3.

4. What federal requirement governs the optical output

As to the optical output of these products, the Foundation can identify none. The Department of Energy regulates lamp efficacy in lumens per watt, as Part IV.G describes, and efficacy is silent as to what the selected technology emits. No federal requirement addresses source luminance, spectral power distribution, temporal modulation or glare in a retail interior. As to employees, 29 C.F.R. § 1926.56 prescribes minimum illumination intensities for construction work; the Foundation is aware of no federal standard prescribing a maximum luminance, a spectral characteristic or a glare limit for general industry.

What exists is voluntary and is not addressed to biological effect: recommended practice published by the Illuminating Engineering Society for retail spaces, model energy codes that regulate installed power density rather than optical character, and the photometric reporting that manufacturers choose to publish.

5. The limit of this Department's authority, stated plainly

The Foundation is sometimes asked why it does not simply request that the Food and Drug Administration regulate the lighting in a store. The answer is that the authority of this chapter does not reach that far, and the Foundation does not claim that it does. Performance standards under § 360kk are prescribed for electronic products and run against manufacturers; § 360oo prohibits the introduction of non-conforming products into commerce. A retailer that buys conforming luminaires and installs them is not a manufacturer, and a store is not an electronic product. Nothing in this chapter authorizes the Secretary to determine how many fixtures a business may install, how it may aim them, or how bright its interior may be.

Two things the chapter does reach, and together they are sufficient to make this product class the Department's concern.

The first is the product. The characteristics that make the aggregate environment what it is are characteristics of individual luminaires as manufactured and sold: the radiance of the emitting surface, the spectral power distribution, the presence or absence of diffusion, the beam distribution, and the temporal modulation imposed by the driver. Every one of them is fixed before the product reaches the purchaser. A standard addressed to those characteristics would change the installed environment without regulating any installation.

The second is the exposure. Section 360ii(a)(4) directs the Secretary to study and evaluate not only emissions but "conditions of exposure to" electronic product radiation. That phrase is what reaches the installed environment. A retail interior is a condition of exposure, and evaluating it requires no authority over the retailer whatever. Section 360ii(a)(2) runs the same way: it directs the minimization of "the exposure of people to" unnecessary electronic product radiation, and not merely the emission of it. Part II.D.

6. What the Foundation asks as to this class

That the luminous environment of representative large-format retail interiors be measured as it is encountered — at eye height, in the directions a person actually looks, and in terms of luminance and spectral content rather than illuminance at a work plane. Part IX.C.

That employee exposure across a full shift be evaluated, in consultation with the Secretary of Labor under § 360ii(a)(6) and with the National Institute for Occupational Safety and Health. Part II.H.

That the emission characteristics of individual luminaires be disclosed, so that a purchaser, an employer or an occupational health professional can ascertain them before installation. Part IX.F.

That this exposure setting be included in the research and evaluation directed by § 360ii(a)(2) and (a)(4), which at present it is not.

G. Consumer Lamps, Fixtures, and Household Products

This subsection concerns the light-emitting diodes a person lives with: the lamps in fixtures, and the indicators on appliances, tools, chargers, outlets, alarms, routers, televisions, furniture and the rest of what occupies a modern household. Subsection 1 names the class in full, because its breadth is not apparent from a summary and because almost nothing in it is a lighting product. The Foundation treats the indicator at length and the lamp briefly, which is the reverse of the attention these receive elsewhere, for a reason it states at the outset. The lamp is at least nominally within a framework. The indicator is, on the account at Part V.C.2.k, typically not evaluated at all.

1. The products this subsection reaches, and the code the Center has already assigned them

The Foundation sets the class out by naming it, because the breadth is the first thing to understand about it and a general phrase does not convey it. The products in this subsection include: lamps in fixtures and the fixtures themselves; and the indicator, status and annunciator lamps fitted to kitchen and laundry appliances, including ovens, ranges, refrigerators, dishwashers, washing machines and dryers; to cordless and corded power tools, battery chargers, air compressors and portable generators; to wireless routers, modems, network switches and televisions; to wall outlets, switches, surge protectors and power strips; to smoke alarms and to carbon monoxide and carbon dioxide alarms; to thermostats, door locks, doorbells and cameras; and to furniture with electrical functions, including powered recliners and adjustable beds. It also includes seasonal and decorative light strings and the backlighting behind a display panel.

This Department has classified that class. Product code RIQ, reproduced at Appendix F.1.20, is defined by the Center as:

> Finished LED products intended to act as an indicator or for decorative purposes, such as Christmas tree lights or display backlighting. LED product only intending to emit visible radiation at low intensities.

The entry records, against the field for applicable performance standards, that no standard applies and that the general radiological health requirements of parts 1000 to 1005 do. So the position for this class is the position Part IX.A describes for the illumination lamp: the product is classified, its emission is recorded as optical, the general requirements are stated to apply, and nothing limits what it may emit.

Two features of that definition do the work of this subsection, and the Foundation separates them because they fail in different ways.

The first is the word low. The class is confined to products intending to emit visible radiation at low intensities, and low is nowhere defined. Subsection 2 sets two indicator components of identical physical size beside each other and finds a difference of between about two hundred and

twenty and four hundred and twenty times in luminous intensity. Both are within this class as it is drawn. A classification whose boundary is an undefined adjective cannot exclude anything, and the Foundation does not ask for the adjective to be defined; it asks for the limit sought at Part IX.I, which is a different thing and is what an undefined boundary actually calls for.

The second is the word intended, and it is the more interesting of the two. The class turns on what the product is intended to do, and for a great many of the products named above the intention is to be noticed. A status lamp exists in order to be seen across a room, in daylight, by somebody who is not looking for it. On a smoke alarm or a carbon monoxide alarm the indicator is part of a safety function, and a manufacturer with reason to make it conspicuous has every reason to make it bright. That is a design pressure toward higher intensity operating inside a classification premised on low intensity, and no instrument reconciles the two. The Foundation does not suggest that annunciators should be made less visible. It observes that the brightness of an indicator is determined by what it has to do, that what it has to do is often a safety requirement, and that nothing anywhere establishes a ceiling at which conspicuity has been achieved and further intensity is unnecessary radiation within the meaning of paragraph 360ii(a)(2).

One further characteristic of this class distinguishes it from every other in this Part, and the Foundation states it plainly because it is the reason the class matters at all. The exposure cannot be avoided without giving up the function. A person who finds a streetlight intolerable can draw a curtain, and Part VII records that many have. A person who finds the indicator on a smoke alarm intolerable cannot cover it without defeating the alarm, cannot unplug it, and in a rented dwelling cannot replace it. The same is true of a carbon monoxide alarm, of a thermostat, and of a wall outlet. Subsection 2 describes the exposure; this is what makes it different from a lamp.

2. The indicator, and the characteristic nobody can obtain

An indicator is a single small emitter whose purpose is to be looked at. It is encountered at short range, frequently in a dark room, and often by someone who did not choose to encounter it and cannot switch it off without disabling the appliance. The Foundation offers no estimate of how many are present in an American dwelling and does not need one; the relevant fact is what is known about any particular one of them.

The governing characteristic is the beam angle, because it determines both how concentrated the emission is and whether the optical treatment described at Part V.C.2.k applies. The industry specifies it as the full angle between the directions at which luminous intensity falls to half its value on the optical axis, written 2θ-one-half and defined on the component data sheets in those terms. The Foundation examined two ordinary five-millimeter indicator components:

A diffused red device, gallium aluminum arsenide, peak wavelength 660 nanometers, luminous intensity 36 millicandela minimum and 80 typical at 20 milliamperes, specified at a full viewing angle of 110 degrees. The half angle is therefore 55 degrees and the emission occupies about 2.68 steradians.

A water-clear yellow device of the same five-millimeter package, luminous intensity 15,000 to 20,000 millicandela at the same 20 milliamperes, specified at a full viewing angle of 15 degrees. The half angle is therefore 7.5 degrees and the emission occupies about 0.054 steradian.

Two components of identical size, fitted behind identical panel apertures, differing by a factor of about 50 in the solid angle into which they emit and by between about 220 and 420 in luminous intensity depending on whether typical or minimum figures are compared. The two choices travel together, because the clear lens is what produces both. And the second device has a half-power angle of 7.5 degrees, which places it inside the range in which the partial-coherence analysis at Part V.C.2.k is valid and in which treating the source as fully incoherent understates what reaches the observer.

None of that is disclosed to anyone who meets the appliance. The figure exists: it is on the component manufacturer's data sheet, it is known to the appliance maker who specified the part, and it is a routine parameter of the trade. It does not appear on the appliance, in its manual, on its energy label, or in any filing made in respect of it. A person who wakes at night in a room containing the device cannot obtain it. A physician asked about that person cannot obtain it. A public entity conducting the self-evaluation described at Part VIII cannot obtain it. The number is not unknown. It is known one tier up the supply chain and is not carried forward, because no instrument requires that any emission characteristic of a visible-light diode product be disclosed to anybody. Part IX.F.

The Foundation asks the Department to notice the shape of that, because it recurs throughout this comment and is clearest here. The difficulty is not that the emission characteristics of these products are hard to measure. They are measured, by the people who make the components, as a condition of selling them to the people who make the appliances. The difficulty is that the measurement stops at the boundary of a commercial transaction and is required to go no further.

3. The lamp

General service lamps and the fixtures that hold them are the product class through which most Americans encounter diode lighting, and the Foundation treats them here only to record what is and is not fixed about them. Within the photobiological framework a general lighting service lamp is assessed at the distance producing 500 lux, which Part V.C.2.k describes. There is no federal limit on the luminance of the emitting surface, on the spectral power distribution, or on the temporal modulation of any of them, and Part V.B.1 records that the spectral output of a phosphor-converted lamp shifts toward the short wavelengths as the phosphor degrades over the product's life, so that a measurement made at manufacture does not describe the lamp in service.

4. What the Foundation asks as to this class

Four things, none of which requires a finding this record cannot support. That the Department confirm, as Part IX.A asks generally, that a product classified under RIQ is within the scope of its authority. That the disclosure sought at Part IX.F reach this class, so that the beam angle and the luminous intensity which exist on the component data sheet are carried forward to the person who meets the appliance; subsection 2 sets out that the figure is known one tier up the supply chain and is required to go no further. That the research at Part IX.C include the exposure geometry specific to this class, which is a small high-radiance source at short range in a dark-adapted eye, and which differs from every other class in this Part in that the exposed person cannot end it without disabling a function they rely on. And that any classification system developed under Part IX.G not rest on an undefined adjective, the defect subsection 1 identifies in the present class.

H. Displays, Screens, and Personal Devices

What the products are

Self-luminous screens. Televisions and monitors, tablets and telephones, the interactive whiteboard and the projector now standard in American classrooms, the display fitted in a vehicle dashboard, and the screens on payment terminals, kiosks and self-service equipment. Part VI.S treats the decorative lighting applied to equipment of that last kind and Part VI.T the lighting on mobile devices; what distinguishes this class from both is that the surface is conveying information rather than signaling presence.

What makes this class different from every other in this Part

Two things, and the second is not addressed anywhere in the regulatory apparatus.

The number of emitters. In every other class the emitters in the field of view can be counted: one headlamp, two beacons, a row of luminaires. In a display they number in the millions per device, each individually driven. Part III.D.8 treats the number of emitters during exposure as a

characteristic requiring a boundary, and Question 15 of the notice raises it. A criterion written for a countable number of point sources does not describe this class.

Modulation per color channel. Part III.E.1 and Part III.E.2 treat temporal characteristics and rise and decay times, and Part V.D treats temporal light modulation. None of those quantities is computed per wavelength channel. A display can present a surface of constant total luminance while modulating strongly in color, because the channels modulate against one another, and a criterion expressed in the usual temporal quantities would not reach it. Part VI.K treats the entertainment class in which color-changing programming is the deliberate point of the product. The Foundation identifies the gap and does not assert that any effect follows from it: it states that the quantity is not measured and that no criterion describes it.

Who is exposed, and under what conditions

Nearly everyone, at close range, for hours daily. The conditions divide sharply and the Foundation keeps the halves apart because its request differs between them. A person using their own telephone or monitor chooses the device, controls its brightness, and can put it down. A child in a classroom facing an interactive whiteboard does none of those things, and Part VI.E.1 treats that setting. Nor does a driver facing a dashboard display, a worker facing a monitor for a shift, which Part V.H treats, or a person obliged to use a payment terminal to complete a transaction. Part VII.F records accounts of people ceasing to enter places for reasons of lighting, and Part VI.S records that the nearest account in this record to that class concerns the screen of a tabletop payment terminal in a restaurant, which belongs here.

Which agency asserts jurisdiction, and what this Department has already done

This Department has classified these products. Appendix F records three display codes in the Center's classification of radiation-emitting electronic products, and the Foundation asks the Department to read the definition of one of them. It turns on the presence of a high intensity light source, and the term high is nowhere defined in the classification. So the Department's own operational record contains a category of product distinguished by the intensity of its source, with no statement anywhere of what intensity qualifies. Part II.B.6 sets out what a product code is and is not, and the Foundation does not treat the code as a rule.

No performance standard under § 360kk applies to the visible light these products emit, and Part VIII.D.1 establishes that generally. No other federal body limits it either: the radiofrequency emissions of a display are within the Federal Communications Commission's rules and its energy consumption is within the efficiency framework Part IV.G describes, and neither reaches what the screen emits toward the person looking at it.

What the Foundation asks as to this class, and what it does not

It does not ask for a limit on the screen of a device its user chooses, holds and controls, and it says so plainly because the opposite request is the one that would be assumed. A person who can dim their own telephone is not the subject of this comment.

What it asks is three things. That the characterization at Part IX.C reach this class, and specifically that it resolve modulation per color channel rather than integrating it away, which Part IX.C.3 sets out. That the definition of the display code turning on a high intensity light source be given a value, since the Department has already drawn the distinction and has not said where it falls. And that disclosure under Part IX.F reach the settings in which the exposed person does not control the device, which are the classroom, the vehicle, the workplace and the terminal a transaction requires.

I. Security and Deterrent Lighting Systems

This class is the newest in this Part and the only one for which the Foundation has a complete independent measurement of an actual product in actual use. The Foundation therefore sets the subsection out differently from the others. It describes the class briefly, gives the measurements,

and then does the one thing this comment is otherwise never able to do: it sets measured values for a product on an American street against every published criterion the Foundation has been able to find, and reports what happens.

1. What the products are

Self-contained units installed on private property and directed at the space around them, combining cameras with high-intensity light-emitting diode sources operated in a strobing mode. They are marketed for deterrence and surveillance rather than for illumination, and that distinction is central to everything below. A luminaire is designed to put light on a surface so that a person can see. These products are designed to be looked at, and to be unpleasant to look at. The aversiveness is the function.

They are mounted on trailers or masts, moved between sites, and operated unattended. They are not street lighting, they are not vehicle lamps, and they are not signs. No federal instrument addresses them, and the Foundation has found no product class in 21 C.F.R. part 1040 into which they fall.

2. Who is exposed, and under what conditions

The population is everyone within line of sight, which in the surveyed installations includes a public sidewalk, a parking lot entrance in continuous use, and a roadway. Exposure is involuntary in the strict sense: the person has not sought the source out, cannot negotiate with its operator, and in the cases described below encounters it while walking on a public way or driving on a public road. It occurs at night, against a dark-adapted eye, which is the condition under which every mechanism treated in Part V is at its most consequential and under which, as Part V.D.1 establishes, the instruments built to measure modulation are least able to operate.

3. The product that has been measured, and how the measurement came to exist

The Foundation commissioned an independent measurement report on these units, described at Part IV.E.3 and listed at Appendix D.4. It was prepared by Ken Walczak of Night/Light Consulting, LLC, a board member of DarkSky International and a member of the Illuminating Engineering Society, and is dated 10 September 2026. The lamp characterized is an Abrams Manufacturing TG-300-B, measured in the laboratory on a purchased unit and observed in service at three sites in Chicago and one in Woodland, California.

The Foundation states its own position in the document plainly. It commissioned the report and paid for it. It did so because no federal measurement convention existed to which a complaint could refer, and because no federal body measures these products. The Department should weigh the report accordingly, and the Foundation asks it to notice the fact the commissioning discloses: the only photometric characterization of this product class known to the Foundation exists because a private party paid a consultant to make it.

4. The measurements

The values below are taken from the report. Those marked as laboratory values were obtained on a purchased lamp powered at 12 volts direct current from a calibrated supply and stabilized for at least five minutes, with the lamp in its steady setting.

Luminance in the direction of the central peak of emission: 700,000 candelas per square meter.

Total emission area of the three light-emitting diodes in the unit: 10.4 square centimeters, from which the report derives an average peak luminous intensity of 728 candelas.

Illuminance at one meter, photopic corrected, at the center of the emission peak: 145 lux.

Spectrum: peak emission at 456 nanometers, with more than 80 percent of the emitted light in the blue part of the spectrum. The report summary gives the blue content as 81.5 percent.

Flicker, which the report attributes to pulse-width modulation in the driver: frequency 100.1 hertz, flicker percentage 63.9, flicker index 0.24, cycle 10.0 milliseconds.

Strobing, which the report distinguishes from flicker as a designed function rather than a residual fluctuation: frequency 20.9 hertz, modulation 77.4 percent, flicker index 0.385, cycle 47.85 milliseconds.

The lamp offers fifteen flash patterns. The pattern observed in use at every surveyed unit was the default, which the report identifies as P9 Quint 75 PH1: five pulses at about 20 hertz followed by a gap of 0.2 seconds, the whole repeating more than twice a second, with the first four pulses lasting about 50 milliseconds and the fifth about 200 milliseconds.

5. The measurements set against IEEE Std 1789-2015

Appendix D.2 describes that document and states what it is: a recommended practice of a professional body, which imposes no obligation on any manufacturer and with which no federal regulation requires compliance. The comparisons below are therefore comparisons with a voluntary criterion, and the Foundation makes them because it is the only quantitative criterion in existence for the quantity measured. The report itself describes the results as violations of that document. The Foundation does not adopt that word. Nothing is violated, because nothing was required.

The arithmetic is the Foundation's, from the recommended practices as published at clause 8.1.1 and the measured values above.

The strobe, at 20.9 hertz and 77.4 percent modulation, is below the 90 hertz boundary, where all three recommended practices apply. Recommended Practice 1, for limiting possible adverse biological effects, permits modulation below 0.025 times the frequency, which is 0.52 percent. The measured value is about 148 times that. Recommended Practice 2, the no-observable-effect level, permits 0.01 times the frequency, or 0.209 percent, which the measured value exceeds by a factor of about 370. Recommended Practice 3 is the seizure-prevention practice and is stated differently from the other two:

> "Recommended Practice 3: (seizure prevention) For any lighting source, under all operating scenarios, flicker Modulation (%) shall satisfy the following goal: Below 90 Hz, Modulation (%) is less than 5%."

The measured modulation is 77.4 percent against a goal of 5 percent: about fifteen times. The Foundation draws the Department's attention to the words for any lighting source and under all operating scenarios, which are the only place in the document where that formulation is used.

The flicker, at 100.1 hertz and 63.9 percent, is above the 90 hertz boundary, where the seizure practice does not apply. Recommended Practice 1 permits modulation below 0.08 times the frequency, or about 8.0 percent, which the measured value exceeds by a factor of about eight. Recommended Practice 2 permits 0.0333 times the frequency, or about 3.33 percent, exceeded by a factor of about nineteen. The same document's comment at clause 8.1.1.1 adds that it seems reasonable to give a general guideline to avoid flicker below 90 hertz whenever possible. The strobing function of this product is a deliberate modulation at 20.9 hertz.

6. The decision tree, and why it returns no answer

Clause 7.4.1 of the same document contains a risk assessment for photoepilepsy, and Figure 19 states it as a decision tree with three gates taken in order: visual solid angle, luminance change, and frequency. The Foundation applies it to the measured lamp and reports the result, which is not the result the Foundation expected.

The luminance gate is 20 candelas per square meter. Taking the modulated change as 77.4 percent of the measured 700,000 candelas per square meter, or about 542,000, the gate is exceeded by a factor of about twenty-seven thousand. The frequency gate is given in Figure 19 as 1 to 65 hertz, and the measured 20.9 hertz falls within it; it also falls within the 3 to 65 hertz range stated at

clause 7.4.1.4, and within the range of maximum provocation identified in the clinical literature at Part V.E.

The solid angle gate is 0.006 steradians, and the lamp does not meet it. A source of 10.4 square centimeters subtends 0.006 steradians only within about 42 centimeters of the emitting surface. At any distance at which a person would encounter one of these units, the lamp is far below that gate.

Two gates of three are therefore met, and met by very large margins, and the third is not met at all. The Foundation asks the Department to read what the document says about that case, because it says it in terms:

> "No information on the probability of seizure has been located for flicker that meets zero, one, or two (but not all three) of the flicker hazard criteria (solid angle, flash rate, modulation depth)."

The tree assigns such a case to medium risk, and states that it does so by assumption: assuming that the probability of seizure is low or very low, the risk matrix indicates a medium risk level, and the decision tree in Figure 19 is based on this assumption. The document adds that on a different assumption a more complicated decision tree incorporating more risk levels would be necessary.

That is the finding of this subsection, and the Foundation states it without enlargement. The only quantitative framework in existence for assessing this hazard returns, for this product, an answer that its authors identify as an assumption standing in for evidence that has not been located.

7. Why the gate that fails cannot simply be carried across

The three gates are not independent and were not derived independently. Clause 7.4.1.1 takes them from the expert consensus of the Epilepsy Foundation of America working group, which defined a flash as a potential hazard if it has luminance of at least 20 candelas per square meter, occurs at a frequency of at least 3 hertz, and occupies a visual solid angle of at least 0.006 steradians. A footnote to that criterion states what the solid angle figure was calibrated against: an area greater than 25 percent of the area of a television screen, at standard viewing distances of two meters or more.

The document is explicit that the terms interact:

> "The statement recognizes that for flashes less than 20 cd/m2, the risk may be less because the time-averaged luminance is low, but that as the time-averaged luminance increases, lower and lower modulations may be capable of inducing a seizure. The statement was designed for use with displays having a typical luminance of about 200 cd/m2 for which a flash of 20 cd/m2 provides about 5% modulation depth."

Two things follow, and the Foundation separates them because the first is about this document and the second is about the product. The first is that the 5 percent figure in Recommended Practice 3 is not a property of the visual system. It is 20 candelas per square meter expressed as a fraction of a television of about 200 candelas per square meter. The second is that the lamp measured here presents a luminance about three and a half thousand times that display, and the document states that as luminance rises the modulation capable of inducing a seizure falls. Whether the solid angle boundary calibrated at 200 candelas per square meter marks the same boundary at 700,000 is not addressed anywhere the Foundation has looked.

One arithmetical comparison makes the scale of the extrapolation visible, and the Foundation states its limits before stating the figure. It is a comparison of the product of luminance and solid angle, which is proportional to the flux the source delivers to the retina. It is not a seizure threshold, and the Foundation does not offer it as one; the literature at Part V.E establishes that retinal area matters to this mechanism in its own right and not merely as a proxy for flux. With that said: the threshold pairing of 20 candelas per square meter with 0.006 steradians gives a product of 0.12. A modulated change of about 542,000 candelas per square meter reaches the

same product at about 1.7 × 10 to the minus seventh steradians, which for a source of 10.4 square centimeters is a distance of about 68 meters. The lamp delivers the threshold flux from the far side of a parking lot while subtending roughly one five-thousandth of the area the criterion names.

The Foundation does not conclude from this that the solid angle criterion is wrong, and expressly does not ask the Department to find that it is. It concludes that the criterion was calibrated against a class of object this product does not belong to, that the document itself says the criteria interact, and that nobody has done the work that would say where the boundary lies for a small source of extreme luminance. That is a research gap of exactly the kind paragraphs 360ii(a)(2) and (a)(5) direct the Secretary to close, and it is the Foundation's answer to the question this Request for Information asks about research priorities.

The clinical criteria, applied to the same lamp

The preceding paragraphs apply a recommended practice of an engineering body. The clinical criteria are stated by the expert body in the field, in the review described at Appendix C.98, and the Foundation applies them here as well because they are the primary statement from which the engineering document's version was taken.

> "In 2005, a panel convened by the Epilepsy Foundation of America concluded that a flash is a potential hazard if it is brighter than 20 candelas per square meter, occupies at least 10% of the visual field, flashes or changes color at a frequency between 3 and 60 Hz, and endures for at least half a second."

Applied to the measured lamp, three of the four conditions are met and one is not.

Brighter than 20 candelas per square meter. Met. The modulated change is of the order of 542,000, exceeding the condition by a factor of about twenty-seven thousand.

A frequency between 3 and 60 hertz. Met. The measured strobe frequency is 20.9 hertz. The review adds elsewhere that flashes at 15 to 20 hertz are the most likely to provoke seizures.

Enduring for at least half a second. Met. The lamp operates continuously in a pattern that repeats more than twice a second.

Occupying at least 10 percent of the visual field. Not met beyond very short range, for the reason given above: an emitting area of 10.4 square centimeters.

The Foundation states the consequence without enlarging it. Under the clinical criteria as under the engineering decision tree, this lamp fails the spatial condition and meets the others by wide margins. The review says in terms that flashing police car lights only rarely provoke seizures, perhaps because the image rarely occupies a large part of the visual field, and that sentence is set out and answered at Part VI.C.1 rather than omitted here. The Foundation does not assert that this lamp provokes seizures. It asserts that three of four criteria are satisfied, that the fourth is satisfied at close range and not at distance, that no federal instrument limits any of the four, and that the only reason any of them can be evaluated at all is that a private party paid for a measurement.

8. The other criteria, and what they do and do not reach

California Title 24. The report identifies the one American code criterion it could find that addresses the measured quantity. Joint Appendix 8 of the California Building Standards Code requires that light sources exhibit, in the report's quotation of it, less than 30 percent flicker for frequencies at or below 200 hertz, measured at both full and dimmed levels, with Joint Appendix 10 supplying the test method. Both measured values exceed that limit: the flicker at 63.9 percent by a factor of about two, the strobe at 77.4 percent by a factor of about two and a half. The Foundation records two limits on that comparison. It is a State building standard, and whether it reaches a trailer-mounted surveillance unit on a parking lot is a question of California law that neither the report nor this comment resolves. And it is a State standard, which is the point of Part

II: the only operative numerical limit on temporal modulation the Foundation has found anywhere in American law is in the building code of one State.

Glare. The report calculates the small-source Unified Glare Rating for each surveyed location, using a luminous intensity of 728 candelas, a Guth position index of 1 for peak line of sight, and background luminances of 3.0 candelas per square meter for the urban Chicago sites and 0.3 for the suburban Woodland site. On a scale where 19 is just acceptable and 31 is just intolerable, it reports 24.3 at 90 meters, 39.6 at 10 meters and 45.9 at 4 meters at the Chicago pharmacy site, and 29.7 at 50 meters at Woodland. Adjusting the luminous intensity for the intermittency of the strobe, by the flicker index of 0.385, it reports 17.7, 32.9 and 39.3 at the same three Chicago distances. The report states that the minimum distance at which the rating becomes acceptable is 194 meters unadjusted and beyond 73 meters adjusted, and 235 meters at Woodland.

The Foundation records what the report itself says about that metric, because it bears on how much weight the figures carry. The Unified Glare Rating provides a method for determining the acceptability of glare in indoor environments; the report states that an updated metric is needed for the outdoor environment, and that the small-source variant was created to begin to characterize outdoor nighttime glare more realistically. The published scale ends at 31 and the report extends it for presentation. Figures above 31 are therefore outside the range for which the metric is defined, and the Foundation presents them as what they are: a statement that the source is far outside the range of any criterion that exists, rather than a calibrated value.

Illuminance. The report measures 145 lux at one meter and sets it against the recommendation in ANSI/IES RP-43-25 of 4 lux typical and 8 lux maximum for pedestrian safety in a developed commercial space. The report is careful that the comparison is of unlike things, since the function of the product is signaling rather than illumination, and the Foundation repeats that caution here.

9. The spectrum, and the one place where every framework stops

The emission peaks at 456 nanometers with more than 80 percent of its output in the blue. Part V.B.3 and Part V.F set out why that matters. What belongs here is what the criteria do with it, which is nothing. IEEE Std 1789-2015 lists the spectral composition of the light among the parameters on which seizure risk is known to depend, at clause 7.4.1.1, and then states at clause 7 that features associated with wavelength are not considered. The flash criteria of the broadcast guidance address a transition to or from saturated red and nothing else. The photobiological framework at Part V.C.2 addresses blue light but by a weighted radiance the Foundation cannot compute from this report. A near-monochromatic blue source operated in a strobing mode is a case that every instrument in this field names as relevant and none evaluates.

One corroboration belongs here, from a different literature and a different purpose. The study described at Appendix D.4, conducted under contract to the United States Fire Administration, measured discomfort glare from flashing warning lamps of four colors at equal intensity and found that blue and white were the most glaring and that the effect of color was about twice the effect of intensity, attributing the result to short-wavelength content. The lamp measured in this subsection emits more than eighty percent of its output in the blue with a peak at 456 nanometers. On the only federally funded assessment of discomfort glare from flashing lamps the Foundation has found, this product sits at the worst end of the spectral axis, and nothing in the photobiological framework at Part V.C.2 or in any instrument described in Part II reaches that fact.

10. What the Foundation does not claim from this report

Four things, stated so that the Department does not have to find them. The report is not a health study. It reports no biological endpoint, no exposure of any identified person, and no clinical outcome, and it does not claim to. Its statements about health risk are the stated opinion of a lighting consultant about what the measured values imply, and the Foundation relies on the measurements rather than on those statements.

The report does not state the accuracy or uncertainty of its instruments, and does not map each instrument to each reported reading. The Woodland site was not surveyed in person; it was assessed remotely from geographic information system data and eyewitness accounts, and the Foundation does not place the Woodland figures on the same footing as the Chicago ones.

The luminance of 700,000 candelas per square meter was measured with the lamp in its steady setting rather than while strobing. The report argues that averaging the output of an intermittent source over time, while correct as photometry, does not represent the physiological experience of a dark-adapted viewer, and illustrates the point with a photographic flash. The Foundation records that this is an argument rather than a measurement, and that the report itself applies a time-averaging factor of 0.385 when it calculates glare. Where this comment uses a modulated luminance change it computes it from the measured modulation of 77.4 percent, and says so.

And the report is internally inconsistent in three places that the Foundation has found, each of which is recorded at Appendix D.4 and none of which affects the measured values relied on above.

11. What follows for this Department

A product is in use on American streets whose emitting surface is at a luminance of the order of 700,000 candelas per square meter, which strobes at 20.9 hertz with 77.4 percent modulation, which carries a further 63.9 percent modulation at 100.1 hertz from its driver, whose output is more than 80 percent blue with a peak at 456 nanometers, and which is aimed at public sidewalks and roadways and operated unattended at night. Every one of those figures exists because a private party commissioned a consultant to measure them. No federal instrument sets a limit on any of them. The only quantitative criterion that addresses the modulation is a voluntary recommended practice that this product exceeds by factors between eight and three hundred and seventy, and whose own risk assessment returns, for this product, an answer its authors describe as an assumption made in the absence of located evidence.

J. Signage, Billboards, and Dynamic Message Displays

This product class differs from every other in this Part in one respect, and the Foundation puts it first because the rest of the subsection follows from it. These are the largest emitting surfaces in the built environment. A roadway luminaire presents an aperture measured in centimeters and a retail downlight rather less; a video display on the side of a building presents one measured in meters. Part V.B.2 establishes that the distance at which a source ceases to be resolved by the eye, and therefore the distance beyond which retinal exposure begins to fall, scales with the size of the emitting aperture. For this class that distance is measured in kilometers.

1. What the products are

Direct-view light-emitting diode video displays, installed outdoors and oriented toward public space. The class includes video billboards on buildings and roadside structures, perimeter and facade displays at stadiums and arenas, dynamic message signs on highways, and the increasingly common replacement of printed signage with emissive panels on commercial premises. The emitting surface is an array of discrete diodes rather than an illuminated translucent face, which distinguishes this class from the backlit sign it replaced: the older product diffused light through a lens or a vinyl face, and this one does not.

Two characteristics of the class are material and both follow from its construction. The content changes, so the emission is temporally modulated by design and not merely as an artifact of the driver, which distinguishes it from the flicker treated at Part V.D. And the luminance is set to be legible against daylight, which means it is set against the brightest background the product will ever face and is then operated against the darkest.

2. Who is exposed, and under what conditions

Two populations, and the second is the one this subsection is about.

The audience for whom the product is designed looks at it deliberately and briefly: a driver reading a message sign, a spectator watching a replay. That exposure is voluntary in the ordinary sense and the Foundation does not treat it as the problem.

Residents of the surrounding area did not choose the exposure, cannot alter it, and receive it from inside their own dwellings for as long as the display operates. The emission enters windows. It is present during the hours when the occupant is attempting to sleep, if the display operates then, and in the field of view whenever the occupant looks outward. This is the condition of exposure that paragraph 360ii(a)(4) directs the Secretary to study and evaluate, and the Foundation is aware of no federal study of it.

3. Source size, and why distance does not resolve the problem

The Foundation works the arithmetic for a specific installation because it is the clearest demonstration in this comment of the proposition at Part V.B.2. The installation is described at paragraph 4 below: three outdoor video displays, each approximately thirty feet by fifty feet.

Thirty feet is 9.14 meters, and the Foundation uses the smaller dimension because it governs. Applying the relation at Part V.B.2.c, that the distance at which an aperture subtends a given angle is the aperture divided by the angle:

The display subtends 100 milliradians, the upper bound of the averaging field, at approximately 91 meters.

It subtends 11 milliradians, the criterion below which the retinal photochemical hazard may be assessed as an irradiance rather than a radiance, at approximately 830 meters.

It subtends 1.5 milliradians, the minimum angular subtense beyond which the inverse square law begins to govern retinal exposure, at approximately 6.1 kilometers.

Within five kilometers of that display, the irradiance delivered to the retinal image of it does not diminish with distance. A resident at four kilometers and a resident at four hundred meters receive, at the retinal image, the same irradiance; what differs is how much of the retina receives it. The Foundation asks the Department to compare that with the approach the public health assessment described below took to the same installation, which was to identify as a needed datum the "data on nearby residential distances and lines of sight to the screens." Line of sight governs. Distance, within that radius, does not.

The Foundation states the limits of that arithmetic. It assumes the whole emitting surface is at a common radiance, which a video display showing an image is not: the relevant aperture at any instant is the bright region of the picture, which may be a fraction of the panel. It assumes clear air. And it concerns the irradiance within the retinal image rather than the total optical power entering the eye, which does fall as the inverse square throughout, as Part V.B.2.b explains. The proposition is not that a distant display is as hazardous as a near one. It is that moving a dwelling further away does not reduce the intensity of the exposure at the retina, which is what a setback requirement assumes it does.

4. What a public health body found when it examined this class

The Foundation has located one assessment of this product class by a public health body, and it is not a United States one. In January 2013 the National Collaborating Centre for Environmental Health, a body funded by the Public Health Agency of Canada, published an evidence brief by M. Shum and M. Wiens titled Health effects of large LED screens on local residents. It is an organizational publication and not peer-reviewed research, and the Foundation identifies it as such; it is listed at Appendix D and is not an entry in Appendix C.

The brief examined three high-definition light-emitting diode video billboards, each approximately thirty by fifty feet, installed in 2011 around a sports stadium, and considered four potential effects on nearby residents: photosensitive epilepsy, retinal damage, stress and

annoyance, and circadian or sleep disruption. Its overall conclusion is the reason the Foundation brings it forward:

> "The lack of information on exposure characteristics of the LED video billboards and the affected population, along with the lack of scientific evidence informing the process, precludes undertaking a current risk assessment."

The Foundation asks the Department to attend to the first of those two grounds. The brief did not conclude that the evidence was adverse or that it was reassuring. It concluded that the assessment could not be performed, and the first reason given was the absence of data about the exposure. Among the data the brief identified as needed were the screen manufacturer, the flicker frequency and the maximum luminance — which is to say, what the product emits.

How the brief treated luminance is the part that bears most directly on this comment. It records that the supplier listed the maximum luminance of the displays as 5,000 to 6,000 cd/m², and that the actual measurements were unknown. The brief then disposed of the retinal question by reference to a screening threshold which it attributes to the 1997 guidelines of the International Commission on Non-Ionizing Radiation Protection, to the effect that sources below 10,000 cd/m² are not hazardous and that radiometric measurement is not necessary. Because the displays were believed to operate below full capacity and therefore below that figure, the risk was judged limited.

The Foundation does not say the brief was wrong to reason that way; the threshold is what the guidance provides and the brief applied it honestly and said what it did not know. The Foundation says that the reasoning illustrates the structure this comment is about. A finding of limited hazard was reached on the strength of a figure from a manufacturer's specification sheet, unverified by measurement, compared against a threshold whose function is to make measurement unnecessary. Part V.K.3 describes the same structure in the 2018 SCHEER Opinion, where a safety conclusion was conditioned on exposure limits. Here the conclusion is conditioned on a screening threshold below which the limits need not be evaluated at all.

The brief also stated four gaps, in 2013, which the Foundation reproduces because they describe the position thirteen years later:

- That no studies examining physiological stress responses to unwanted outdoor light in humans were found.
- That no research had been done specifically on large light-emitting diode screen exposure and retinal damage.
- That sleep and metabolic effects had yet to be studied in relation to exposure to outdoor light at night.
- That data were needed on residential distances, lines of sight and the characteristics of the exposed population.

5. The daytime comparison, and the condition of use

The brief placed the luminance of the displays in context by comparison with the sky, recording that the sky on a cloudy day has a luminance of about 3,000 cd/m², rising to 6,000 to 10,000 cd/m² on a clear day. On that comparison a display at 5,000 to 6,000 cd/m² is unremarkable: it is no brighter than the sky behind it.

The Foundation accepts the figures and identifies what the comparison omits. A display designed to be legible against a daytime sky is operated after dark against a background several orders of magnitude dimmer. Part V.C.4 sets out the discomfort glare metric and identifies the background luminance in its denominator: the same source luminance against a darker background yields a higher glare rating, and the relation is not marginal. A luminance that matches the daytime sky is not a luminance that matches the night sky, and the comparison with daylight describes the one hour of the product's operation when it is least consequential for a resident.

Two further quantities in the brief are worth recording, because the comment elsewhere argues about luminance at length and states few values. The brief sets out five limits which it attributes to guidance of the International Telecommunication Union produced for broadcasters, Recommendation ITU-R BT.1702 of 2005, Guidance for the reduction of photosensitive epileptic seizures caused by television: that flashes with a frequency greater than 3 Hz are prohibited; that flashes with changes in luminance of 20 candelas per square meter or more are prohibited; that flashes covering more than one quarter of the screen area are prohibited; that flicker from saturated red light is prohibited; and that the color, size and duration of striped images are limited. And the brief separately identifies alternating dark and bright images differing by 20 candelas per square meter as of greatest concern for photosensitive epilepsy, which is the subject of Part V.E.1.

The Foundation draws attention to the position that leaves. A numerical flash criterion exists, is expressed in the quantity that governs, and applies to the television in a dwelling but not to the sixty-foot display outside its window.

The third of those five is worth isolating, because it is a spatial criterion and this comment has argued a spatial point. The limit is expressed as a proportion of the screen area, and the brief explains why in its own discussion of what provokes seizures: "The larger the visual image, the greater the portion of the brain is stimulated. This variable also depends on the distance of the viewer from the source." That is the quantity the arithmetic above concerns. For a broadcast image the proportion of the visual field is fixed by the television and the room. For a thirty by fifty foot display outside a window it is fixed by nothing, and it is larger for the nearer resident.

The Foundation records, because it bears on how much the brief can be made to carry, that the brief does treat these broadcast criteria as the applicable benchmark for the installation. Its conclusion on this head is conditional: the risk of photosensitive epilepsy "should be minimal if images on the LED screen comply with the International Telecommunications Union recommendations to prevent photosensitive seizures". The Foundation adopts the finding and draws attention to the condition. Compliance by a display with broadcast content guidance is a choice made by whoever loads the content. No instrument identified anywhere in this comment requires it, no authority verifies it, and the brief did not know whether it was happening at the installation it was asked about. It is the same structure Part VI.J.6 describes in the brightness criterion: a safety conclusion resting on a setting rather than on a property of the product.

Two statements in the brief that run against this comment

The first concerns flicker, on which this comment argues at length at Part V.E. The brief states that "Most LEDs are designed to control for these fluctuations, and perceptible flicker occurs only when the LED is deeply dimmed", citing work of Bullough and others. The Foundation records that statement, does not suppress it, and notes three things about it rather than disputing it. It concerns perceptible flicker, and Part V.E concerns modulation at frequencies above the threshold of perception as well as below it. It is a statement about design intent across a product category rather than a measurement of these displays, whose modulation the brief elsewhere records it did not know. And deep dimming is the condition under which these particular displays operate at night, the brief recording that two of the three run at twenty-five percent of capacity outside the hours of nine to seven and the third at twenty percent.

The second concerns the evidence base generally, and the Foundation quotes it because it is the fairest statement of the position and because it is adverse to any suggestion that the science is settled in the Foundation's favor: "Most of the research examines indoor lighting, personal screen use, or occupational exposures to industrial lighting and thus may not be generalizable to the scenario of exposure to a large outdoor screen." The Foundation agrees, and that sentence is the reason this comment asks for a research program and a measurement requirement rather than asking the Department to find a hazard established.

A feature of the brief's reference list, stated because the Foundation would rather disclose it than be shown it

The reference list of the brief contains three documents that do not appear to belong to the propositions near which their numbers fall. Reference 7, which the text cites for the proposition that workplace lighting conditions have been studied across office and health care settings and that inability to control lighting is associated with worker stress, is listed as Cummings J., Wind farm noise and health, Acoustic Ecology Institute. Reference 11, which the text cites for the spectral dependence of melatonin suppression, is listed as Bartholomew R.E., a letter concerning a review of the published literature on epidemic hysteria. A further entry is a summary of seventeen reviews of the research literature on wind farms and health.

The Foundation states the innocent explanation first and believes it to be the likely one: the in-text superscripts and the numbered list in the published web version do not align, and this is a numbering fault rather than a representation that wind-farm literature supports propositions about lighting. The Foundation makes no allegation and draws no inference about the authors. It records the matter for two practical reasons. The first is that the comment should not rest any proposition on a passage whose supporting citation cannot be identified, and it does not: the propositions the Foundation takes from this brief are its statements about what was not known and what had not been studied, which are statements about the brief's own inquiry and require no citation. The second is that a comment which relies on a document ought to have read its reference list.

6. What federal requirement governs the optical output

As to the optical output of these products the Foundation can identify none. Outdoor displays are regulated where they are regulated at all by municipal sign ordinances and by State highway authorities, and those instruments address size, placement, dwell time and in some cases illuminance measured at a property line. None of them, so far as the Foundation has found, limits the luminance of the emitting surface, the spectral content of the emission, or the depth and frequency of its temporal modulation. Part IX.C and Part IX.I.

The criterion the ordinances use, who wrote it, and what it says it does not address

The paragraph above records that control of these products, where there is any, is municipal. The Foundation sets out the technical basis of that control, because there is one, because it is not a public instrument, and because the document which supplies it is explicit about the question it does not reach. The report is described at Appendix D.4. It was prepared by Ian Lewin of Lighting Sciences Inc. of Scottsdale, Arizona, is dated November 26, 2008, and states its own commission: it was prepared for the Outdoor Advertising Association of America under contract, for the development of nighttime brightness recommendations for digital billboards.

The criterion it recommends is 0.3 footcandles above ambient, measured with a footcandle meter held at eye height and faced toward the display at a standardized viewer distance, which for a 14 by 48 foot bulletin is 250 feet. It is derived from the light trespass practice of the Illuminating Engineering Society of North America. The Foundation draws attention first to the quantity. The criterion is expressed in illuminance at a stated distance, which is the form Part V.B.2 identifies as incapable of constraining retinal exposure, and not in the luminance of the emitting surface.

The report nonetheless permits the conversion, and supplies the formula for it, so the luminance the criterion implies can be computed. Its equation A5 gives luminance in candelas per square meter as 10.76 multiplied by the illuminance in footcandles, multiplied by the square of the distance in feet, divided by the area in square feet. For the standard bulletin at the standard distance the recommended limit works out at about 300 candelas per square meter. That arithmetic is the Foundation's, using the report's formula and the report's own standard geometry, and the figure is not stated in the report.

The report also measured a real display, and the comparison between the two sets of figures is the material one. A commercially produced electronic display of 20 millimeter pixel spacing, made in

2006, was measured on a goniophotometer by the approved methods of the Illuminating Engineering Society.

Color at the 100 percent setting	Measured luminance (cd/m²)
White, 6,800 kelvin	7,000
Green	5,100
Red	1,500
Blue	700
Implied by the recommended criterion	about 300

The recommended nighttime criterion is therefore about 4 percent of what the hardware was measured to deliver. Three consequences follow and the Foundation separates them. The emitting surface of this product class is capable of some twenty-three times the brightness the criterion contemplates after dark. Compliance is accordingly not a property of the product but a setting on it, and depends on the dimming being configured correctly and left so. And the comment's own figures at subsection 5 above place the measured full-output value of 7,000 candelas per square meter inside the range given there for a clear daytime sky, which is consistent: the hardware is built for daytime legibility and must be turned down by a factor of more than twenty at night.

The Foundation adds one comparison from Part V.C.2, because it locates this product in the photobiological framework. The governing exposure guidelines state that assessment of a source is normally required only where its luminance exceeds ten thousand candelas per square meter. The measured white output of this display is 7,000. It sits at about seventy per cent of the threshold at which the photobiological framework would begin to look at it, and therefore below it, and the Foundation does not suggest that the framework has been breached. What it asks the Department to notice is that a product encountered by the public from a public road sits within a factor of one and a half of a screening threshold, and that no one is required to measure it.

Then the exclusion, which the Foundation quotes rather than summarizes because the words are the author's and they are unambiguous.

> "The investigations and this report do not cover factors related to changing images and billboard message movement. Issues that may be related to motorist attention are beyond the scope of the work and use of the proposals in this study should be based on that understanding."

So the criterion that governs the brightness of a changing illuminated display states, in the document that developed it, that it does not cover the changing of the images, the movement of the message, or anything related to the attention of motorists. The Foundation makes no complaint of that. A consultant instructed to develop a brightness recommendation is entitled to define his scope and is to be commended for stating it. The point is what follows for the Department. When it is said that these products are regulated, what is meant is this criterion; and this criterion disclaims the effect on driver attention, which is the effect the public would most expect a limit on a roadside display to address.

One further matter is recorded as a chronology, without characterization, because the sequence is the fact. The report considered two possible bases for the recommendation. One was driver glare, of which it states that the procedures of the Illuminating Engineering Society "can, in theory, be used to produce limitations on digital billboard luminance that will ensure that any glare problems created for drivers will be relatively minor". The other was light trespass. The report states that of the two "the first method has disadvantages" and recommends the second. It also sets out the three requirements the analysis was to satisfy, the third being "The needs of OAAA members, who require effective use of digital billboards, which in turn requires adequate brightness for clear visibility." A glare-based criterion was available and was described as

workable in theory. A nuisance-based criterion was adopted. The commercial requirement for brightness was one of the three stated constraints on the choice. The Foundation states those three facts and draws no inference from them beyond the one in the next paragraph.

The inference is about the record rather than about anyone's motives. The only operative brightness criterion for this product class in the United States was developed under contract to the industry that sells it, is expressed in a quantity that does not constrain retinal exposure, implies a luminance some twenty-three times below the measured capability of the hardware it governs, and excludes driver attention from its scope by its own terms. That is not a criticism of its author, who disclosed every one of those features in the document itself. It is the answer to the question whether anybody has set a limit for this class on health or safety grounds. The Foundation submits that nobody has, and asks the Department to do so under paragraph 360ii(a)(4) and, if warranted, paragraph 360kk.

What tells the other way is recorded at Appendix D.4 and summarized here. The report states that its luminance figures represent a worst case of an all-white display which it describes as unlikely absent a malfunction; that displays viewed at an angle, as most are, present substantially lower luminance than the head-on figures; and that on a comparison with measurements by the Lighting Research Center of Rensselaer Polytechnic Institute, digital billboards will be only slightly brighter than the maximum luminance of conventional billboards. The first two are reasons the measured values overstate ordinary exposure. The third is a comparison drawn against the brightest of the class being replaced rather than against its typical member, and the Foundation notes the distinction without pressing it.

The temporal questions the American criterion excludes, which have been reduced to numbers elsewhere

The exclusion quoted above is the center of this subsection. The only operative American brightness criterion for this product class states, in the document that developed it, that it does not cover changing images, message movement, or anything related to the attention of motorists. The Foundation records here that those questions have been reduced to numbers in other jurisdictions, because whether a criterion can be drafted bears on whether one should be.

The source and its weight, stated before its contents. Zhu Y., Consider digital billboards a contributing outdoor light source, Buildings, 28 July 2023, described at Appendix D.1. It is a short article in a trade publication by a lighting practitioner. It reports no measurement, conducts no study, and its substance is a summary of other documents. The Foundation relies on it for one thing only, which is to identify criteria that exist and the instruments that carry them.

The criteria it reports, which it attributes principally to guidance of the New Zealand Transport Agency and to related sources, are these:

- a minimum dwell time, being the interval between successive images, of eight seconds, which the article describes as "widely accepted by the industry";
- a finding that "Images with dwell time shorter than 7 seconds attract the attention of drivers more than road signs";
- a maximum transition between successive displays of "between 0.5 to 2 seconds, without other visible effects";
- a requirement that "the average luminance level should not fluctuate greater than 30% between images";
- restrictions on how many displays may fall within a driver's field of view, the article reporting that "In the U.S., standards limit the number of billboards to two or three within the driver's field of view";

and placement rules, of which the example given is a New Zealand district plan requiring billboards to stand at least fifty meters from a signalized intersection and not to be "directly visible from a residential zone".

The fourth of those is the one the Foundation places before the Department. A limit on how much the average luminance may change between successive images is a modulation criterion. It is expressed as a percentage change in a photometric quantity, which is the form the recommended practices at Part V.D.3 take, and it governs the same variable that Part VI.J.8 asks the Department to characterize for this class. Somebody has written the number down. It is not in any American instrument the Foundation has found.

The Foundation states with equal clarity what these criteria do not do. Not one of them limits the luminance of the emitting surface. They govern how long an image stays, how fast it changes, how much the average may change between images, how many displays a driver may face and where they may stand. The quantity this subsection has shown to be unregulated, which is how bright the surface is allowed to be, is unregulated in these instruments too. Two jurisdictions have addressed what changes, and neither has addressed how bright.

One further formulation is worth adopting because it is careful, and because the comment has elsewhere declined less careful versions of the same claim. The article states that "research has not proven that digital billboards affect motor vehicle crash rates", while reporting that they "may have an impact on driver speed, lateral control, mental workload, ability to follow road signs, and eye movements and fixations". That is the same distinction Part VI.J.7 draws from the one rigorous causal study in this field, and the Foundation adopts it: the demonstrated effects are on what drivers do with their attention, and the crash question remains open.

And the article's own conclusion, which the Foundation records because it is the position this whole Part describes: that the number of these displays is expected to increase, and that "their lighting impacts on traffic, environment, and public wellbeing are not yet fully understood".

The eight second figure, corrected by the research it rests on

The Foundation reported the dwell time criteria above from a trade article, and recorded there that it had not read the instruments behind them. It has since read a document that reviews the underlying research, and it corrects one of those figures here rather than leaving it to stand.

Wachtel J., Compendium of Recent Research Studies on Distraction from Commercial Electronic Variable Message Signs (CEVMS), The Veridian Group, Inc., February 2016, described at Appendix C.113. The Foundation states its nature first. It is a review of other people's work, not primary research, and nothing in it was measured by its author. It is the second update to a report the same author prepared in 2009 for the American Association of State Highway and Transportation Officials under National Cooperative Highway Research Program Project 20-7/256, and it summarizes twenty-one studies in tabular form, giving for each one its sponsor, its method, its findings and its weaknesses. It is now ten years old and captures nothing published since.

The correction concerns the minimum dwell time of eight seconds, which the trade article above describes as widely accepted by the industry. The most recent study in this compendium is an on-road study of that very question, and its authors reach the opposite conclusion. Belyusar D., Reimer B., Mehler B. and Coughlin J.F., A field study on the effects of digital billboards on glance behavior during highway driving, Accident Analysis and Prevention, volume 88 (2016), pages 88 to 96, conducted at the New England University Transportation Center and the Massachusetts Institute of Technology AgeLab, with one hundred and twenty-three subjects driving an instrumented vehicle past a digital billboard on a sixty-five mile per hour highway. The subjects were divided between men and women and between drivers aged twenty to twenty-nine and drivers aged sixty to sixty-nine. They were given no task; they simply drove.

The finding is reported in the compendium in the authors' own words, and it is about the moment of change rather than about the display:

> "Drivers glanced more at the time of a switch to a new advertisement display than during a comparable section of roadway when the billboard was simply visible and stable."

And their conclusion, which is the correction:

> "Given typical billboard dwell (cycle) times of six (6) or eight (8) seconds, these findings add to the argument the dwell times for such signs should be considerably longer."

So the figure the Foundation reported above as the industry-accepted minimum is the figure the most recent on-road measurement in this field identifies as too short. The Foundation does not ask the Department to adopt eight seconds, or any other number, and it withdraws no part of what it reported, which was an accurate account of what the trade article says. It records the correction because a criterion described as accepted by the industry that sells the product, and contradicted by the research, is the same pattern this subsection has already described in the brightness criterion, and the Foundation would rather state it against its own earlier paragraph than leave the figure unqualified.

The mechanism, which is the part of this that belongs before the Department

The Foundation is candid about the limits of this document for its purposes. Not one of the twenty-one studies measures a health endpoint, a visual endpoint or any biological effect whatever. They measure glance duration, lane position, reaction time and crash rates. Driver distraction is the business of the National Highway Traffic Safety Administration and the Federal Highway Administration, and the Foundation does not suggest that the Department of Health and Human Services should take up road safety.

One thread in it does belong here, and the Foundation confines itself to that thread. It is the mechanism by which these displays take a driver's attention, which the review describes as involuntary and physiological rather than as a choice:

> "This attention is often captured through a 'bottom up' physiological process, in which the driver attends to the sign unintentionally and unconsciously, with the eyes captured involuntarily by the sign's changing imagery, brightness, conspicuity, and/or movement."

One of the reviewed studies, Roberts, Boddington and Rodwell for Austroads in 2013, states the same thing in terms of the optical property itself:

> "The appearance of movement or changes in luminance can involuntarily capture attention, and engaging information can capture attention to the detriment of driving performance, particularly in inexperienced drivers."

That is a statement about what a change in luminance does to a person who did not choose it, and it is the proposition this comment has advanced throughout about this class of product. The quantity named is luminance. The response named is involuntary. Whether such a response is properly characterized as a biological effect of electronic product radiation within the meaning of the statute is a question for the Department, and the Foundation asks it rather than answers it. But the Department cannot reach that question while the only American criterion for this product class excludes changing images from its scope by its own terms, and while no federal health authority has examined the matter at all.

A second study in the review, Edquist, Horberry, Hosking and Johnston in 2011, records the consequence in the same involuntary terms: billboards "can automatically attract attention when drivers are engaged in other tasks, delaying their responses to other aspects in the environment", and that effect was strongest in scenes already cluttered with visual material, which the authors note is where these displays are most often erected.

A natural experiment, recorded with its limitation

The review describes one study the Foundation considers worth setting out, because its design is one that rarely becomes available. Following complaints, the Supreme Court of Israel ordered a series of

billboards on an urban freeway near Tel Aviv to be covered for one year while an evaluation was carried out. At the end of that period they were uncovered. Gitelman, Zaidel and Doveh studied eight treatment sites and six control sites on the same highway, with traffic volume as a control variable, across the period in which the displays were present, then covered, then present again.

The review reports that at the control sites crashes were essentially unchanged throughout, and that at the treatment sites, after adjustment for traffic volume, covering the displays was associated with reductions of sixty percent in all crashes, thirty-nine percent in injury and fatal crashes and seventy-two percent in property damage crashes. The later paper adding the third period reports that removal was associated with a thirty to forty percent reduction in injury crashes on two different databases, and that uncovering them again was associated with an increase of forty to fifty percent or eighteen to forty-five percent in such crashes depending on the database, with similar trends for damage-only, injury and total crashes and for night-time against daytime injury crashes.

The Foundation records the limitation in the same breath, and it is severe. The review states that the complete study exists in Hebrew only and that an English translation is available for the executive summary alone. The Foundation has read neither. Every figure in the preceding paragraph is at third hand: a review's account of a report the reviewer read in summary. The Foundation offers it to the Department as an indication of where the evidence points and as a document worth obtaining, and not as a fact it has verified.

What runs the other way, stated because it does

Three of the reviewed studies found no such effect, and the Foundation sets them out rather than reporting only the twenty-one that suit it.

- The Federal Highway Administration's own study, Perez, Bertola, Kennedy and Molino in 2012, used an instrumented vehicle in Pennsylvania and Virginia by day and by night and found that digital billboards "were not associated with 'unacceptably long glances away from the road'". That is the federal government's own finding and it runs against the position this comment takes.
- Hawkins, Kuo and Lord in 2014, sponsored by the on-premise signage industry, analyzed crash data at one hundred and thirty-five sign locations against one thousand three hundred and one control sites in four states and found "no evidence the installation of on-premise signs at these locations led to an automatic increase in the number of crashes".
- Samsa and Phillips in 2015, for the Outdoor Media Association of Australia, found fixation durations well below three quarters of a second and no significant difference in vehicle headway, though they did find poorer lateral deviation when billboards were present. The review records that only an abstract of that study is available.

The review disputes the first of those three at length and the Foundation does not adopt the dispute. Its author wrote the critique on which the review relies to set the federal study aside, which is to say that on this point the reviewer is a party. The review also makes an allegation about the conduct of a different industry-sponsored study which the Foundation will not repeat and does not rely on, because no evidence for it is given in the document and the Foundation is not in a position to test it. What the Foundation takes from the review on this point is only the undisputed procedural fact it records: that the federal study was released on the agency's website, has never been formally published, and carries no agency report number.

The American criterion tested by people who had to use it

The preceding passages describe the criterion from its own documents. The Foundation now records what happened when a road authority and a university optometry department set out to apply it.

Krumina G., Volberga L., Ikaunieks G. and Naumovs L., The Development of Brigthness Evaluation Method for Digital Billboards, IOP Conference Series: Materials Science and Engineering, volume

1202 (2021), article 012035, described at Appendix C.111. The first three authors are of the Department of Optometry and Vision Science at the University of Latvia and the fourth of the Department of Road Equipment and System of the Latvian State Roads. The work was funded by that road authority and by the university. It is open access under a Creative Commons licence, and its object was practical: to find a way for a supervising authority to check the brightness of a billboard while it is operating, using an instrument the authority can afford.

What they found when they applied it

They tested the method of the Outdoor Advertising Association of America and the International Sign Association, which they describe as developed to simplify the recommendation of a former member of the board of the Illuminating Engineering Society of North America, naming the author of the report at Appendix D.4. Their conclusion, in the abstract:

> "We tested the recommended method of OAAA and concluded that it is not applied for large billboards (over 25 square-meter) due to the calculated far distance and low sensitivity of lux meter."

The Foundation draws attention to the nature of that failure, because it is not a disagreement about stringency. The American method fixes the measurement distance by the dimensions of the screen, so that a large display must be measured from far away; and at that distance the quantity to be measured, an illuminance increment of three tenths of a foot-candle above ambient, falls below what the instrument the method prescribes can reliably read. The criterion is not merely permissive for large displays. On this assessment it cannot be applied to them at all.

A structural objection, and an independent check on the Foundation's arithmetic

Their second objection concerns area. The American method yields a permitted luminance that does not vary with the size of the display, and the authors state the consequence twice, in their analysis and again in their conclusions: "The larger the digital billboard area, the more it dazzles a person if the luminance remains constant", and "The larger the area of digital billboard or light object, the more it dazzles the driver even at a low screen brightness level". Their own proposed limit accordingly scales inversely with the square root of the billboard area.

They also compute what the American criterion implies in luminance, and the figures matter to this comment for a reason independent of their argument. Part VI.J.6 above derives, from the formula in the American report itself, an implied luminance of about 300 candelas per square meter for the standard bulletin at the standard distance. These authors, working independently in Latvia from the same method, obtain 322 candelas per square meter for an intrinsically dark environment, rising to 423, 524 and 827 as the setting moves through rural, suburban and urban ambient levels. The Foundation records the correspondence because the arithmetic at Part VI.J.6 is its own and this is the only independent check on it the Foundation has found.

What the criterion permits, measured on the discomfort scale

The authors then do the thing nobody in the American record has done. They take the luminances the method permits and evaluate them against the De Boer scale of discomfort glare, which they define as running from 1 for unbearable glare through 3 for disturbing, 5 for just acceptable and 7 for satisfactory to 9 for unnoticeable, and on which they state that comfort begins at 5. The computation was performed for a real installation, a billboard of 52 square meters at a crossroad on Lielirbes street near Riga, standing 15 to 19 meters from the edge of the road.

The results for the American method, at two viewing distances and four ambient zones, are these:

- in the darkest zone, a permitted luminance of 19 candelas per square meter at 30 meters, rating 4.7; and 215 at 100 meters, rating 3.9;
- in the next zone, 58 at 30 meters rating 5.2, and 646 at 100 meters rating 4.3;
- in the third, 155 rating 4.5, and 1,722 rating 3.8;

in the brightest ambient zone, 291 rating 4.2, and 3,229 candelas per square meter at 100 meters, rating 3.5.

Seven of those eight ratings fall below the value the authors identify as the threshold of comfort, and the paper marks those seven as out of criterion. Four of them fall closer to the scale's label for disturbing glare than to its label for acceptable. The comparison the Foundation draws is with the authors' own proposed limits, which return ratings between 5.2 and 6.5 and are marked as within criterion throughout. It is not with the Netherlands instrument they also assess, which fares better than the American method but not well: three of its six tabulated ratings, those at the thirty meter distance, are also marked out of criterion.

The Foundation states the proposition carefully. This is a calculation and not a survey of people: the De Boer values are predicted from an illuminance-based model, which the authors report correlates with measured ratings at a Pearson coefficient of 0.87 in the study they take it from. What it establishes is not that any particular billboard caused discomfort to any particular person. It is that when the only operative American brightness criterion for this product class is evaluated against the standard scale for the effect it exists to prevent, it permits values that the scale classes as uncomfortable.

Why this bears on Part VI.B.2 as well

The scale these authors define is the scale on which the American evaluation of adaptive driving beam headlamps at Part VI.B.2 rested. That evaluation reported ratings between six and seven and described the result as low perceived glare. On the definition given here, 7 is satisfactory and 5 is just acceptable, so those ratings sit where the evaluation placed them. The Foundation records the definition here because the comment uses the scale in two places and should use it consistently, and because a reader meeting a De Boer number anywhere in this comment is entitled to know what the number means.

One finding the Foundation notes for Part V.E

In reviewing the literature the authors report a Taiwanese study in which drivers rated their comfort against the angular size, brightness and image flicker rate of a light-emitting diode screen, and in which "the larger discomfort in the study participants was at a screen flashing at a frequency of 16 Hz". The Foundation records that at second hand and does not rely on it, but notes that 16 hertz falls within the band Part V.E.1 identifies as carrying the greatest photosensitive risk, and that the study is therefore worth obtaining.

What this paper does not establish

It is a conference paper, its measurements were made on billboards near Riga, and its purpose was to design a practical inspection method rather than to study any health outcome. It measures no biological endpoint and examines no one; its discussion asserts that the difference between a billboard's illuminance and ambient lighting at night can cause sleep disorders for people living nearby who receive the light through their windows, but offers no evidence for that and the Foundation does not rely on it. Its central comparison is computed rather than observed: no person rated any of the installations whose De Boer values it tabulates. Its criticism of the American method is directed at that method's usability and its treatment of area, not at any claim about injury. And the Foundation notes that an assessment of an American instrument by authors applying it in a different regulatory and lighting context should be checked rather than adopted.

What these screens are measured to emit, and what the road they stand beside emits

The passages above concern what the criterion permits. This one concerns what the products do, and it supplies the comparison this subsection has lacked.

He Y., Zhang X., Quan L., Mi R., Cui Y., Xu J. and Tian Z., Influence of coloured light projected from night-time excessive luminance outdoor LED display screens on vehicle driving safety along urban roads, Building and Environment, 2021, described at Appendix C.112. The authors are principally of

Chongqing University and the work was supported by the National Natural Science Foundation of China. The Foundation states at once what it has read. The article is behind a paywall and the Foundation has read its abstract, its list of highlights, its introduction and the truncated section summaries the publisher displays. It has not read the methods, the results or the conclusions in full.

The two luminances

The first figure is the screen. The authors state that they determined, in combination with field tests, the "excessive luminance values of typical OLDSs at night (1,000, 3,000, and 5100 cd/m2)", and used those three values as the experimental conditions.

The second figure is the road. In their introduction they state that "The average luminance of the urban road surface at night is usually 1.0–2.0 cd/m2, which causes the visual characteristics of vehicle drivers to change from photopic vision in the daytime to mesopic vision at night-time".

The arithmetic is the Foundation's and it is simple division. A display at the lowest of those three values is of the order of five hundred to a thousand times the luminance of the road surface beside it. At the highest it is between two and a half and five thousand times. The driver is required to read a roadway at one to two candelas per square meter while a surface of several thousand stands in the same visual field.

Set against the criterion, the same figures give the measure of the gap this subsection has been describing. The implied luminance of the American criterion is about 300 candelas per square meter on the Foundation's own derivation and 322 on the independent one at Appendix C.111, rising to 827 for the brightest urban ambient zone. Typical screens as these authors measured them run from about three to about sixteen times the first figure, and from about one and a quarter to about six times the second. The proposition at Part VI.J.6, that compliance with this criterion is a setting on the product rather than a property of it, is corroborated by field measurement on another continent.

The authors say as much directly, and the Foundation quotes it because it is the clearest statement of the point the comment has found anywhere: "To pursue better advertising effects, the luminance of many advertising signs (including OLDS) at night greatly exceeds the luminance control value established in the specifications and guidelines". They record that the United States, Europe, Australia, China and other countries have issued such guidelines, governing position, luminance, relationship to traffic signs and signals, area, dynamic requirements, screen content and closing time. The guidelines exist. They are exceeded.

What the experiment found, so far as the Foundation can read it

Twenty-four subjects viewed fourteen simulated night road scenes at the three screen luminances, in a darkened room, on a television at a viewing distance of 920 millimeters, and responded to small targets. Five thousand and forty reaction time measurements were obtained. Where the reaction time exceeded two thousand milliseconds or no response was made, the authors recorded the trial as a missing dot, treating it as a case in which the subject "did not see" the target and "the safety risk to driving was high".

The result reported in the abstract has two halves and the Foundation gives both. Colored light projected from these screens "can improve a driver's ability to recognise small targets and reduce RTs in the case of low WFL values, but the coloured light causes more MDs and affects traffic safety". So reaction time, measured on the targets that were seen, improved; and the number of targets not seen at all increased. The Foundation records the first half because it runs against the position this comment takes and because a measure that improves is not evidence of harm.

One exception is stated in the abstract and again in the fragment of the conclusions the publisher displays, and it is the finding the Foundation places before the Department. The improvement holds for the colors tested "in addition to blue light"; and of blue the conclusion states that "blue light can

increase RTs, i.e., worsen driving safety". The sentence is cut off in the preview at the following clause and the Foundation does not know what it says.

Taken at the weight the Foundation can give it, which is that of an abstract, that is a spectral finding on a driving safety endpoint: among the colors a large outdoor display can emit, the short-wavelength one is the one reported to lengthen the time a driver takes to respond. Part V.B.3 and Part V.F treat the spectral question generally, and Part VI.B.1 records the two sources finding that short-wavelength content increases discomfort while leaving disability glare to luminance. This is a third kind of effect again, and it is measured in milliseconds of response rather than in ratings.

A finding the Foundation does not use, and why

The abstract reports that the night recognition ability of female subjects under this exposure was better than that of male subjects. The Foundation does not rely on that finding. It rests on twenty-four subjects, the preview does not disclose how they were divided, and the comment already declines a sex-difference finding running in the opposite direction, reported at Appendix C.103 from a study of twelve subjects under fog. Two small studies reaching opposite conclusions on the same kind of question is the ordinary signature of samples too small to support either, and the Foundation treats both the same way.

The criterion measured against the products, and traced to the standard it was borrowed from

The preceding passages describe the American criterion from its own documents, record what happened when a road authority tried to apply it, and set out what typical screens emit according to field work in China. This passage does three things those could not. It reports luminance measured with a calibrated photometer on identified American signs at identified American addresses; it sets those measurements against every recommended value the literature contains; and it identifies the standard from which the American criterion was taken, which is not a roadway standard at all.

Wachtel J., Report on Digital Sign Brightness, prepared for the Nevada State Department of Transportation, Washoe County, the City of Reno and the City of Sparks, The Veridian Group, Inc., November 2014, described at Appendix C.114.

Three matters of provenance before its contents, each of which cuts against the weight the Foundation can give it. First, it is by the author of the review at Appendix C.113, so two of the sources in this subsection are the same person and the Foundation does not treat them as independent of one another. Second, the report states on its own face that the work was performed at the request of Scenic Nevada, which it records as having had no role other than providing maps of sign locations for the site visit. Scenic Nevada is an advocacy organization and the Foundation discloses that as plainly as it discloses the sponsorship of the industry report at Appendix D.4. Third, the report was prepared for a State department of transportation, a county and two cities, but it is a consultant's report and nothing in it shows that any of those bodies adopted it. The Foundation does not describe it as a Nevada standard and the Department should not read it as one.

What was measured

Nighttime luminance was measured on identified signs in Reno, Sparks and unincorporated Washoe County on 22 September and 18 October 2014, with daytime readings on 19 October, using a Minolta LS-100 calibrated photometer with a one degree acceptance angle. The appendices list each sign by number, location, jurisdiction, whether it is on-premise or off-premise, the message it was displaying, the number of meter readings taken and the average and range of those readings. The Foundation has read those tables.

The summary figures are these. On 22 September, sixteen traditional billboards averaged 59.8 candelas per square meter, with a range of 2.2 to 291, and seven LED billboards averaged 1,291, with a range of 107 to 5,390. On 18 October, eleven traditional billboards averaged 51.1, with a range of 2.1 to 240, and eight LED billboards averaged 1,318.2, with a range of 44 to 4,440. Three fixed

internally illuminated signs averaged 191.3. The report states that the digital signs measured in the two visits, taking billboards and on-premise signs together, averaged more than twenty-two times the traditional billboards measured on the same nights in the same county. The Foundation has checked that figure against the two pairs of averages and obtains between twenty-two and twenty-six times.

Two single readings are worth stating because they bound the range. The highest average recorded for any sign at night was 3,850 candelas per square meter, for an on-premise digital sign on South Virginia Street in Reno, with individual readings to 5,390. A digital billboard at a retail site on Interstate 395 averaged 1,961.9 with readings to 3,142, and the table carries a footnote the Foundation reproduces in full: “Messages on this sign were often too bright to be readable.”

The measurements against the recommended values

The report collects the luminance values that the technical literature recommends for these signs at night. The Foundation sets them out because the comparison is the point, and because the sources are not of one persuasion:

- Thirty candelas per square meter. A Federal Highway Administration study, reported at second hand through a municipal code review, concluded that “a brightness of 30 nits was sufficient to view the message on an electronic billboard at 650 feet at night and 1000 nits was sufficient during the day”.
- Thirty to seventy-five candelas per square meter. The model guidelines of Kuhn, Garvey and Pietrucha, prepared for the United States Sign Council, which is to say for the on-premise sign industry.
- About forty candelas per square meter as an appearance limit. Luginbuhl and others, reasoning from adaptation: drivers “should be subjected to brightness levels of no greater than 10 to 40 times the brightness level to which their eyes are adapted for the critical driving task”, and since roadway lighting and headlamps give about one candela per square meter, “this implies signage should appear no brighter than about 40 nits”. They recommend that the new technologies not exceed one hundred.
- Forty-five to one hundred and eleven candelas per square meter. The standard of the Illuminating Engineering Society of North America directly applicable to this product class, titled Recommended Luminances for Poster Panels, Painted Bulletins, and Other Advertising Signs.
- One hundred candelas per square meter. Freyssinier, Narendran and Bullough, who found that sign luminances of no more than that figure “were found to optimize legibility and acceptability, even when competing signs were present”.
- One hundred and fifty candelas per square meter at night. Carhart, for the Illinois Coalition for Responsible Outdoor Lighting, rising to two hundred where the limit is set by calibration against a full white display.
- One hundred in rural areas and one hundred and fifty in brightly lit urban areas. The recommendation of this report itself.

Against that range the measured averages of 1,291 and 1,318.2 are extraordinary, and the arithmetic that follows is the Foundation’s. They are about forty-four times the thirty candelas per square meter the Federal Highway Administration study found sufficient to read the message at six hundred and fifty feet. They are about thirty-three times the appearance limit Luginbuhl derives from adaptation. They are about thirteen times the hundred that three separate sources converge on, which is the comparison the report itself draws when it states that the digital signs “averaged 12-13 times the level recommended by the many experts cited in this report”. The highest single reading, 5,390, is one hundred and eighty times the thirty.

The Foundation draws the Department's attention to the convergence between this report and the field work at Appendix C.112. Those authors, working in China some six years later and wholly independently, identified the excessive luminances of typical screens at night as one thousand, three thousand and five thousand one hundred candelas per square meter. The measured averages here are 1,291 and 1,318.2 and the measured maximum is 5,390. Two sets of field measurements on two continents, by investigators with no connection to each other, arrive at the same floor and very nearly the same ceiling. The Foundation had recorded that the Chinese figures rest on an abstract it could not read in full; they are now corroborated by measurements it has read in full.

That the signs are not easier to read for being brighter

The report records two observations that the Foundation places before the Department because they dispose of the only justification ever offered for these luminances. Of the traditional billboards: "None of the traditional billboards measured in Washoe County presented any visibility or legibility concerns, even though several of these signs had luminance values below 5 cd/m2." And of the digitals: "One digital billboard in Washoe County measured only 44 cd/m2. Yet, there was no difficulty seeing or reading this sign."

The report states the general proposition in its list of consequences of excess sign luminance, and the Foundation adopts it: "Beyond certain luminance levels, brighter signs become more difficult to see and to read, thus defeating the advertiser's specific purpose". The sign whose messages were often too bright to be readable is that proposition measured. A product emitting at two thousand candelas per square meter is not doing its own job better than one emitting at forty-four. It is emitting more light into the eyes of everyone who passes for no gain to anybody, including its owner.

Where the American criterion came from, which is the finding the Foundation most wishes to place before the Department

Part VI.J.6 has described the only operative American brightness criterion for this product class, has recorded that it was developed under contract to the industry that sells the product, and has recorded at Appendix C.111 what happened when a road authority and a university optometry department tried to apply it. This report supplies the piece that was missing, which is where the number came from.

> "It is interesting to note that Lewin's methodology and his resultant recommendations are, in fact, based on a standard for light trespass rather than a standard relevant to roadways and driving."

The report identifies the source as a technical memorandum of the Illuminating Engineering Society of North America titled Light Trespass: Research, Results, and Recommendations. It then records that the same society already had in force a standard written for this very product class, Recommended Luminances for Poster Panels, Painted Bulletins, and Other Advertising Signs, which recommends illuminance levels "consistent with luminances of 45-111 nits". Following the trespass memorandum instead, the report states, billboards "could reasonably be expected to achieve luminance levels of 300-350 nits, a level some 3-6 times higher than is necessary or desirable for roadside advertising signs", and it concludes that the trespass standard "is the wrong standard to use when developing brightness criteria for signs to be viewed by road users".

The Foundation asks the Department to hold that beside two figures it has already derived by other routes. Its own arithmetic from the industry report at Appendix D.4 gives an implied luminance of about three hundred candelas per square meter. The optometry department at Appendix C.111 computed three hundred and twenty-two for the darkest ambient zone. This report reproduces the table in the industry document itself, which gives three hundred, three hundred and forty-two, three hundred and three hundred and thirty for the four standard billboard sizes. Three independent routes to the same number, and this report explains it: the number is what you get when you take a criterion written to stop light falling on a neighbor's window and apply it to a surface a driver has to look at.

Two further matters the report records about that criterion. It observes that having explained the merits of measuring illuminance, its author ultimately converts the illuminance readings into luminance values anyway, which the report describes as "begging the question of why the far simpler and more direct method of measuring luminance was not followed in the first place". And of the later industry measurement protocol, in which an assistant holds an opaque black sheet in front of the meter to block the sign, the report gives three reasons why it cannot work in the field and adds that "there seems to be no recognition or endorsement by Dr. Lewin of the proposed OAAA approach". The Foundation notes separately that the underlying industry document is cited in this report's reference list as undated.

That the industry is not of one mind, and that one half of it agrees with the Foundation

The comment has said at Part VI.J.6 that the American criterion is expressed in a quantity that does not govern what a person sees. It is worth recording that the on-premise sign industry says the same thing. The United States Sign Council, in its Model On-Premise Sign Code, states:

> "The USSC standard for the measurement of on-premise sign illumination is Luminance. Luminance measures light output at its source, does not vary with ambient light conditions, and further can be objectively measured both during the sign fabrication process and after installation in the field to ensure adherence to the illumination requirements of this model". And: "This Model Code strongly recommends that other light measurement methods be avoided in regard to on-premise signs (for instance, an illuminance standard, or including ambient lighting conditions as a part of a complicated formula), because these methods do not account for true sign brightness which, in regard to traffic safety, is the primary determinant as to whether a sign is visible and legible to the motorist".

That is one trade body rejecting, in terms, the measurement approach another trade body developed and promotes. The Foundation does not suggest that either position was arrived at disinterestedly. It places the division before the Department for a narrower purpose: the proposition that luminance is the quantity that governs what a road user sees, and that an ambient-dependent illuminance formula does not capture it, is not a contention of this Foundation against an industry. It is common ground between the Foundation, the independent researchers, the road authorities of three countries and one of the two American sign industries.

The report records one further thing about the on-premise industry's position which the Foundation states without comment, the facts being sufficient: that notwithstanding the thirty to seventy-five candelas per square meter its own commissioned consultants recommended, the sign council "continues to recommend a nighttime maximum luminance level of 750 cd/m2, a value more than ten times greater than their own consultants recommended".

A nineteen sixty-six finding on adaptation, and sixty years of nothing after it

The report quotes a study the Foundation had not encountered and which bears directly on Part V and on Part VI.B.1. Allen, Smith, Janson and Dyer, Sign Brightness in Relation to Legibility, a final report on a highway planning and research study conducted in cooperation with the United States Department of Commerce, Bureau of Public Roads, published by the Michigan State Highway Commission in 1966. Its finding, as quoted:

> "the data suggested that high-luminance signs can change the adaptation level of the eye (or the pupil size, or both). This finding suggests that the driver's vision would be impaired for other tasks requiring dark adaptation. It seems unwise to install unnecessarily bright signs that are unpleasant to the driver and may impair his vision"

The Foundation asks the Department to notice four things about that passage. It describes an effect on the eye rather than on behavior: a shift in adaptation level and possibly in pupil size, and consequent impairment of vision for tasks requiring dark adaptation. It is the same quantity, the adaptation level of the driver's eye, that Part VI.B.1 takes from the headlamp literature at Appendix

C.108, and the same mechanism. It was produced in cooperation with a federal agency. And it is sixty years old.

In those sixty years the luminances actually emitted by roadside signs have gone from the tens of candelas per square meter that floodlit billboards produce to the thousands measured in this report, and the Foundation has been unable to identify any federal health authority that has examined the question in the interval. A finding that bright signs may impair a driver's dark adaptation, made when the brightest signs were a fraction of what is now installed, has never been revisited by the agency that Congress charged with the biological effects of electronic product radiation.

The Foundation states the limits of what it has. It has not read the 1966 study; it has read a quotation from page thirty-three of it in this report. It does not know the size of the effect, the method by which it was obtained or the luminances at which it was observed.

Two further matters the report records

On malfunction. The report observes that digital displays, particularly those controlled remotely, are subject to failures that may be manifested in "display segments that appear to flash or scintillate", and recommends that any such failure produce an immediate conversion of the display to an off or all dark configuration until it is corrected. That is a flash-producing failure mode in a product of this size, and Part V.E.1 is the place in this comment where flashing is treated. The Foundation notes that no American instrument it has identified requires such a fail-safe.

On daytime output. The report states that manufacturers promote signs capable of eleven thousand candelas per square meter or higher, records a daytime measurement of 4,442.3 on a single digital sign, and recommends a daytime ceiling of three thousand. For comparison it gives the luminance of the sun as approximately six thousand five hundred. A product marketed on its capacity to approach the luminance of the daytime sky is a product whose optical output nobody has assessed for effect on the eye.

The source behind two of the findings above, now obtained, and what it adds

Two propositions in this subsection have rested on a critic's account of a document the Foundation had not read: the ratio of ten to forty times the adaptation level, and the origin of the American criterion in a light trespass standard. The Foundation has now obtained that document. It confirms both, and it supplies a third finding which the Foundation regards as the most serious thing it has to say about the American criterion.

Luginbuhl C.B., Israel H., Scowen P., Polakis J. and Polakis T., Digital LED Billboard Luminance Recommendations: How Bright Is Bright Enough?, 9 November 2010, described at Appendix C.117. The first author is of the United States Naval Observatory Flagstaff Station and the third of Arizona State University; the remaining authors are named without institutional affiliation. The Foundation states three things about its status at once. It is marked DRAFT on its face and the Foundation has found no final version. It is not a publication of the Naval Observatory or of any agency, and must not be represented as one. And its authors write from a concern with the darkness of the night sky, which is an interest, disclosed here as the Foundation discloses the sponsorship of the industry report at Appendix D.4 and the advocacy commission behind Appendix C.114.

The adaptation argument, in its own terms

The argument runs from a property of the eye rather than from a preference about signs, and the Foundation sets out the chain because each link is a published recommended practice of the same standards body whose figures the American criterion invokes.

The first link is asymmetry. The authors quote the ninth edition of the society's lighting handbook at page 3-9 to the effect that where a change in brightness lies within the range of the cone photoreceptors a few minutes suffices for adaptation, and that as to direction, "changes to a higher [brightness] can be achieved much more rapidly than changes to a lower [brightness]". The authors draw the consequence: the eye adapts quickly to the bright sign and slowly back to the dim roadway.

The comment has the same asymmetry measured in seconds at Appendix C.108, where readaptation after facing headlamps took a mean of 3.63 and 5.14 seconds.

The second link is the roadway. Design luminances for illuminated roadways are about one candela per square meter, varying from about 0.3 to 1.2 by road type. That is the level the driver's eye is adapted to, and it is the denominator of everything that follows.

The third link is the ratio the same society recommends for adjacent areas. Its recommended practice for exterior environments states that where roadways are lighted to a base level, adjacent areas "should be no brighter than ten times that level. Additional brightness will not attract more attention, and may present a hazard to motorists on adjacent roadways." Its practice for parking facilities sets a maximum to minimum range of fifteen to twenty to one, on the stated ground that a driver looking at the brightest spot in the field of view must still be able to detect an object in the dark areas of it. Its practice for merchandise areas states that luminance ratios "should not exceed 20:1", adding that "Increasing the lighting level does not add to merchandise attraction, and may create a hazard to motorists on adjacent roadways or a nuisance for neighbors."

From a twenty to one ceiling and a roadway at one candela per square meter the authors obtain twenty candelas per square meter as the maximum for a sign visible to drivers. They then record that the society's own recommended practice for roadway sign lighting gives twenty to eighty, and that the figure in the lighting handbook for poster panels, painted bulletins and other advertising signs is consistent with forty-five to one hundred and eleven. Their recommendation is that no sign visible from a roadway exceed one hundred candelas per square meter in an urban environment, and they say in terms that "it can be easily argued that this value is too high".

The contradiction inside the standard itself

The finding the Foundation asks the Department to read twice is this. The same lighting handbook, at page 17-26, carries a table titled Recommended Luminous Background Sign Luminances giving values between two hundred and fifty and one thousand four hundred candelas per square meter. The authors state the consequence:

> "These recommendations, if visible to highway drivers, will subject drivers' eyes to a brightness ratio of 250-1400:1. According to their own recommendations this ratio is unsupportable and will lead to compromised visibility and safety on public roadways."

And they add an observation about the structure of the document rather than about its numbers: "It is perhaps telling that nowhere in the discussion of recommended advertising sign brightnesses is transient adaptation or the vision of drivers mentioned."

One standards body, one handbook. In the sections on roadways, parking and merchandise it limits adjacent brightness to ten or twenty times the adaptation level because exceeding it may hazard motorists. In the section on advertising signs it recommends values up to fourteen hundred times the roadway, and in that section the vision of drivers is not discussed. The Foundation makes no allegation about why. It observes that this is what a subject looks like when no authority is charged with the biological question, which is the condition Part II of this comment describes.

What conventional billboards actually emit

The authors measured. Fifty-five floodlit billboards in the Phoenix metropolitan area in August and November 2009, and three in the Chicago area in November 2010, were measured on white surfaces with a Minolta LS-100 luminance meter, and the individual readings are tabulated by advertiser, city and cross street. The average was fifty-four candelas per square meter; fifty-two of the fifty-eight were at or below one hundred and fifty-six of the fifty-eight below one hundred and fifty. Separately, five hundred and ten billboard faces inventoried in the Tucson metropolitan area gave an estimated average of fifty-nine, with four hundred and twenty-four at or below one hundred and five hundred and two at or below one hundred and fifty.

The Foundation records the difference in method between those two sets, because the authors do. The Phoenix and Chicago figures are measurements. The Tucson figures are not: no direct luminance measures were made, and the values were deduced from lamp lumens and sign areas using assumed values for light loss factor, coefficient of utilization and surface reflectance, which the authors state. The comment relies on the measured set and reports the deduced set as corroborating it.

Those figures give the comparison its force. Conventional floodlit billboards, erected in most cases with no restriction on brightness and therefore illuminated to whatever the industry found satisfactory, run at about fifty to sixty candelas per square meter. The American criterion permits about three hundred. The products measured in Nevada at Appendix C.114 ran at about thirteen hundred. And the authors note that digital billboard products on the market in 2010 commonly advertised maximum luminances between six thousand five hundred and seven thousand five hundred.

What the criterion was built on, which is the finding of first importance

The authors describe the industry report precisely: a method based ultimately on considerations of light trespass as developed in the society's technical memorandum TM-11-00, using a footcandle meter at five feet, between one hundred and fifty and three hundred and fifty feet from the sign depending on its size, comparing the reading with the sign on against the reading with it off, and treating a difference of 0.3 footcandles or less as acceptable. They then state what that permits, and the Foundation notes that this is a fourth independent arrival at the same number: "the report indicates that this method effectively limits the luminance of signage to 300-350 nits."

Then the conceptual objection. The authors examined what the trespass memorandum actually measured, and report that a group of observers was shown brightly illuminated panels, of two thousand to seven thousand five hundred candelas per square meter, and asked to judge whether they seemed too bright. The critical sentence:

> "the observers were asked only to rate how 'objectionable' they found the illuminated panels to appear; no evaluation of visual performance - the ability to see objects or read signs - was attempted."

The authors state the error that follows and the Foundation adopts the statement: the approach "has confused lighting that has been judged to cause an acceptable level of light trespass or even just an 'objectionable' sensation with the much more vital issue of sign lighting that compromises the vision and therefore safety of drivers. The ability to see and light trespass/objectionability are essentially unrelated."

And then the sentence that the Foundation places above every other quotation in this Part, because it is the industry report convicting itself out of its own mouth:

> "The OAAA report recognizes this, stating 'Digital billboards are not the form of lighting that TM-11-00 was developed to limit.' Yet the OAAA report does just that."

If that is accurate, and the Foundation has flagged below that it must be verified in the industry report itself, then the only operative American brightness criterion for this product class was derived from an instrument which the criterion's own author acknowledged was not developed to limit this kind of lighting, resting on a study that measured whether people found panels objectionable and never measured whether anyone could see. The Foundation has argued throughout Part VI.J that the criterion is expressed in the wrong quantity. This is the further and graver point: the underlying evidence was never about vision at all.

The authors close with the proposition the Foundation asks the Department to carry into its own consideration of this product class: "Transient adaptation, and not light trespass, or 'objectionability,' is the overriding concern for public safety with regard to the brightness of signage." Transient adaptation is a property of the human eye. It is measured in Appendix C.108 in

seconds, reported in Appendix C.114 from a federally cooperative study of 1966, and it is the endpoint on which this subsection, the headlamp subsection at Part VI.B.1 and the roadway subsection at Part VI.D all converge.

The industry report read against the criticism of it

The Foundation has the industry report. It is at Appendix D.4 and the comment has quoted its exclusion clause, reproduced its measured luminance table and computed with its equation A5 since this Part was first drafted. It has now been re-read in full against the criticism set out above, and this passage records what that comparison establishes. Every quotation below is from the report itself.

The sentence verified

The most serious charge in the preceding passage was that the report applies an instrument its own author acknowledged was not made for this purpose. That charge is made out. At section A3.1 the report states:

> "Digital billboards are not the form of lighting that TM-11-00 was developed to limit. In fact, digital billboards are specifically intended to be seen over a wide area, much of which may be remote from the billboard itself. Nevertheless, the principles of TM-11-00, in terms of the calculation method and the limits it provides, can be examined to determine whether the methodology can form a useful method of specifying billboard luminance limits."

The Foundation gives the whole passage, including the sentence beginning Nevertheless, because the criticism quoted only the first sentence and the third is the author's reason for proceeding. He did not overlook the objection. He stated it, and went on, on the ground that the calculation method and the limits could still be useful. The Foundation does not suggest concealment. It says that an acknowledged mismatch between an instrument and its application is a matter for the body adopting the criterion to weigh, and that no federal health authority has ever weighed it.

What the criterion is calibrated to, in the report's own words

The preceding passage asserted that the underlying research measured objectionability rather than visual performance. The report confirms it twice, without being asked. At section A3.7, of the limits it borrows: they "are realistic and prevent undue annoyance to a majority of viewers, and thus appear to have formed a satisfactory basis for specifying such lighting limits." And at the close of Section A:

> "Because these values have been derived from IESNA publication TM-11-00, which in turn is based on an extensive human factors research project, adoption of such values should satisfy the requirement that most persons will not find these billboard luminances to be objectionable."

The requirement the criterion is designed to satisfy is that most persons will not find the luminance objectionable. That is the standard on its face, stated by its author. It is a standard about annoyance. It is not a standard about whether a driver can see, and it is not a standard about the eye.

That the glare method was considered and set aside

The report did not overlook driver glare. It examined it first, as its Method 1, built on the roadway lighting standard, and then declined it. The five reasons given are set out in the report and the Foundation characterizes them fairly: that the roadway standard has fourteen classifications; that a billboard is visible from many vantage points so the applicable class is unclear; that glare depends on distance and the viewing distance varies; that glare depends on the angle from the line of sight, which changes as the driver moves; and that the extent of glare depends on billboard size. The conclusion drawn from them is administrative:

> "because of all the variables involved, the establishing of realistic billboard luminance limits based on the RP-8-00 methodology would be exceedingly complex. Even if simplifications were introduced, there would be problems in deciding which luminance limit would be

> applicable to a given billboard. Checking and enforcement similarly would be highly problematic. For these reasons, Lighting Sciences Inc. has not developed and is not recommending a billboard luminance specification system based upon glare limitations."

Every one of those five reasons is true, and every one of them is a reason why the quantity is hard to administer rather than a reason why it does not matter. The Foundation asks the Department to notice what the passage concedes by its structure: that a specification addressed to driver glare was the first approach considered, that it was rejected for complexity and enforceability, and that the simpler instrument adopted in its place was one the report elsewhere says was not developed for this kind of lighting. Difficulty of measurement is a reason to fund measurement. In the hands of a body with no health mandate it became a reason to measure something else.

The report also records a gap in terms, and the Foundation adopts the sentence: that while a single billboard at these levels is unlikely to produce significant glare, "Situations where a multiplicity of such billboards appear in the driver's field of view simultaneously require further research." That research has not been identified by the Foundation as having been done, and the trade guidance at Part VI.J.6 reports that American practice permits two or three such displays in the field of view at once.

The dimming table, which quantifies what compliance consists of

The report measured one display and then computed what it must be dimmed to in order to meet the criterion. The Foundation reproduces the result because it is the most economical statement in this Part of a proposition the comment has advanced throughout. For the four standard sizes the required settings are 4.3, 4.9, 4.3 and 4.7 percent of full output. The report states the arithmetic for the medium size: an allowable 342 candelas per square meter against a measured 7,000 at full power, giving 4.9 percent. It later assumes, in its sky glow calculations, that a fourteen by forty-eight foot display "would be operated at 4.3% of full output at night, as recommended in table 4 above".

A product that complies with the only operative American brightness criterion is a product turned down to about one twentieth of what it can emit. The other ninety-five percent remains in the device, available at any time, reachable by a controller setting. The report confirms the setting governs the output, recording that measured luminance reduction "accurately corresponded to within a few percent of the dimming settings indicated on the controller". Part VI.J.6 has said that compliance with this criterion is a setting rather than a property of the product. The report says the same thing in a table, and puts a number on it.

The comparison the report draws, and the figure it draws it against

The report concludes Section B by comparing its recommended levels with conventional billboards, and the Foundation examines the comparison because it is the report's principal reassurance. It cites a technical memorandum of the Lighting Research Center at Rensselaer Polytechnic Institute, Evaluation of Billboard Luminances, dated 31 March 2008 and sponsored by the New York State Department of Transportation, for the proposition that "it is probably reasonable to expect that the luminance of a conventional billboard would not be likely to exceed about 280 cd/sq.m. during the nighttime". From that it concludes that digital billboards at its recommended 300 to 342 "will be brighter, but only slightly brighter, than the maximum luminance of conventional billboards."

The arithmetic is correct and the comparison is not, and the Foundation can now show why because it has the measurements. The 280 figure is an upper bound: what a conventional billboard would not be likely to exceed. It is not what conventional billboards emit. Two independent sets of field measurements set out earlier in this subsection answer that question. Fifty-eight floodlit billboards measured in Phoenix and Chicago averaged fifty-four candelas per square meter, and twenty-seven measured in Washoe County, Nevada averaged between fifty-one and sixty. Against the figure that conventional billboards actually reach, a limit of 300 to 342 is not slightly brighter. It is about six times brighter, and the arithmetic is the Foundation's from the measurements at Appendices C.114 and C.117.

The Foundation states the limits of that criticism. Comparing a proposed maximum with a measured maximum is a defensible thing to do, and the report says plainly which figure it is using. The Rensselaer memorandum, which the Foundation has not obtained, may well support the 280. What the Foundation contends is narrower: that a reader of this report alone would take from it that the recommended levels sit close to existing practice, and that the measurements show existing practice to be some six times lower. The comparison that would have shown this is one no party to the report had any reason to draw.

The instruments the 2013 brief reached for are both borrowed. One is broadcast guidance addressed to television and disclaimed for billboards. The other is a photobiological screening threshold whose effect is to end the inquiry. Neither was made for this product, and between them they are the whole of what a public health body examining this class had available.

7. A measured cost of attention capture, and the limits of what it shows

Everything above in this subsection concerns the optical output of the product. This paragraph concerns something else, and the Foundation separates it carefully because the distinction is the whole of its honesty. There exists one rigorous causal study of the effect of this product class on crashes, and it is not a study of emission. It is a study of what the display says.

The study is described at Appendix C.97. A State transportation department displayed the year-to-date count of statewide road fatalities on its dynamic message signs for one week in each month, the week before its monthly board meeting, beginning in August 2012. The authors used that schedule as a natural experiment, with data on 880 signs and every crash in the State between 1 January 2010 and 31 December 2017, holding fixed the road segment, the year, the month, the day of the week and the time of day, and running placebo tests on weeks before the campaign began and on road upstream of the signs.

What they found is stated in their own structured abstract:

> "Contrary to policy-makers' expectations, we found that displaying fatality messages increases the number of traffic crashes. Campaign weeks realize a 1.52% increase in crashes within 5 km of DMSs, slightly diminishing to a 1.35% increase over the 10 km after DMSs. We used instrumental variables to recover the effect of displaying a fatality message and document a significant 4.5% increase in the number of crashes over 10 km."

They give two calibrations. The effect is "comparable to raising the speed limit by 3 to 5 miles per hour or reducing the number of highway troopers by 6 to 14%". And, on their own description a back-of-the-envelope calculation, the campaign "causes an additional 2600 crashes and 16 fatalities per year in Texas alone, with a social cost of $377 million per year".

Their account of the mechanism is attentional, and the supporting pattern is specific. The messages, in their words, are "'in-your-face,' 'sobering,' negatively framed messages" which "seize too much attention (i.e., are too salient), interfering with drivers' ability to respond to changes in traffic conditions". In support they report that a higher displayed count causes more crashes than a lower one, that the effect is worse on more complex road segments, that it falls with distance from the sign, and that the messages "increase multi-vehicle crashes (but not single-vehicle crashes)". They set out seven alternative explanations and give evidence inconsistent with each.

What this study does not show, stated before what it does

It is not evidence that the emission of a dynamic message sign causes crashes, and the comment does not offer it as such. The signs were already in place and operating in both conditions; the abstract says so, describing the campaign as displaying counts on "previously installed highway dynamic message signs". The luminance, the spectral content, the refresh behavior and the physical presence of the sign were identical in treated and untreated weeks. The design holds the emission fixed and varies the message. Nothing in it bears on the quantities that the rest of this subsection, and the rest of this comment, are about.

What it does show, which is a premise the whole of Part VI rests on

Every device in Part VI that exists to be noticed — the warning beacon, the emergency lamp, the deterrent strobe, the message sign — is deployed on an unstated premise: that capturing more of a person's attention is better, and that a device which captures more attention is therefore safer. The Foundation has not found that premise examined anywhere in the regulatory material described in Part II or Part IV. It is simply assumed.

This study is a measurement of it, in the one case where somebody thought to measure. The authors state the general finding in terms: behavioral interventions "can be too salient, crowding out more essential considerations and causing the intervention to backfire with costly consequences". A device designed to seize attention does seize it, and the attention comes from somewhere. On a road, it comes from the driving task.

The Foundation is explicit about the status of the extension it draws. The measured instance is message content. Whether a high-luminance flashing lamp imposes an attentional cost of the same kind is not established by this study and the Foundation does not assert that it is. What the study establishes is that the premise is not self-evidently true, that it is measurable, that in the one case measured it was false, and that the cost of being wrong was calculated at hundreds of millions of dollars and sixteen lives a year in one State. That is a reason to measure, which is what paragraphs 360ii(a)(4) and (a)(5) direct.

Two further findings that answer objections this comment habitually meets

The first is habituation. The commonest answer to any complaint about an intrusive light is that people become used to it. The authors report the opposite for an attention-capturing roadside stimulus observed over five years, stating as one of their five lessons that "individuals don't necessarily habituate to behavioral interventions, even after years of treatment". The second is that the effects "do not necessarily persist after treatment stops", which is to say the harm ended when the practice ended.

The regulatory finding, which is the reason this appears in a comment to this Department

The campaign was not an aberration of one State. The authors record that it "has been implemented in 28 US states". These are devices and messages governed by the Manual on Uniform Traffic Control Devices, published by the agency which told the Foundation, in the letter quoted at Part II.H.6, that the health effects of light-emitting diode devices extend beyond its authority. No one was required to evaluate whether this intervention worked or what it cost. It ran for years in more than half the States. The evaluation was eventually performed by two economists and published in a general science journal, and it found harm.

The authors drew the same conclusion the Foundation draws, and the Foundation adopts their words rather than its own: "it is important to measure an intervention's effect, even for simple interventions, because good intentions do not necessarily imply good outcomes".

The same cost measured directly, in seconds taken from the driver

The study above infers the cost of attention capture from crash counts. There exists a second measurement of the same cost, taken the other way round: by tracking where drivers actually looked, for how long, and what was in front of them while they looked. The Foundation has the full text of that study and sets it out here because the two methods agree and because the second supplies a unit.

Herrstedt L., Greibe P. and Andersson P.K., Driver attention is captured by roadside advertising signs, 16th Road Safety on Four Continents Conference, Beijing, 15 to 17 May 2013, by the Danish consultancy Trafitec, described at Appendix C.115. The review at Appendix C.113 records that an independent reviewer considered this the best designed and conducted on-road study in the field.

The limitation that governs everything below

The Foundation states it before the findings because it is decisive for the use that can be made of them. The empirical part of this study measured one hundred and nine drive pasts of sixteen conventional static roadside advertising signs on Danish rural main roads, selected as the most striking such signs by Danish standards. They are painted and printed boards. The study measured no digital display, no electronic sign and no light-emitting product of any kind in its empirical part, and it reports no optical quantity whatever: no luminance, no illuminance, no spectral content, no modulation. Its endpoints are where the eye went, for how long, at what angle, and what was in front of the car at the time.

What it measured

Thirty-two drivers aged between twenty-three and seventy, men and women, drove an instrumented car on four routes in three regions of Denmark, by day and outside peak hours, without being told the purpose of the drive. The car carried a three-camera eye-tracking system sampling head and eye position sixty times a second, a scene camera, satellite positioning for speed, and a laser scanner measuring the distance to vehicles ahead across about fifty degrees either side at a range of eighty to one hundred and twenty meters. Two hundred and thirty-three glances at the sixteen signs were recorded.

That the signs took the attention

In sixty-nine percent of the drive pasts the driver was tracked glancing at the sign at least once, and in almost half of all drive pasts twice or more at the same sign. Most glances were short: fifty-six percent lasted under half a second. But eighteen percent of the tracked glances lasted one second or longer, and for more than twenty-two percent of the drive pasts the total duration of successive glances at the same sign reached two seconds or more, with ten percent reaching three seconds or more. The horizontal angle of the glance reached forty-five degrees in some cases; forty-eight of the two hundred and thirty-three glances, twenty-one percent, fell outside what the authors define as the normal range of road users' visual behavior on rural roads, by the combination of angle and duration. The authors note that the wider the angle, the longer the driver needs to bring attention back to the road ahead.

The unit, which is what this study contributes

The authors construct a quantity they call the safety buffer, and the Foundation adopts it because it expresses the cost of a glance in the only currency that matters to the person in front. It is the time gap to the vehicle ahead, in seconds, minus the duration of the glance away from the road:

$$T\,(\text{sec.}) = l\,(\text{sec.}) - t\,(\text{sec.})$$

Where T is the safety buffer, l the time gap to the driver ahead and t the advertising glance duration. Their worked example is a time gap of 1.1 seconds and a glance of 0.60 seconds, leaving a buffer of 0.5 seconds. That remainder is, in their words, the maximum time the driver has to perceive, interpret and respond to a sudden incident after bringing the eyes back from the sign.

The Foundation asks the Department to attend to what that formulation does. It converts an act of looking at an advertisement into a quantity of response time removed from the driver, and it makes the cost additive with whatever else is consuming the same budget. A device that holds the eye for six tenths of a second takes six tenths of a second from every driver behind whom a car is following too closely, whether or not anything happens in that interval.

What the buffer came to

Of the two hundred and thirty-three glances, a vehicle was present ahead within a time gap of under three seconds in sixty-five. In fifty-nine of those the safety buffer was less than two seconds, and for twenty percent of all advertising glances it was below 1.5 seconds. Two glances produced a buffer below zero, which is to say that the driver looked at the advertisement for longer than the entire gap to the car in front.

The arithmetic the Foundation adds is the ratio within the estimable cases, and the authors do not state it. Fifty-nine of sixty-five is about ninety-one percent. Where a vehicle was close enough ahead for the buffer to be calculated at all, nine glances in ten left the driver under two seconds to react. The authors' own summary states the figure the other way, as a quarter of all tracked glances, because they divide by every glance including the seventy-two percent taken with no vehicle ahead. Both statements are true of the same table and the Foundation gives both.

And the threshold it is measured against

The two second figure is not arbitrary. It comes from the hundred-car naturalistic driving study of the Virginia Tech Transportation Institute and the National Highway Traffic Safety Administration, which this study cites and which the Foundation records as a federal product. In that data, looking away from the road at driving-irrelevant stimuli for a total of at least two seconds within any six second period almost doubles the risk of being involved in a crash or near-crash. The same study measured, in the six seconds before the event, a cumulative average of 1.8 seconds of eyes away for crashes and 1.25 seconds for near-crashes, against 0.85 seconds for baseline driving.

Measured against that threshold, seventeen of the one hundred and nine drive pasts in this study met the definition of visual distraction — more than one drive past in six. Those seventeen were spread across eleven of the thirty-two test drivers and eight of the sixteen signs, which is to say across about a third of the drivers and half the signs. The authors draw the conclusion the Foundation would draw: the effect "seems to apply to a substantial part of all road users and is not concentrated on a single – or few – persons".

Their overall conclusion is stated in the abstract and the Foundation quotes it exactly: "The overall results of the empirical studies show that advertising signs do affect driver attention to the extent that road safety is compromised."

What this does to the Foundation's own argument, which is not all favorable

The Foundation will not leave the obvious inference to be drawn against it later. The signs measured here emit no light of their own. They are painted boards lit by the sun. If conventional static signs capture attention to the extent that road safety is compromised, then attention capture is not a property peculiar to light-emitting products, and nothing in this study shows that an LED display does anything a large painted board does not.

That is the correct reading and the Foundation adopts it. It sharpens rather than weakens what this comment actually claims. The Foundation does not contend that the Department should regulate these products because they are distracting; distraction is the business of the agencies named in Part II.H.6 and the Foundation says so at Part VI.J.6. What it contends is that these products emit optical radiation at luminances measured in the thousands of candelas per square meter, with spectral content and temporal modulation that no federal health authority has examined, and that those are properties of the emission rather than of the message. The studies in the review at Appendix C.113 that compared the two found the digital signs worse than the static ones on every behavioral measure. This study establishes the floor beneath that comparison: that even the version with no emission at all already takes measurable time from the driver.

The same measurement on electronic signs, by the road administration that then removed them

The study above measured painted boards. There is a companion to it which measured electronic ones, on a motorway, by day and by night, and it is the most two-sided source in this Part. The Foundation sets out what it found against this comment as fully as what it found for it, and places the adverse findings first among the results.

Dukic T., Ahlström C., Patten C., Kettwich C. and Kircher K., Effects of electronic billboards on driver distraction, Traffic Injury Prevention, volume 14 (2013), pages 469 to 476, described at Appendix C.116. The first, second, third and fifth authors are of the Swedish National Road and

Transport Research Institute; the fourth is of the Light Technology Institute of the Karlsruhe Institute of Technology. The research was funded by the Swedish Transport Administration, which is to say by the road authority itself and not by any party to the dispute about these products.

The occasion for the study is the part the Foundation asks the Department to notice first. Sweden had not permitted roadside electronic billboards at all. In 2009 the administration gave temporary permission for twelve, of which eight were installed, on a four-lane motorway through central Stockholm, and made the trial period subject to a road traffic safety evaluation in which driver distraction was of particular interest. The product was admitted provisionally, for measurement, with the question open. That is the opposite of the American position described at Part VI.J.6, where the product was admitted generally and the criterion came afterward from the industry that sells it.

What was measured

Forty-one drivers, mean age forty-two, drove an instrumented Volvo on a forty kilometer route in the autumn of 2010 wearing a head-mounted eye tracker sampling at fifty hertz, twenty of them between nine in the morning and three in the afternoon and twenty-one between half past six and half past nine in the evening. Four electronic billboards were studied against seven conventional signs on the same stretches, being three overhead gantries, two guide signs and one bus lane sign, together with one large static paper billboard. The participants were not told the purpose of the experiment until afterward. The billboards changed message every seven seconds, so each driver saw three or four advertisements while approaching one. The authors record the optical difference between the two classes in one sentence: "The billboards are lit, while the other signs are retroreflective, which most likely makes the billboards brighter."

What this study found against the Foundation's position

Four findings, and the Foundation states them without qualification before it states anything in its favor.

- The authors' own conclusion is that the safety question is open. "Whether they attract attention too much, that is, whether they are a traffic safety hazard, cannot be answered conclusively based on the present data." The Foundation does not represent this study as showing that these products are hazardous, because its authors expressly decline to say so.
- No effect on driving was found. There were "no consistent significant changes in driving behaviour with respect to speed, lateral placement of the vehicle or headway" between the stretches before, at and after a billboard.
- No difference was found between day and night on any visual behavior measure, and the authors draw an inference from that which is adverse to this comment. Drivers "did not avoid looking at the billboards at night-time more than during daytime, indicating that the brightness was not so high as to cause considerable glare".
- The accompanying crash analysis found nothing. The larger Swedish investigation of which this formed part examined accident statistics from 2003 to March 2011 and, in the authors' words, "no significant differences were found that could be attributed to the billboards when comparing before and after their installation".

The third of those bears directly on the central contention of this Part and the Foundation addresses it rather than passing over it. The inference is a reasonable one and the Foundation does not call it wrong. It records what it rests on, which the authors state in the sentence immediately before: "Unfortunately we did not have the opportunity to measure the luminance of the electronic billboards." The conclusion that brightness was not high enough to cause considerable glare is therefore an inference from the absence of a behavioral difference, not a finding from photometry, in a study whose authors identified the missing photometry as a limitation. That is the same structure the Foundation identifies at Part VI.J.4 in the public health brief and at Part V.K.3 in the 2018 Opinion: a conclusion about optical output reached without measuring the optical output. The

Foundation makes the observation about the state of the evidence and not about these authors, who said plainly what they had not done.

A fifth point belongs here too, because it cuts against the mechanism this comment has taken from other sources. The authors note that "a substantial number of drivers did not look at the billboards at all, which is a strong indication that they actually can be" ignored. If capture were wholly involuntary that would not be so. The Foundation accordingly does not assert that attention capture by these displays is irresistible, and Part VI.J.6 should be read subject to this.

What it found that supports the Foundation

On the visual measures the differences were significant and they were all in one direction. Significantly more participants looked at the billboards than at the other signs. When they did, dwell times were longer, the number of fixations was greater, and the maximum fixation duration was longer, each at the conventional level of significance. No significant effect was found on visual time sharing.

The concentration of the long glances is the finding the Foundation regards as most telling, because it concerns the tail rather than the average. Six fixations across the four electronic billboards lasted more than two seconds, ranging from 2.1 to 3.5 seconds, spread across different drivers and across all but one of the billboards. Across the seven conventional signs such a fixation occurred once in total. The authors put it in a single sentence: "Note that all cases where the visual time sharing intensity exceeds the threshold belong to the electronic advertising billboard group." Six of the seven glances exceeding two seconds were at the electronic billboards, and in four of those six the level of glance diversion reached the threshold the authors take from the naturalistic driving literature.

The Foundation notes what that means for the sample. The authors describe their participants as "a best case scenario", being middle-aged experienced drivers familiar with the road, and record why: "both novice and older drivers have been found to be more affected by electronic billboards", older drivers having "deteriorated physiological abilities" and being "more prone to suffer from glare". The result above is what the product does to the drivers least affected by it.

The mechanism, stated as a mechanism

The authors adopt the two-dimensional framework of Trick and Enns and apply it to this product class in terms the Foundation asks the Department to read closely:

> "In the context of electronic billboards, the mechanism that has the greatest influence on the driver is reflexive attention selection (automatic/bottom-up). Reflexive responses cannot be disengaged and at best the negative effects can be minimised by intentional inhibition."

Read with the finding two paragraphs above that a substantial number of drivers did not look at all, the claim is narrower than it first appears: the reflexive component cannot be disengaged, but a person may inhibit what follows from it at a cost in effort. That is a description of a stimulus which imposes a load whether or not the person yields to it, and it is the proposition this comment advances about this class of emission. The authors state it in a peer-reviewed journal, on the authority of a published framework, about electronic displays specifically.

The seven second cycle, and where it came from

Part VI.J.6 records a dwell time of eight seconds described in a trade article as accepted by the industry, and records at Appendix C.113 that the most recent on-road study says that figure is too short. This study shows how such a number is arrived at. The seven second cycle used on these billboards was, in the authors' words, "a compromise between traffic safety demands and requests from the billboard owners", specified by the road administration "based on trial and error followed by further refinements after complaints from the public".

One of those refinements is a measured temporal effect and the Foundation records it because no instrument it has identified addresses the phenomenon. The displays originally blanked between messages. That "was found to cause distraction since drivers said that they couldn't help waiting for the next message to appear", and the transition was altered so that one advertisement followed directly after another. A driver held by the anticipation of a change he has learned to expect is being acted on by the temporal structure of the emission rather than by its content, which is the subject of Part V.E.

What the road authority did about it

The study closes with the regulatory outcome, and the Foundation quotes the sentence in full because the attribution matters: "Based on the results reported here, along with results from the other studies, the Swedish authorities decided not to extend the test period and to remove the billboards under investigation."

The Foundation is careful about what that does and does not show. The decision is attributed to this study together with others, not to this study alone, and one of those others was an unpublished questionnaire which the authors report "showed that glare and visual clutter was seen as a problem". The Foundation has not seen that questionnaire and does not rely on it. Nor does it suggest that the Department should reach the conclusion a Swedish authority reached, on a Swedish motorway, under a different statute.

What the sequence shows is a method. A road authority declined to permit the product generally; permitted a small number provisionally; funded measurement by its own research institute; published the measurement including the findings that cut against restriction; and then decided. The Foundation asks the Department to compare that with the position Part VI.J.6 describes, in which the only operative American criterion for the same product class was written under contract to the industry that sells it, borrowed from a standard for light trespass, and has never been tested by any federal health authority at all. The Foundation does not ask the Department to ban anything. It asks for the step the Swedish authority took first, which was to measure.

8. What the Foundation asks as to this class

That the luminance of the emitting surface of representative outdoor light-emitting diode displays be measured as installed, at night, and in the directions in which dwellings lie, and that the measurement be of the product rather than of the illuminance it produces at a property line. Part IX.C.

That the temporal characteristics of the content be characterized — transition rate, luminance step and depth of modulation — and evaluated against the flash-rate material at Part V.E.1, given that a numerical criterion for this exact risk exists in broadcast guidance and does not reach this product.

That the conditions of exposure of residents be studied under paragraph 360ii(a)(4), which for this class means the exposure received inside a dwelling, at night, from a source the occupant cannot switch off.

That any limit the Department may prescribe not be expressed as a setback distance. For a source of these dimensions a setback does not reduce the intensity of retinal exposure within several kilometers, for the reasons given at paragraph 3 and at Part V.B.2.e, and a requirement framed in distance would appear to address the hazard without doing so.

K. Decorative, Architectural, and Entertainment Lighting

This class is treated briefly, and the Foundation says why at the outset. Entertainment and architectural lighting differs from every other class in Part VI in that the exposure is in large part sought: a person buys a ticket to a concert knowing there will be stage lighting. The Foundation

does not ask the Department to regulate a light show, and nothing in this subsection should be read as asking for that.

Three features nonetheless bring the class within the scope of this comment, and the third is the reason it appears at all.

1. What the products are, and the two exposures they create

Stage and effect lighting at concerts, festivals and clubs; strobes, moving heads, wash and beam fixtures and laser effects; architectural facade and feature lighting on buildings and structures; and decorative installations in public and commercial space. All are now predominantly light-emitting diode, and effect fixtures in particular are operated in modes of deliberate temporal modulation at frequencies and depths chosen for effect rather than constrained by any criterion.

The first exposure is the audience, which is voluntary in the ordinary sense and which the Foundation does not press. The second is not. Architectural and decorative installations are directed at public space and are seen by people passing, and festival and venue lighting is seen by people living beside the site and by workers whose employment requires them to be present for the duration. A person employed at a venue is exposed for a shift, repeatedly, by occupational necessity, and does not choose the programming. Part V.H treats occupational exposure generally and the Foundation records here that this class is among the most intense occupational optical exposures it is aware of, and among the least studied.

2. What is known

This class has one study behind it that no other class in Part VI can match, and the Foundation puts it first. It is a cohort study of 400,343 people, described at Appendix C.99, and it is the only population evidence in this comment that a stroboscopic exposure in public space is associated with a measured increase in a diagnosed clinical outcome.

Twenty-eight electronic dance music festivals in the Netherlands in 2015 were divided by the condition under which they took place. Festivals held in darkness, indoors or at night, were treated as exposed; those held in daylight were treated as unexposed. All of them used stroboscopic lighting. The exposed group comprised 241,543 people and 2,222,196 person hours; the unexposed 158,800 people and 2,334,360 person hours. On-site medical staff recorded thirty seizures in the exposed group and nine in the unexposed.

The incidence density ratio was 3.5, with a 95 percent confidence interval of 1.7 to 7.8 and p less than 0.0005. The authors conclude that stroboscopic light effects at such events held in darkness “probably more than triple the risk of epileptic seizures”.

The study is accompanied by a case. A twenty-year-old man had a tonic-clonic seizure at an indoor festival. At a later examination after sleep deprivation, stroboscopic stimulation “throughout the 14–25 Hz range elicited generalised epileptiform discharges”, and the same discharges and sensations occurred when he was shown phone video of the concert he had attended.

The variable that distinguishes the two groups, which is the reason this study matters beyond its own subject

The exposure contrast is not intensity. It is darkness. The same kind of event, with the same kind of lighting, attracting the same audience, produced three and a half times the seizure incidence when it took place against a dark background rather than in daylight.

That is the proposition this comment advances throughout Part V and has nowhere else been able to support with population data. Part V.C.3 sets out why a dark-adapted eye receives a flash differently from a light-adapted one. Part V.D.1 records that the instruments built to measure modulation require about one hundred lux to resolve a signal and that the stroboscopic metric is stated by its own authors not to be applicable in dark environments or with outdoor lighting. Part VI.I reports a lamp measured against a suburban background luminance of 0.3 candelas per

square meter. Every product class in Part VI that operates after dark operates in the condition this study identifies as the one that differs.

The Foundation does not extend the finding to those products. The study concerns concert lighting and its authors say expressly that the results may be less applicable to other kinds of event. What it establishes is that the state of adaptation of the viewer is not a theoretical refinement of the criteria discussed in Part V. It is a variable large enough to move a clinical incidence rate by a factor of three and a half in a cohort of four hundred thousand people.

What the study does not contain, stated before the lesser evidence

No photometry of any kind. No luminance, no measured flash rate, no modulation depth, no spectral data, and no measurement of any fixture at any venue. The exposure variable is whether the event occurred in darkness. The authors also concede that sleep deprivation, exertion and stimulant use cannot be fully separated from the lighting, writing that stroboscopic effects are "prime suspects, but probably not solely responsible" for the increase, and seizures were identified by on-site staff from witness reports rather than by confirmed diagnosis. The Foundation does not cite this study for any proposition about intensity.

A second and much weaker study addresses what attendees report. It is described at Appendix C.95 and it is a survey. Two hundred and six people in Portugal were asked about their experience of lighting at summer festivals between June and September 2024. Of those, 14.3 percent reported high sensitivity to stage lighting and 23.4 percent moderate sensitivity. Asked what would improve visual comfort, 44.81 percent favored higher-quality light-emitting diode systems, 37.66 percent designated areas of low light for visual rest, and 31.82 percent minimizing the use of intermittent lighting. Of the stage lights themselves, 20.13 percent found them uncomfortable.

The Foundation presents that as what it is: self-report from a small sample in one country, cross-sectional, with the authors' own statement that the design does not permit inference of causation and that the margin of error is 6.8 percent. It is not a measurement of anything, and the paper reports no photometry of any fixture at any event.

Those two studies are the evidentiary record the Foundation has been able to assemble for a class of product operated at deliberate high modulation in front of audiences numbered in the tens of thousands. Between them they establish that the exposure is associated with a measured increase in seizures when it occurs in darkness, and that a substantial minority of attendees report discomfort. Neither contains a single photometric measurement of a single fixture, which is the condition this comment describes for every product class in Part VI.

3. Why the class matters to this Department despite the voluntary character of the principal exposure

Because it is the clearest case in Part VI of deliberate modulation at frequencies and depths selected for aesthetic effect, with no criterion of any kind constraining the selection. Part V.D establishes that the recommended practice addressing modulation sets a seizure-prevention goal below 90 hertz, and Part VI.I establishes what a real product does against it. An effect fixture programmed to strobe is doing deliberately, and at the operator's choice of rate, what that practice addresses. No federal instrument reaches it. No American broadcast or venue rule reaches it either: the expert working group convened by the Epilepsy Foundation records that several countries, but none in North America, require television programs and advertising to meet guidelines for reducing the risk of visually provoked seizures, and that there is no provision in United States federal law requiring a warning of flashing lights even in television content.

And because the voluntary character of the audience exposure does not extend to the worker, the resident, or the person walking past an architectural installation, and because a person who has consented to attend a concert has not thereby been given any information about what the emission will be. Part IX.F asks the Department to require disclosure of emission characteristics. This is the class in which the absence of disclosure is most complete: a ticketholder cannot learn

the modulation frequency or depth of the fixtures at a venue, and neither can a person with diagnosed photosensitivity who has been advised by a clinician to avoid exactly those conditions.

L. LED Products That Also Emit Radiofrequency Energy [RFI Q13]

This class is defined by a property of the product rather than by where it is installed: it comprises light-emitting diode products that emit radiofrequency energy as well as optical radiation. Part II.B.5 establishes the consequence under the Act. Both emissions are electronic product radiation within § 360hh(1)(A), both arise from the operation of an electronic circuit within the same product, and a single product may therefore engage the performance standards of part 1030, which governs microwave and radiofrequency emitting products, and the optical provisions of part 1040.

The regulatory position is not symmetrical, and the asymmetry is the reason this subsection exists. The radiofrequency emission of such a product is subject to the rules of the Federal Communications Commission, which require authorization of unintentional radiators and limit what they may emit. Those limits exist to prevent interference with other radio services. The optical emission of the same product is subject to nothing. So a product that emits two kinds of electronic product radiation is constrained in one of them, for a reason unconnected with health, and unconstrained in the other.

Part II.H.8 sets out the Commission among the agencies with which this Department is directed to consult and maintain liaison, Part II.H.20 sets out the one documented instance of such consultation in the history of the program, which occurred in 2019 and concerned radiofrequency, and Part IX.E.4.b sets out a docket of that Commission that is open as this comment is filed. The Foundation draws attention to the sequence: the single occasion on which this Department consulted that Commission about electronic product radiation concerned the emission the Commission already regulates, and not the one nobody does.

1. Networked and wirelessly controlled luminaires

What the products are

Lamps, luminaires and lighting controls containing a radio. The class includes the consumer lamp controlled from a telephone, the commercial luminaire on a building management network, and the controller, sensor or gateway installed alongside them. The radio may use any of the short-range protocols in common use. The defining feature for this comment is that a lamp, which was formerly a passive device on a circuit, is now also a transmitter and in many cases a receiver that is energized whenever the fixture has power, whether or not it is emitting light.

Who is exposed, and under what conditions

The occupants of the building, continuously, at distances of a few meters, from devices mounted overhead. The exposure differs from most of the radiofrequency exposure a person receives in that the person did not choose the device, frequently does not know it is transmitting, and cannot switch it off without switching off the light. Part III.G.2 treats user control of indicator lights as a technique of minimization and the same reasoning reaches the radio: a person who wants light does not necessarily want a transmitter.

The federal position

Authorization under the Commission's rules establishes that the device will not cause harmful interference. It is not a health determination and is not presented as one by the body that issues it. No federal evaluation of the combined exposure from a product of this kind has been identified by the Foundation: that is, no evaluation that considers the optical emission and the radiofrequency emission of the same device together, which is the exposure the occupant of the room actually receives. Part II.B.5 establishes that the Act reaches both.

2. Smart-city and connected streetlight systems [RFI Q13.h]

What the products are

Street lighting in which each pole carries a networked control node. The node reports the condition of the luminaire, accepts dimming and scheduling commands, and in many deployments communicates over a cellular or mesh radio link. The same pole may carry additional municipal equipment attached to the lighting network, including cameras, environmental sensors and acoustic sensors. The lighting conversion is frequently the occasion for the network: the pole is already being visited and already has power.

Who is exposed, and under what conditions

Residents of the street, continuously and involuntarily, from a fixed installation in the public right of way outside their dwellings. The exposure cannot be avoided by leaving a building, which distinguishes it from the class at subsection 1, and it cannot be declined, because the installation belongs to the public entity rather than to the resident. Part VI.D treats the optical emission of roadway and area lighting and Part VI.P treats light trespass into dwellings.

The federal position, and the one that matters here

The radio link is authorized under the Commission's rules. The optical emission is subject to no federal limit, as Part VIII.D.1 establishes. And the federal involvement in the installation of these systems has been as a driver of it rather than as an evaluator: Part IV.G sets out the efficacy framework that drove the conversion to light-emitting diode roadway lighting, and Part IV.G.5 establishes that no biological or health evaluation accompanied it.

What this class adds to the comment

It adds the identity of the purchaser, and that is why the Foundation treats it separately rather than as an instance of subsection 1. The entity procuring a connected street lighting system is a public entity, and Part VIII establishes what else that entity owes. It holds the self-evaluation duty of 28 C.F.R. § 35.105, which Part VIII.C shows it cannot complete for the optical emission because no federal characterization exists. It is now procuring, on the same poles and in the same transaction, a second emitting system, with no federal criterion for the exposure from either. A city which asked what the combined installation outside a resident's bedroom window delivers to that resident would find no federal answer to either half of the question.

The Foundation makes no assertion about the health effects of the radio link, has not evaluated it, and relies on no study about it. Its position is confined to allocation: both emissions are electronic product radiation under § 360hh(1)(A), this Department holds the program duty for both under § 360ii, and the characterization requested at Part IX.C would have to reach the product as installed rather than the luminaire in isolation.

3. Autonomous and driver-assistance vehicle systems [RFI Q13.i]

What the products are

The sensing and signaling systems of vehicles with driver-assistance or automated driving functions. Three emissions are relevant and they are of different kinds. Optical signaling and illumination, which is the subject of Part VI.B. Radar, which is radiofrequency. And lidar, which emits pulsed infrared laser radiation from a device mounted on the vehicle and scanned across the scene in front of it.

Why lidar is the most important item in this subsection

Because it is the one emission in this entire Part for which this Department has already prescribed a performance standard. Part II.A.2 enumerates the standards at part 1040, and the first two are for laser products and for specific purpose laser products. A lidar unit is a laser product. Whatever

classification it carries, it falls within a regime this Department wrote, administers and enforces, and its emission is therefore subject to a federal limit expressed in radiometric terms.

Set that beside the headlamp mounted a few inches away from it. The headlamp emits visible light, at an intensity Part VI.B.1 and Part V.C establish to be the subject of the largest single group of accounts at Appendix A, and no federal performance standard limits what it may emit as a radiometric quantity. The same Department, on the same vehicle, limits the infrared laser and not the visible beam. The Foundation advances that as the clearest available demonstration that the obstacle is not authority, not capability, and not the difficulty of writing a radiometric limit for a vehicle-mounted source. The Department has done it. It has done it for the emission the driver of the oncoming car cannot see.

Who is exposed, and under what conditions

Other road users, pedestrians and cyclists, at close range, from a moving platform, at night as well as by day, involuntarily and without notice. The number of emitting devices in the field of view rises with the number of equipped vehicles, which is the characteristic Part III.D.8 treats and which Question 15 of the notice raises. Part V.J.2 establishes that measurement conditions determine the result, and the conditions here are motion, multiplicity and darkness.

The federal position

Divided, and the division is between this Department and another. The vehicle and its lamps are within Federal Motor Vehicle Safety Standard No. 108, administered by the National Highway Traffic Safety Administration. The radar is within the Commission's rules. The laser is within this Department's own part 1040. No single body evaluates what the composite installation delivers to a person standing in front of it, and Part IX.E.4.a sets out the proceeding now open at the Department of Transportation in which the question could be raised.

4. Conducted and radiated emissions from LED drivers

What the products are

The driver is the circuit that converts the supply to the current a diode requires. In almost every product in this Part it is a switching converter, operating at frequencies in the tens or hundreds of kilohertz, and it is the component that produces both the temporal modulation Part V.D treats and the electrical emissions this subsection concerns. Those emissions take two forms: energy conducted back onto the building wiring, and energy radiated from the product and from the wiring attached to it.

Who is exposed, and what is reported

Occupants of the premises, and users of equipment connected to the same wiring. Part VII.B.7 sets out the accounts at Appendix A describing radiofrequency interference attributed to light-emitting diode products. The Foundation reproduces those accounts without adopting them and asserts no mechanism for any health effect of conducted or radiated emissions; what it records is that the reports exist and that they describe a second emission from the same product.

The federal position

The Commission's limits for these emissions are interference limits. They are expressed as field strength at a stated measurement distance, or as voltage on the supply line, and their purpose is the protection of radio services rather than of people. The Foundation states that without complaint: the limits do what they were written to do. The consequence for this comment is that a product may comply with every applicable electrical emission limit while the question this Department is directed to ask under § 360ii(a)(2), which is whether the emission and the exposure to it are unnecessary and can be minimized, has not been asked about either of its emissions.

M. Products Intended for or Used by Children

Every other class in this Part is defined by what the product is. This one is defined by who holds it. The Foundation separates it for three reasons: the exposure geometry is different, because a child brings an object closer to the eye than an adult does and for longer; the receiving eye is different, because the young lens transmits more short-wavelength light than the adult lens; and the regulatory position is different, in a way that is specific enough to state in a single sentence and is set out at subsection 3.

1. Toys containing light-emitting diodes

The Center has classified this product. Product code RIO, led toys and entertainment products, is assigned to products that incorporate light-emitting diodes to be used in toys or entertainment products to control, illuminate or interact with the user, and the radiation type recorded against it is optical. Appendix F.1.14. The applicable performance standard recorded against it is that no standard is applicable and the general radiological health requirements of parts 1000 to 1005 apply. The product is therefore an electronic product emitting electronic product radiation, so classified by this Department, with no emission limit of any kind.

What such products emit is not a matter of inference. Part V.C.2.k sets out a market surveillance campaign in which fifty toys containing one hundred and three diodes were bought from retailers and tested by accredited laboratories against the eye safety limits of the European standard that governs them, and thirty percent of the toys contained at least one diode that failed. Appendix C.59. It also sets out the opinion of the national health agency that commissioned that campaign, which concluded that the limits the toys were tested against are themselves derived from an arithmetical error and asked for the standard to be suspended. Appendix D.1.18.

Neither finding is about the United States, and the Foundation does not present either as describing this market. They are offered for what they are: the only systematic measurements of optical emission from toys in commerce that the Foundation has been able to identify anywhere, produced by a national government that asked the question. No comparable measurement of the American market has been identified, and the reason is given at subsection 3.

2. Products given to children that are not toys

A standard addressed to a product category leaves uncovered the same emission from a product outside the category, which is the proposition at Part II.C. The national health agency named four such products in terms: night lights, torches, illuminated clothing and decorative lamps. Appendix D.1.18. Its expert committee recommended that these undergo the same ocular safety assessment as toys, on the ground that a child’s eye does not distinguish between an emission from an object sold as a toy and the same emission from an object that is not.

In the classification maintained by this Department those products are distributed across at least three codes and possibly four. A night light or a decorative lamp falls within RIQ, low emission leds as indicators or decorations, whose definition expressly includes decorative purposes and which is examined at Part VI.G and Appendix F.1.20. A torch falls within RHH, which names flashlights. Illuminated clothing has no evident code. None of the codes carries a performance standard, so the distribution has no consequence for what any of these products may emit; it is recorded because the Department will need it if a standard is ever prescribed.

The Foundation adds one product the national agency did not name, because it is the one its correspondents raise most often and because it is squarely within this class. A child sleeps in a room. Part VI.G and Part IX.J address the indicator lamp that remains illuminated in that room through the night, and the Foundation does not repeat the argument here beyond noting that the occupant of the room is frequently a person who did not choose the product, cannot reach the switch, and is at the age at which the lens transmits the most.

3. The federal standard that governs toys in the United States limits sound and does not limit light

The Foundation states this subsection carefully, because it is the strongest single proposition in this Part and it rests on two federal instruments rather than on any study.

Toys sold in the United States are governed by a mandatory federal safety standard. Section 106 of the Consumer Product Safety Improvement Act, 15 U.S.C. § 2056b, made the voluntary toy safety standard of ASTM International a consumer product safety standard enforceable as such, and the Consumer Product Safety Commission has incorporated the current edition by reference at 16 C.F.R. § 1250.2(a). The edition presently incorporated is ASTM F963-23, effective April 20, 2024.

That standard limits what a toy may emit. Section 4.5 governs sound-producing toys and sets numerical limits in decibels, with a test method at section 8.20 and a stated rationale at Annex A14.4. The Commission describes the purpose of the section as reducing the risk of hearing loss. The limits are specified at a stated measurement distance, and the Commission's rulemaking records that the distance was changed from 25 centimeters to 63.5 centimeters when the standard was revised, which is the same structural feature this comment examines at Part V.C.2.k in another toy standard on another continent.

The Foundation has not identified any provision of that standard addressed to optical emission. There is no limit on luminance, on luminous or radiant intensity, on blue-light-weighted radiance, on modulation, or on any other optical quantity, and no photobiological assessment requirement of any kind.

So the position in the United States is this. A toy that makes a sound loud enough to damage a child's hearing may not lawfully be sold, and the limit is written down, measured by a prescribed method at a prescribed distance, and enforced by a federal agency. A toy that emits light of any intensity whatever may lawfully be sold. The agency that has classified that toy as a radiation-emitting electronic product, and given it a product code, is this Department, and it has prescribed nothing.

The Foundation does not say that the two emissions are equivalent or that the two agencies have the same duty. It says that the asymmetry is not explained by any difference in statutory authority. The Commission acted on sound under a general consumer product safety authority. This Department holds a specific authority over electronic product radiation, has exercised it to classify the product, and has the standard-setting power of § 360kk and the recommendation power of § 360ii(b)(1). Part IX.E.4 asks what consultation has occurred between the two.

4. What the Foundation asks for this class

Nothing that requires a finding this record cannot support. That the Department state on the record whether the product classified under RIO is within the scope of its authority, which Part IX.A asks generally. That it consult the Consumer Product Safety Commission under § 360ii(a)(3), which Part IX.E.4 sets out. That the research at Part IX.C include this class and address the exposure geometry and the receiving eye specific to it. And that any classification system developed under Part IX.G treat the age of the person exposed as a parameter rather than as a qualification added afterward.

N. Lighting on Bicycles, Scooters and Personal Mobility Devices

This class exists because of a gap in the federal scheme that is easy to state and, so far as the Foundation can establish, complete. A bicycle is not a motor vehicle, so the motor vehicle lighting standard does not reach its lamps. Part VI.B. The one federal requirement that does govern bicycles governs reflectors and requires no lamp at all. And the lamps now fitted to these conveyances are among the most intense small-source emitters a person encounters at eye level.

1. What the products are

Forward lamps and rear lamps fitted to or carried on bicycles, electric bicycles, scooters, hoverboards, skateboards and similar conveyances; side, wheel and spoke lighting; deck and frame illumination; and helmet-mounted lamps. Appendix F.2.12 sets the class out as a proposed product code and this subsection describes the exposure behind it.

Three characteristics distinguish these lamps from the vehicle lamps at Part VI.B. They are mounted low, at roughly the eye height of a seated driver and of a walking adult, rather than above the roadway. They are commonly operated in a flash mode, which Part V.D treats and which on a bicycle is chosen by the rider rather than specified by anyone. And they are sold on luminous flux as a marketing figure, in lumens, with no statement of beam angle, luminance or spectral distribution, so the quantity a purchaser is given is the one quantity that does not describe what the lamp does to an eye. Part V.J.

2. Who is exposed, and under what conditions

Oncoming drivers, pedestrians and other riders, at close range, at night, on shared paths and streets. The exposure differs from the roadway classes in that the source moves toward the observer at closing speed rather than passing at a fixed height, and in that there is no aiming requirement, so the lamp points wherever it was clamped. Part VII records ten reports of harm attributed to a bicycle, electric bicycle or scooter lamp.

3. The federal position, which is that there is none

The Foundation sets out each instrument that might govern this class and what it does.

Federal Motor Vehicle Safety Standard No. 108 governs lamps on motor vehicles. A bicycle is not a motor vehicle and the standard does not reach it. Part VI.B.1 and Part II.H.5.

The Consumer Product Safety Commission's requirements for bicycles, 16 C.F.R. part 1512, do reach bicycles, and what they require is passive. Section 1512.16 opens by directing that "Bicycles shall be equipped with reflective devices to permit recognition and identification under illumination from motor vehicle headlamps", and then prescribes an essentially colorless front-facing reflector, a red rear-facing reflector, pedal reflectors front and rear, and either retroreflective tire sidewalls or spoke-mounted reflectors. The section does not require a bicycle to carry a lamp. It specifies no luminous intensity, no beam angle and no photometric limit of any kind for a lamp, because it is not about lamps.

The Foundation asks the Department to notice the premise of that regulation, because the premise is what has been overtaken. The requirement is written so that a bicycle can be recognized under illumination from a motor vehicle's headlamps. It treats the bicycle as a passive object which is seen because something else lights it. Light-emitting diode lamps inverted that: the bicycle is now an active emitter, often operated in flash mode, aimed horizontally, and bright enough that the rider is seen from a distance. Nothing in the federal scheme followed the inversion. The reflector rule still describes a passive object, the motor vehicle standard still excludes the conveyance, and no instrument addresses what the lamp emits.

Within this Department's own scheme the position is the one this Part reports for every other class. Section 1040.10 governs laser products and these are not laser products, which Part IX.A.5 describes from this Department's own page. No standard under § 360kk reaches them. Appendix F records that no existing product code reaches them either, which is why F.2.12 proposes one.

4. What the Foundation asks as to this class

That the class be given a product code, which Appendix F.2.12 sets out in the fields the Center's own entries use. That the disclosure sought at Part IX.F reach it, so that a lamp sold on a lumen figure carries the beam angle and the luminous intensity as well. That the research at Part IX.C include the exposure geometry specific to this class, which is a small high-radiance source at eye

height closing on the observer. And that any standard prescribed under Part IX.I address the flash mode, which on these products is selected by the user and limited by nobody.

O. Aircraft, Drone, and Obstruction Lighting

Part II.H.7 treats the Federal Aviation Administration as an agency and sets out what its instruments contain: the obstruction lighting specification with its candela values and its mandated reduction at night, the lighting rule for small unmanned aircraft with its minimum and no maximum, and the certificates authorizing performances flown with thousands of aircraft at once. This subsection does not repeat that. It describes the product class and the exposure, which that Part does not.

1. What the products are

Three families, which share a characteristic and little else. Obstruction lighting on towers, masts, wind turbines, tall buildings and other structures, in steady red, flashing red, and medium- and high-intensity white. Lighting carried on aircraft, including anti-collision strobes, position lights and landing lights. And lighting carried on small unmanned aircraft, which since 2021 may be operated at night and must then carry anti-collision lighting visible for at least three statute miles. Part II.H.7.

What they share is that each is designed to be conspicuous at a distance of miles, which is a specification for a small source of very high intensity, and that each is operated above the observer at an angle from which no shielding is possible. What distinguishes them from every other class in this Part is that the exposure is incidental to the purpose: nobody installs an obstruction light in order to light anything, and the people who see it are not its intended audience.

2. Who is exposed, and under what conditions

Residents within sight of a lighted structure, which for a high-intensity white obstruction light at its daytime value is a considerable distance; people beneath an approach or departure path; and, for the unmanned aircraft, anybody outdoors where one is flown, including those outside the audience at a performance. The exposure is nocturnal, it repeats at a fixed rate for the whole of the dark period, and the observer has no control over it and frequently no idea whom to ask. Part VII records thirty-five reports attributed to security or neighboring-property lighting and sixty to streetlights; the Foundation has not separated out obstruction lighting and does not assert a count for this class.

One feature of the obstruction specification bears directly on who is exposed, and it is to the specification's credit. The intensity is required to step down at night, automatically and by a large factor, and Part II.H.7 gives the figures. The Foundation records that because it is the only federal lighting instrument the Foundation has found which mandates a nighttime reduction as a condition of conformity, and because it answers the objection that the capability sought at Part IX.J is impracticable. It also records that the reduction exists so that the lamp can be seen against a dark sky rather than for the benefit of anyone beneath it.

3. The federal position

For obstruction lighting there is a federal specification, it is numerical, and it is expressed in candelas, flash rates and flash durations. It is not a health instrument and does not address the exposure of persons on the ground, and Part II.H.7 says so. For small unmanned aircraft there is a federal rule which sets a minimum conspicuity and no maximum, and in which the words luminance, brightness, candela and glare do not appear. For lighting carried on aircraft the Foundation has not established the governing provisions and does not state them.

Within this Department's scheme the position is the usual one. No standard under § 360kk reaches any of the three families, and Appendix F records no product code that reaches them. That

absence is worth stating because it is not duplicated elsewhere: for the other classes in this Part the Foundation can at least point to a proposed code. For this one it cannot.

4. What the Foundation asks as to this class

That the obstruction lighting specification be obtained and examined by this Department, for the reason given at Part II.H.7: it is the nearest thing in federal practice to the ambient-sensing and default-low capability Part IX.J asks the Department to recommend, and a Department recommending such a capability should know what the existing federal instrument already does. That the lighting rule for small unmanned aircraft be consulted on under paragraphs (a)(3) and (a)(6), the aviation agency having acknowledged in its own circular that a strobe on one of these aircraft can impair accurate observation by a human eye while limiting the remedy to the pilot. And that any classification system developed under Part IX.G treat elevation above the observer, and motion of the source, as parameters.

P. Residential and Multifamily Exterior Lighting, and Light Trespass

Every other class in this Part is chosen by somebody with a relationship to the exposed person: a manufacturer selling to a purchaser, an employer lighting a workplace, a public authority lighting a street. This class is chosen by a neighbor. The emitter is privately owned, it is installed on private property for the owner's own purposes, it is directed at property the owner does not own, and there is no federal regulator, no state regulator in most places, and frequently no local ordinance either. Part VI.I treats deterrent and surveillance lighting as a commercial product class. This subsection treats the same physics in the setting where no institution stands between the emitter and the exposed person at all.

1. What the products are

Wall-mounted and eave-mounted floodlights on houses, condominiums and apartment buildings; motion-activated security lamps; driveway, path and landscape lighting; pole-mounted yard lights; garage and carport lighting; and the exterior lighting of multifamily common areas, parking areas and walkways, which is selected by a landlord or an association and directed at dwellings including those of the tenants themselves. Appendix F.2.5 proposes a code reaching roadway, area and exterior luminaires, and Appendix F.2.13 one reaching deterrent, surveillance and security lighting systems.

2. Who is exposed, and under what conditions

A person in their own dwelling, at night, in a room they cannot darken, for as long as the neighboring installation operates. The exposure reaches the eye of someone lying in bed, which is the condition Part V.G treats for circadian effect and Part V.C for the dark-adapted eye, and it reaches them through a window, which means the mitigations Part VII records — window coverings in eight reports, shielding in fifty-four — are mitigations the exposed person pays for and installs in order to exclude a product somebody else bought.

Part VII records thirty-five reports attributed to security or neighboring-property lighting. The Foundation draws attention to one feature of that group rather than to its size. In these reports the exposed person commonly knows exactly who is responsible, has asked, and has been refused, and in at least one instance the request produced retaliation rather than relief. That is a different situation from every other class in this comment, where the exposed person cannot find anyone to ask, and it bears on the remedy: a person in this situation does not need to be told who installed the light.

3. The federal position, and why its absence has a different character here

There is no federal instrument. There is no performance standard under § 360kk, no product code reaching the class as such, and no federal requirement governing the luminance, the spectral

distribution, the aiming or the shielding of a privately owned exterior lamp. That much this subsection shares with the rest of this Part.

What differs is the alternative. For a vehicle headlamp there is a federal standard that could carry a limit. For roadway lighting there are consensus recommendations adopted by public authorities, which Part VI.D examines. For a workplace there is an employer and an occupational safety program. Here there is private nuisance law, which the Foundation describes accurately rather than dismissively: it is retrospective, it requires the injured person to bring an action against a neighbor, it turns on reasonableness rather than on any measured quantity, and it produces no standard that anybody can design to. A person seeking relief must establish, case by case, that a thing is unreasonable when no instrument anywhere states what reasonable is. Part V.J sets out that the quantity which would settle it is not recorded by anyone.

The Foundation does not ask this Department to regulate what a householder may install on their own wall, and nothing in this subsection asks for that. Part II.H.3 records the Foundation's position that it does not ask this Department to assume the authority of States and municipalities over lighting design. What it asks is what it asks everywhere in this comment: that the emission characteristics of the product be established and disclosed, so that the person who buys the floodlight knows what it emits, the person exposed to it can say what reaches them, and a local authority minded to legislate has a quantity to legislate in. The absence of a measured quantity is what makes this class irresoluble, and the measurement is federal work.

4. What the Foundation asks as to this class

That the disclosure sought at Part IX.F reach consumer exterior luminaires, in the quantities Part V.J identifies rather than in lumens alone. That the research at Part IX.C include exposure through a window at night, which is a geometry no existing assessment framework addresses and which Part V.C.2 sets out. That the classification system at Part IX.G treat trespass geometry — the light that leaves the property on which the lamp is installed — as a parameter of the class, since it is the parameter that distinguishes this class from every other. And that the recommendations the Department may make under § 360ii(b)(1), which Part IX.J sets out and which require no standard and bind nobody, address this class expressly, because it is the class in which a recommendation would do the most work: a stated federal view on shielding and on aiming would be available to every local authority in the country at once.

Q. Rail and Marine Lighting

Two transport modes, each with its own federal regulator, each converting to light-emitting diode sources, and each governed by an instrument that specifies a minimum intensity and no maximum. The Foundation treats them together because the pattern is the same and because the two sets of figures, set beside each other, show how little the pattern has to do with how much light is actually needed.

1. Locomotive lighting: the highest federal minimum the Foundation has found

Locomotive lighting is governed by 49 C.F.R. § 229.125, Headlights and auxiliary lights. Four of its provisions bear on this comment.

The headlight requirement is a floor, and it is a high one. Paragraph (a) directs that each lead locomotive used in road service have a headlight producing a peak intensity of at least 200,000 candela, arranged to illuminate a person at least 800 feet ahead of it. Paragraph (b) sets 60,000 candela for yard service, with illumination of a person at least 300 feet ahead.

The auxiliary lights are the same figure again, and there are two of them. Paragraph (d) requires that a lead locomotive operated above twenty miles an hour over a public highway-rail crossing carry two white auxiliary lights, placed to form a triangle with the headlight, and paragraph (d)(2) directs that each of them produce a peak intensity of at least 200,000 candela, or alternatively at least 3,000 candela at an angle of 7.5 degrees and at least 400 candela at 20 degrees from the

centerline when aimed parallel to the tracks. Paragraph (d)(3) requires that they be focused horizontally within 15 degrees of the longitudinal centerline. So the instrument contemplates three sources, each with a floor of 200,000 candela, aimed within 15 degrees of the direction of travel, at a grade crossing where a motorist is stopped facing them.

They may flash. Paragraph (e) permits the auxiliary lights to burn steadily or to flash on approach to a crossing, and if they flash they must flash alternately "at a rate of at least 40 flashes per minute and at most 180 flashes per minute". Part V.D sets out the response to temporal modulation in that range. The Foundation notes that this is one of the few federal lighting provisions that contains an upper bound of any kind, and subsection 3 sets out what the bound was adopted for.

And there is a dimming provision, which does not reach the lights that matter here. Paragraph (c) provides, in its entirety: "Headlights shall be provided with a device to dim the light." That applies to the headlight. It does not apply to the auxiliary lights, and subsection 3 sets out that the omission was considered and made deliberately.

No provision of the section sets a maximum intensity. Every intensity figure in it is a floor.

2. Marine navigation lights, and the same structure at a millionth of the output

The inland navigation rules are at 33 C.F.R. part 83 and their technical annex at part 84. The intensity provision is § 84.14, which sets a formula rather than a table of products: the minimum luminous intensity is calculated from the required range of visibility, a threshold factor of 2 times 10 to the minus seventh lux, and an atmospheric transmissivity of 0.8 corresponding to a meteorological visibility of about 13 nautical miles. The section prints a selection of figures derived from it.

Those figures are the reason this subsection puts the two modes side by side. A light required to be visible at one nautical mile needs a minimum luminous intensity of 0.9 candela. At two miles, 4.3 candela. At three miles, 12. At four, 27. At five, 52. At six nautical miles — the range required of a masthead light on a vessel of fifty meters or more — 94 candela. Rule 22, at § 83.22 inland, sets the ranges by vessel length: six miles for the masthead light of a large vessel, three for its sidelights and sternlight, and less for smaller craft.

The Foundation asks the Department to hold those two sets of figures together, because the comparison is the argument. A federal instrument requires a light to be seen across six nautical miles of open water, at night, by a mariner whose life may depend on seeing it, and sets the figure at 94 candela. Another federal instrument requires three lights, each of at least 200,000 candela, aimed along a railway at a motorist stopped a few tens of feet away at a crossing. The ratio is more than two thousand to one on a single source and more than six thousand on the three together. Neither figure is wrong for its purpose and the Foundation does not suggest the marine value would serve on a locomotive. What the comparison establishes is that conspicuity does not require intensity in the quantities now in use, that federal practice already contains an instrument which achieves a longer range with a vanishingly smaller output by attending to atmospheric transmission and to threshold rather than to brightness, and that nobody has ever been asked to reconcile the two. Part V.C.3 sets out why the quantity that injures an eye is not the quantity that makes a lamp visible.

On a maximum, the marine instruments are the one place in this comment where the Foundation has found a federal lighting rule that mentions one, and it states precisely what it found because the temptation to overstate it is considerable. The international regulations, in the note to section 8 of Annex I, provide:

> Note: The maximum luminous intensity of navigation lights should be limited to avoid undue glare. This shall not be achieved by a variable control of the luminous intensity.

Four qualifications govern that, and the Foundation states all four. It says should and not shall. It is a note appended to a table rather than an operative paragraph. It states no number, so there is no ceiling anywhere to comply with. And it does not appear in the United States inland annex at all: § 84.14 carries the formula and the table and no counterpart to the note. The accurate statement is therefore that an international instrument contains a non-numeric and non-mandatory recommendation that maximum intensity be limited to avoid undue glare, and that the American domestic annex omits even that. The purpose stated is navigational in any event: undue glare affecting a mariner's ability to see, not the protection of anybody's eyes as a health matter.

Two further marine provisions are worth recording because they are the nearest thing in either mode to a restraint on an emission. Rule 20(b), at § 83.20(b) inland and in identical terms internationally, provides that from sunset to sunrise "no other lights shall be exhibited, except such lights as cannot be mistaken for the lights specified in these Rules or do not impair their visibility or distinctive character, or interfere with the keeping of a proper look-out." And international Rule 36, on signals to attract attention, provides that "the use of high intensity intermittent or revolving lights, such as strobe lights, shall be avoided". That sentence does not appear in the inland rule at § 83.36. Both provisions protect the navigational function rather than the eye, both bind only vessels, and the first runs only between sunset and sunrise. The Foundation offers them for what they are: evidence that a regulator which has to care whether people can see has found it necessary to restrain other lights, and has done so without any photometric quantity to restrain them by.

3. What the railroad regulator considered, declined, and later found

This subsection is the reason the class is in this comment, and the Foundation sets it out in sequence because the sequence is the point.

When the auxiliary light requirement was adopted in 1996, the agency considered whether to require a dimmer on those lights and declined. The rulemaking records that the one argument made for a dimmer was that the device might prevent blinding motorists, and that the agency could identify no compelling safety need for a dimmer on auxiliary lights. It acknowledged in the same document that there appears to be a risk that the auxiliary lights might affect the night vision of motorists on parallel roadways. And the statutory direction under which it was acting required it to consider the effect of an enhanced visibility measure on the vision, health and safety of train crew members.

The Foundation asks the Department to read those three facts together and states what it draws from them, which is narrower than it may appear and does not depend on criticizing that agency. The agency identified a risk to the vision of people outside the railroad. It declined a mitigation for them. And the mandate it was working under named one population whose vision it was to consider, and that population was its own crews. There is no criticism in that. An agency given a mandate naming train crew members does not acquire authority over the eyes of motorists by noticing that they are affected. What it does have, when it notices, is a reason to tell somebody who does have that authority, and paragraph 360ii(a)(6) is the provision under which that conversation would happen. Part II.H. The Foundation has identified no record of it.

The same reading applies to the flash rate. The section caps flashing at 180 flashes per minute, which is three hertz, and the rulemaking ties that cap to avoiding a flicker vertigo effect on train crew members. So the one upper bound in the instrument exists to protect the people inside the cab. Part V.D sets out what is known about the response of people outside it to modulation in that range, and Part V.E the photosensitive response. The bound is in the right place for the wrong population, which is a more precise way of putting what this comment says generally.

Then the technology changed, and that agency looked at it. In October 2020 its Office of Research, Development and Technology published Compliance Testing for Locomotive LED Headlights and Auxiliary Lights, Phase II, which evaluated discomfort glare from light-emitting diode and halogen lamps using the De Boer scale. Its finding, in its own words, was that for glare ratings

made in dim mode there were statistically significant differences between the two lamp types, "with LED lamps producing worse glare ratings than halogen lamps", and that while the diode lamps gave better contrast and more illuminance in dim mode they "produced significantly worse levels of discomfort glare". Its executive summary states the regulatory consequence:

> the safety requirements stipulated in §229.125 may not adequately accommodate the introduction of LED lamps

That is a federal agency, examining its own performance requirement against the diode source, finding that the requirement may not accommodate the technology, and saying so in a published report in 2020. Part II.F sets out that this Department has conducted no such examination for any product class. Part V.L records the research gaps this comment identifies. The Foundation does not suggest that the railroad agency should have gone further than it did; it studied the question within its own subject and reported the answer. It observes that the answer was published, that it concerns the glare produced by a diode lamp against a performance requirement expressed in candela, and that it is precisely the kind of information paragraph (a)(3) directs this Department to receive from agencies with related interests.

The Foundation records the limits of that report rather than leaving them to be found. It measured discomfort glare and nothing else: not disability glare, not photobiological hazard, and not any effect on a motorist at a crossing, a pedestrian or a trespasser, the observers having rated the lamps from outside the cab. It recommended no maximum intensity. A companion report of April 2021 tested six lamp models and concluded that there were no detrimental effects to the use of diode technology and no detectable degradation in visibility. The Foundation does not present the Phase II finding as a conclusion about health, and it is not one. It presents it as a federal measurement, on a federal performance requirement, showing the diode source performing worse than what it replaced on the one axis that was measured.

4. Who is exposed, and what the Foundation asks

For rail: motorists and pedestrians at grade crossings, where the geometry is three sources of at least 200,000 candela each, aimed within 15 degrees of the direction of travel, possibly flashing, at a person stopped and facing them; people living or working alongside track, including along the parallel roadways the 1996 rulemaking mentions; and railroad employees, who are the one population the mandate names. For marine: other mariners, and people ashore in harbors and along waterways, where the required outputs are small but deck lighting, spotlights and non-required lighting are not regulated photometrically at all.

Four requests, none of which asks this Department to regulate a railroad or a vessel. That the Department obtain the Phase II report and state whether it agrees with its finding, which is a question about a measurement rather than about policy. That it consult the railroad agency under paragraphs (a)(3) and (a)(6) concerning that report and concerning the adequacy of a performance requirement expressed in minimum candela for a diode source, the agency having itself raised the question. That the disclosure sought at Part IX.F reach these classes. And that the comparison at subsection 2 be addressed in whatever the Department develops under Part IX.G: two federal instruments, one requiring 94 candela to be seen at six nautical miles and the other 200,000 to be seen at 800 feet, cannot both be calibrated to what seeing requires, and the discrepancy is a fact about federal lighting practice that a classification system ought to be able to explain.

R. Traffic Signals and Roadway Control Signals

This class is the one in which the loss of a physical property is easiest to describe and has been least examined. The Foundation sets it out in that order: what governs these products, what the governing instrument specifies, what it does not, and the one federal report in which the same agency has already conceded the same pattern for a different property.

1. What the products are, and who is exposed

Vehicle traffic control signal heads in red, yellow and green, circular and arrow; pedestrian signal indications and countdown modules; and the roadway control signals of the same family. Appendix F.2.9 proposes a product code reaching light-emitting diode traffic signal heads and roadway control signals, and this subsection describes the exposure behind it.

The exposed population is everybody who uses a road, and the condition of exposure is specific: the observer is stationary or nearly so, facing the signal directly, at a distance fixed by the stop line, for the duration of the interval, repeatedly, every day. No other class in this Part has that geometry. Part VII records reports attributed to traffic signals, and Part VI.C treats the flashing warning devices which are a different family governed by a different chapter of the same manual.

One fact about this class has no parallel in the comment and belongs at the start. These products were almost universally incandescent, and are now almost universally light-emitting diode, and the conversion was driven by federal energy policy rather than by anything about signaling. Part IV.G describes the same mechanism for general illumination. So the exposure changed, across every intersection in the country, for reasons that had nothing to do with what a driver sees.

2. What governs these products, and the difficulty of reading it

The Manual on Uniform Traffic Control Devices governs. The eleventh edition was adopted by final rule at 88 Fed. Reg. 87,672 (Dec. 19, 2023), effective January 18, 2024, and Revision 1, dated December 2025, was adopted by final rule published March 5, 2026; the manual is incorporated into the federal regulations at 23 C.F.R. § 655.601.

What the manual does about the optical characteristics of a signal module is to point elsewhere. Section 4E.01, paragraph 10, is a Standard statement and directs that for light-emitting diode traffic signal modules the requirements of two publications of the Institute of Transportation Engineers be met: the Vehicle Traffic Control Signal Heads: Light Emitting Diode (LED) Circular Signal Supplement of 2005, and the corresponding Vehicle Arrow Traffic Signal Supplement of 2008, in each case as to “the aspects of the signal head design that affect the display of the signal indications”. Paragraph 11 is Guidance and provides that the intensity and distribution of light from each module should comply with those publications.

Two consequences follow and the Foundation states both, because the first cuts against it.

The first is that the status of those publications is not straightforward. Section 1A.05, paragraph 1, incorporates by specific reference only two documents, and the engineering publications are not among them. Paragraph 4 of the same section, which is Support rather than Standard, provides that “Other publications are referenced in this Manual as useful resources, but they are not regulatory in nature and are not independently legally enforceable.” So the engineering specification is made operative by a Standard statement in Chapter 4E and described as not independently enforceable in Chapter 1A. The Foundation does not resolve that and does not need to. It records it because any argument built on paragraph 10 has to face it, and because a reader who is told the specification governs is entitled to know that the manual says something else about referenced documents elsewhere.

The second is that the specification cannot be read. The engineering institute sells these documents and they are available only through purchase. So the numerical requirements governing the optical output of every traffic signal in the United States — the maintained minimum luminous intensity, the chromaticity coordinates, the electrical requirements — are in documents a member of the public cannot read, referenced by a federal manual that can be. The Foundation states that as a fact about accessibility of the governing quantities rather than as a complaint about the institute, which is entitled to sell its publications. It bears on Part IX.F, which asks that emission characteristics be disclosed, because here the characteristics are specified and the specification is itself behind a paywall.

3. What the instruments specify in the time domain, which is a schedule and not a shape

The Foundation searched the governing manual for every temporal term bearing on the switching of a module: rise time, decay, turn-on, turn-off, flicker, modulation, waveform, duty cycle and millisecond. None of them appears in the part of the manual that governs these products. The word frequency appears, and in every instance it means the frequency of crashes, of rail traffic, or of how often an interval is displayed. There is no temporal axis in the manual at all.

What the manual does specify in time, it specifies for pedestrian indications, and it is a schedule. The flashing upraised hand "shall be flashed continuously at a rate of not less than 50 or more than 60 times per minute", and "The displayed period of each flash shall be a minimum of one-half and a maximum of two-thirds of the total flash cycle." The Foundation draws attention to that second sentence because it is the only duty cycle requirement it has found in any instrument governing any product class in this Part. It constrains the ratio of on time to cycle time, at about one hertz. It says nothing whatever about the shape of either edge.

That distinction is the whole of this subsection and the Foundation puts it in one line. Temporal scheduling is specified. Temporal shape is not.

One temporal requirement does exist for the edge, and the Foundation records it because it runs the wrong way for the argument and must be stated. State specifications for these modules impose an upper bound on switching time: one official state specification requires that turn-on and turn-off time be less than 75 milliseconds, and the same figure recurs on manufacturers' published data for signal modules. The Foundation has not been able to establish whether the figure originates in the engineering specification or was added by the State, because the engineering specification cannot be read. What matters is its direction. A ceiling on turn-on and turn-off time forbids a module from switching slowly. It is not a smoothing requirement; it is the opposite of one. So the position is not that nobody specified the edge. It is that where the edge was specified at all, it was specified as a maximum permitted duration, which excludes the gradual transition rather than requiring it.

On modulation the Foundation found one provision in any instrument it read, and it is qualitative. A state specification requires that a module operate across a stated range of line voltage and that "The circuitry shall prevent flickering over this voltage range." There is no modulation frequency, no modulation depth, no percentage, no flicker index and no measurement method. Part V.D sets out what those quantities are and why they decide the question. The nearest adjacent requirements in the specifications the Foundation read are stability clauses providing that a variation in line voltage shall not cause the light intensity to vary by more than a stated percentage, which are steady-state requirements and not temporal ones.

4. The property that was lost, and the federal report that concedes the pattern for a different one

An incandescent signal lamp has a filament with mass. Current heats it and it takes time to reach full output; when current is removed it cools and the output falls away over a further interval. The light therefore rose and decayed over some tens or hundreds of milliseconds, and nobody specified that because nobody had to: it was a property of the physics, supplied free with the lamp. A diode is a semiconductor and has no such mass. It switches at the speed of its drive circuit, which is to say effectively instantaneously. Part VI.D records the same observation for the roadway class, where the sources that were replaced "took minutes to reach output" and diode sources give instantaneous switching.

The Foundation does not assert a health consequence of that change and has no measurement establishing one. What it asserts is that a property of the exposure was removed from every intersection in the country, by a conversion driven by energy policy, without anyone examining what the property had been doing.

That assertion does not rest on the Foundation's reasoning alone, because the roadway agency has already conceded the identical pattern for a different property of the same lamp. In January 2014 the Federal Highway Administration published a report on light-emitting diode signal module specifications and snow conditions, which records that diode modules do not produce heat at the lens or the face of the signal display, that incandescent lenses typically provided sufficient heat for snow and ice to melt, and that the current module specifications do not address preventing snow and ice buildup. The report arose from a stakeholder workshop of December 2010 attended by the state highway officials' association, the electrical manufacturers' association, the signal association, the public works association, that agency, the engineering institute and the Department of Energy.

The Foundation asks the Department to read that report as a structural precedent rather than as a point about snow. Heat was a property that incandescent lamps supplied incidentally. Nobody specified it, because with a filament nobody had to. The conversion removed it. The specifications still do not address it, and a federal agency has said so in print. Thermal inertia in the time domain is the same kind of property, removed by the same conversion, and unaddressed by the same specifications. The agency has conceded the pattern once. The Foundation asks this Department to examine whether it holds twice.

5. What has actually been measured, and the limits of it

One government-sponsored comparison exists and the Foundation states both what it found and what it is. In December 2003 the Traffic Operations Laboratory of the University of Illinois at Urbana-Champaign published, for the Illinois Department of Transportation, a comparison between the turn on and turn off characteristics of incandescent and light-emitting diode traffic signal modules. Its stated objective was "to compare the turn on and turn off characteristics of incandescent and LED modules".

Its conclusions, in its own words: "For all colors, the LED lenses had shorter fade in times when compared with the incandescent lens"; "For solid yellow and red, the incandescent lens had the longest fade out time"; and, against the Foundation's expectation, "For solid green, the LED Dialight lens had the longest fade out time". The study also found no hazardous combination, reporting that none of the combinations tested could result in multiple signals glowing or in no signal glowing.

The Foundation states the limitation of that study prominently, because it governs how much the study can carry. The measurement was made by videotaping the signal heads and examining the recording frame by frame at thirty frames a second, so that one frame is about three-hundredths of a second. It is therefore an observational study with a quantization floor of roughly thirty-three milliseconds, and fade out is an observer's judgment of when a lens stops appearing lit on a recording rather than a measured decay of luminance. The report states that it does not constitute a standard, a specification or a regulation. The Foundation gives no figures from its tables in this comment, deliberately.

The Foundation has found no photometric measurement — by photodiode, photometer or oscilloscope — of the rise and decay of an incandescent traffic signal lamp against a diode module, in any peer-reviewed, governmental or standards-body source. For a change made at every intersection in the country, that is the whole of the measured record: one video study, twenty-three years old, at thirty frames a second.

One further document records that the question was identified and set aside. A 1999 report of a university lighting research center, examining luminous intensity for traffic signals, equalized the rise times of the two sources deliberately by gating both through the same shutter, and then observed that "The faster rise time of the LED signal may have an effect on reaction time and missed signals", flagging it for future study. The Foundation has identified no such study in the twenty-seven years since.

And one federal safety evaluation of the conversion exists which does not reach the question at all. In August 2013 the Federal Highway Administration published a safety evaluation of converting traffic signals from incandescent to light-emitting diodes, an empirical Bayes before-and-after study of 282 treated intersections. It reports crash modification factors and does not discuss rise time, decay time, thermal lag, temporal switching characteristics, flicker, or driver perception of onset or offset. Its only perceptual concern is stated in its background as issues related to visual discomfort caused by glare at night. The Foundation records that because it is the federal study of this conversion, and because what it examined was crashes rather than what the driver sees.

6. What the Foundation asks as to this class

Five things. That the class be given a product code, which Appendix F.2.9 sets out. That the Department obtain the engineering specification and state, on this record, what it requires as to intensity, chromaticity, modulation and switching, since the specification governs the optical output of every traffic signal in the country and the public cannot read it. That the Department measure the rise and decay of an incandescent signal lamp and of a diode module photometrically, which is a bounded and inexpensive experiment and is the measurement paragraph 360ii(a)(4) directs and Part II.F establishes has not been made for any product class. That the Department consult the roadway agency under paragraphs (a)(3) and (a)(6) concerning the 2014 report on heat, for the structural reason given at subsection 4. And that the disclosure sought at Part IX.F reach the temporal characteristics of a module, which Part I.H already lists among the characteristics to be disclosed and which nothing in this comment has until now explained the significance of.

S. Accent and Trim Lighting on Unattended Self-Service Equipment

This class is treated here for the first time, and the Foundation notes at the outset that doing so corrects a defect in this comment rather than only adding to it. Appendix F.2.7 already proposes a radiation-emitting product code for these products and names them, and until now no subsection of this Part described the class the proposal was written for.

1. What the products are, and the code already proposed for them

Automated teller machines. Public electric vehicle charging stations. Car washes, together with their entry gates and payment stations. Self-service fuel dispensers. Vending machines, parcel lockers and self-checkout terminals. Ice, water, air and vacuum vending in forecourts.

What these have in common is not the function of the machine. It is a band, strip or ring of colored light applied to the exterior of the machine, commonly in blue, violet, green or cyan, whose purpose is to make the machine conspicuous and identifiable from a distance. It is not the lighting that illuminates the keypad, the card reader, the nozzle or the screen, and the Foundation keeps the two separate throughout this subsection because its request depends on the distinction.

Appendix F.2.7 proposes code RIX for light-emitting diode strip, tape and linear accent lighting, and the entry names colored decorative strips applied to vehicle charging stations, automated teller machines and kiosks. The component is the same strip product used for cove, channel and under-cabinet lighting in the consumer and commercial classes at Part VI.F and Part VI.G. What distinguishes this class is where the strip is mounted and who stands in front of it.

2. Saturated color, and why a photometrically modest emission is radiometrically concentrated

The accent lighting in this class is predominantly saturated and narrow-band. It is produced by a diode emitting directly in the blue, violet or green rather than by the phosphor-converted white construction described at Part V.B.1, and Part V.B.3 sets out why a warm or low correlated color temperature source and a narrow-band source are different things.

The consequence is the arithmetic established at Part V.C.1, and it is the reason this class matters out of all proportion to how bright it looks. Every photometric quantity is weighted by the photopic luminous efficiency function, which is small in the blue. A stated illuminance of near-monochromatic blue light therefore corresponds to a radiometric exposure one to two orders of magnitude greater than the same stated illuminance of white light, and Part V.C.1 gives the derivation and the worked figures at two wavelengths. An installation that looks modest, and that any photometric measurement would record as modest, can deliver a short-wavelength radiometric exposure far larger than its appearance suggests. Short wavelength is the region in which the blue-light hazard function and the melanopic action spectrum are greatest, which the front matter, subsection G, sets out.

The Foundation holds one measurement of a saturated blue installation, and it is not of this class. Part VI.I.4 sets out measurements of a commercial deterrent lighting product. The Foundation does not transfer those figures here and does not suggest the two installations are comparable. It cites them for one purpose only: to establish that a measurement of this kind is straightforward, and has been made once.

A temporal characteristic attaches to many of these installations and no criterion bounds it. Color-cycling, chase, breathing and pulsing modes are standard features of the controllers these strips are sold with. Part III.E.1 states the quantities that would describe them. The Foundation has measured none of them.

3. Who is exposed, and the federal position

The exposure is at close range, for a sustained period, and is not sought. A person at an automated teller machine at night stands within about a meter of the fixture for the length of a transaction, in a dark parking area, with the eye adapted to darkness. That is the adaptation condition Part III.D.3 describes, in which a given luminance is at its most disabling, and Part III.E.4 treats the hour of use as a characteristic for that reason. A person washing a vehicle, or charging one for twenty minutes or longer, stands beside the installation longer still.

The Foundation distinguishes this class from Part VI.K on that ground. Part VI.K treats decorative, architectural and entertainment lighting, and rests in part on the proposition that the audience exposure in that class is in large part sought. Nobody approaches an automated teller machine for the lighting.

A second population is exposed and transacted nothing. These installations operate unattended through the night, in forecourts and parking areas frequently adjacent to housing, which is the light trespass subject of Part VI.P and the unnecessary-emission subject of Part II.D.3.

The federal position is that there is none. No performance standard governs the optical output of this equipment. The efficiency framework at Part IV.G does not reach the accent lighting either, because it is not a general service lamp within the definition Part IV.G.2 describes. Part VI.U is the summary table for this Part; it has not yet been built, and this class must appear in it when it is.

The Foundation states the limit of its record plainly, because the limit is substantial. It holds no measurement of any installation in this class. The incident report database at Appendix A contains no report that identifies accent lighting on self-service equipment as the source of the exposure complained of. The nearest report concerns the screen of a tabletop payment terminal in a restaurant, which is a display rather than accent trim and belongs to the class at Part VI.H. This subsection identifies a class and its characteristics. It supplies no numbers for it, and the Foundation does not represent that it has established anything about what these installations emit.

4. What the Foundation asks as to this class

That the class be included in the study and evaluation of emissions and conditions of exposure directed by § 360ii(a)(4), and that the measurement be radiometric rather than photometric, for the

reason at subsection 2: a photometric figure will understate the exposure that matters here by one to two orders of magnitude. Part IX.C.1 makes the general request.

That the code proposed at Appendix F.2.7 be assigned, so that the class has an identity in the Department's own classification. Part IX.G.7 makes the general request.

And one thing that requires no research at all. That the accent function be capable of being extinguished, or reduced, independently of the illumination function of the machine. The keypad, the card reader, the nozzle and the payment screen need light, and the Foundation does not question any of it. The colored band around the cabinet illuminates nothing. This is the technique set out at Part III.G.2 for the indicator lamp on a household device, applied to commercial equipment, and it has the same character: it asserts nothing about whether the emission is harmful, it requires no finding about anyone's health, and the capability is already present in the controllers these products use.

T. Lighting on Robots and Mobile Autonomous Devices, Including Simulated Eyes and Faces

This class appears nowhere else in this comment. Before this subsection was written the word robot did not occur in the document, no code in Appendix F corresponded to such a device, and the Foundation had located no federal criterion addressing what one may emit. It is identified here because the devices are now in the public way, and because the class is the only one in this Part that is still early enough for a criterion to precede the installed base rather than follow it.

1. What the products are, and the two emissions they carry

Sidewalk delivery robots. Food and parcel delivery devices operating on footways, campuses and hospital corridors. Floor-cleaning and inventory robots in airports, transit stations and large retail premises. Security patrol devices. And autonomous equipment on construction and agricultural sites adjacent to public space.

These devices carry two optical emissions and the Foundation separates them, because they raise different questions and only one of them is novel. The first is functional: forward lighting to illuminate the path, indicator and hazard lamps to signal presence and intended movement, and in some devices emitters used for active optical sensing. The second is expressive: arrays of light-emitting diodes arranged and animated to represent eyes, a face, or a mouth.

The functional emission raises the questions Part VI.B and Part VI.C raise for vehicle lamps, with one difference that matters. No federal lamp standard applies, because the device is not a motor vehicle. Part VI.N records the nearest comparison the Foundation has found: the federal regulation reaching bicycles requires reflective devices and does not require a lamp at all, and states no photometric limit anywhere.

2. The simulated face, which is a display designed to be looked at

The expressive emission is the novel thing in this class and it has no regulatory home. It is not a lamp performing a photometric function, and no lamp criterion describes it. It is a display, and Part VI.H treats displays, screens and personal devices.

What distinguishes it from the displays at Part VI.H is the combination of three things: it is mounted on a device that moves, at a height chosen so that it meets the gaze of a person standing or walking, and it is animated for the express purpose of attracting and holding that gaze. A person looks at simulated eyes. That is the design intent, and on the Foundation's observation it succeeds.

The consequence for exposure is specific and it is the reason this subsection exists. A person who looks directly at an emitter is exposed at the fovea, so the quantities that govern are the luminance of the emitting surface and the angle it subtends at the eye, which Part III.D.3 and Part V.B.2 set out,

rather than the illuminance at any surface. A display built to be looked at is a display whose luminance and apparent size matter, and neither is bounded for this class by anything.

Three characteristics compound in this class in a way the Foundation has not found in any other. The animation is temporal modulation whose depth, rate and waveform are chosen for expressiveness and are bounded by no criterion; Part III.E.1 states the quantities and Part III.E.2 the transition times that no instrument specifies. The device moves relative to the observer, which Part III.D.9 establishes converts a spatial pattern into temporal modulation at the retina whether or not the output itself varies. And the emission is frequently saturated color, which carries the arithmetic set out at subsection S.2.

3. Who is exposed, and the federal position

Pedestrians, who did not choose to share a footway with the device and in most places cannot decline it. People with photosensitive epilepsy, migraine and photophobia, and people with sensory processing differences, for whom Part V.E sets out the evidence and Part III.F the question of whose response a criterion is calibrated to.

And children. A device with a face is designed to be approached by children, and it succeeds at that as well. The Foundation sets one comparison beside it and asks the Department to notice the shape of it rather than to draw any conclusion from it. Part VI.M records that the federal standard governing toys in the United States does limit an optical quantity. A toy containing a light-emitting diode is subject to a limit. An autonomous machine carrying an animated face, operating on a public sidewalk where children are present, is subject to none.

The federal position, so far as the Foundation can establish, is that there is none as to emission. These devices are regulated, where they are regulated at all, by state and municipal instruments addressed to where they may operate, at what weight and at what speed. The Foundation has not surveyed those instruments and does not assert what any of them provides.

No code in Appendix F corresponds to this class. Appendix F.2 proposes thirteen codes and not one of them reaches a mobile autonomous device or an expressive display mounted on one. The Foundation identifies the gap and does not fill it in this pass.

4. What the Foundation asks as to this class

That the class be included in the study and evaluation directed by § 360ii(a)(4), and that it be taken early. The Foundation presses the timing because this is the one class in this Part where it is still available: these products are being designed now, and a criterion that exists before a product class is built is a different instrument from one that arrives after the class is installed. Part VI.R sets out what the alternative looks like, in a class converted in its entirety before anyone measured what changed.

That the expressive emission be treated as a display and measured as one, in luminance, apparent source size and the temporal quantities at Part III.E, rather than falling between the lamp rules, which do not reach it, and the display conventions, which were written for a screen a person holds or sits in front of.

That the Department consider whether a radiation-emitting product code should be assigned to the class, which is the request at Part IX.G.7 applied here.

The Foundation states what it does not ask, because the subject invites misreading. It does not ask that these devices be prohibited. It does not ask that they be required to be faceless, and it takes no position on whether a machine should present a face. It asks that what the face emits be measured, and that whatever criterion governs a display govern this one.

U. Regulatory Status by Product Class

The Foundation summarizes the regulatory position established class by class above, because the pattern is easier to see collected than distributed across twenty subsections. The classes fall into three groups.

One class has a federal standard that sets numerical limits on emission

Motor vehicle lighting. Part VI.B establishes that Federal Motor Vehicle Safety Standard No. 108 governs the photometric performance of vehicle lamps, and Part VI.B.4 that it prescribes requirements in candela for rear signal lamps. It is the only class in this Part of which that is true. What it does not limit, for any lamp, is the luminance of the emitting surface, the spectral content of the emission, the depth or frequency of temporal modulation, or the rise and decay times of a signal.

Several classes have a federal instrument that sets a floor and no ceiling

The visible alarm, where Part VIII.D.4 establishes that the flash rate is bounded in both directions and the intensity is bounded only below. The warning and flashing lamps at Part VI.C, where the governing manual specifies flash rates and intensity classes as minima. Aviation and obstruction lighting at Part VI.O and marine navigation lighting at Part VI.Q, where the applicable instruments prescribe minimum luminous intensity. Traffic control signals at Part VI.R. In each, a federal or federally adopted instrument states how much light the device must produce and none states how much it may not exceed.

The remaining classes have no federal instrument reaching the optical emission at all

Roadway, area and parking lighting at Part VI.D. Interior lighting in schools, workplaces and healthcare settings at Part VI.E, and retail and commercial interiors at Part VI.F. Consumer lamps and household products at Part VI.G. Displays, screens and personal devices at Part VI.H, where Part VI.H records that this Department has classified the products and that one class is defined by an undefined term. Security and deterrent lighting at Part VI.I. Signage and dynamic message displays at Part VI.J. Decorative, architectural and entertainment lighting at Part VI.K. Products intended for or used by children at Part VI.M. Bicycle and personal mobility lighting at Part VI.N. Residential exterior lighting and light trespass at Part VI.P, where Part III.D.5 records that the maxima which exist are municipal and state. Accent lighting on unattended self-service equipment at Part VI.S and on mobile autonomous devices at Part VI.T.

Two statements complete the summary. Appendix F sets out the product codes this Department has assigned, twenty-three of them, and the thirteen the Foundation proposes, and records for each class whether a code reaches it; a code is an administrative classification and not a limit, which Part II.B.6 establishes. And Part VIII.D.1 establishes the proposition this summary is evidence for: no performance standard prescribed under § 360kk governs the visible light emitted by any light-emitting diode product in any of these classes.

V. Tariff Classification and Import Screening of LED Products

Every product class described in this Part arrives in the United States, in whole or in part, as an import. At the moment of arrival each one is assigned a number, and that number determines whether this Department sees it at all. This subsection sets out how that works, because it is the one place in the federal system where a light-emitting diode product is routinely identified to this Department as a radiation-emitting electronic product, and because the mechanism appears to have a gap in it that the Foundation can describe but has not been able to resolve.

1. The Harmonized Tariff Schedule, and who writes it

The Harmonized Tariff Schedule of the United States is the tariff law of the United States. It was enacted by section 1204(a) of the Omnibus Trade and Competitiveness Act of 1988, Pub. L. 100-

418, 102 Stat. 1148, which struck the former tariff schedules from 19 U.S.C. § 1202. That section is now a heading carrying editorial notes and no operative text, and the schedule itself is not printed in the United States Code. It is maintained and published by the United States International Trade Commission, an independent agency created by the act of September 8, 1916, 39 Stat. 795, and renamed by section 171 of the Trade Act of 1974, 19 U.S.C. § 2231. The Commission is directed by 19 U.S.C. § 3005 to keep the schedule under continuous review and to recommend modifications, and by § 3007 to publish it; changes of the kind described below are made by presidential proclamation under § 3006. Customs and Border Protection administers it, and is established in the Department of Homeland Security by 6 U.S.C. § 211. Neither the Commission nor Customs is a health agency and neither writes this Department's regulations.

A tariff number has ten digits and they are not all of one kind. The first six are international, taken from the Harmonized System of the World Customs Organization and common to the great majority of trading nations. The seventh and eighth are a legal subdivision of the United States and fix the rate of duty. The ninth and tenth are a statistical suffix used for reporting, and they are set under section 484(f) of the Tariff Act of 1930, 19 U.S.C. § 1484(f), which directs the Secretary of the Treasury, the Secretary of Commerce and the Commission to establish the statistical enumeration; Part II.H.1.d sets out why that matters to this comment. The Foundation sets that out because the distinction matters to what follows: the first six digits are changed by an international body on a periodic cycle, and the United States follows.

2. How this Department uses the tariff schedule

This Department attaches flags to tariff lines. A flag on a line tells the filer that an article classified under it may be subject to this Department's requirements and that entry data is expected. The data itself is transmitted in the Automated Commercial Environment under 21 C.F.R. part 1, subpart D, added by the final rule at 81 Fed. Reg. 85,854 (Nov. 29, 2016), and includes the complete FDA Product Code, which for a diode illumination lamp is the code reproduced at Appendix F.1.11. Importation of electronic products is separately governed by 21 U.S.C. § 360mm, by 21 C.F.R. part 1005 and by 19 C.F.R. §§ 12.90 to 12.91, and the declaration is made on Form FDA 2877, Declaration for Imported Electronic Products Subject to Radiation Control Standards.

The chain is therefore complete and it is worth stating plainly. An international body writes the heading. The Commission publishes the schedule. This Department flags the line. The importer files the product code. Customs admits or refuses the article. Part II.H.20 describes that relationship as the Department itself has described it, and Part II.B.6 the classification it rests on.

3. The instruction of June 6, 2017, and the line it drew

On June 6, 2017 Customs and Border Protection published CSMS 17-000330, Light-Emitting Diode (LED) Reporting to FDA, relaying an update from this Department. It stated that "LED products emit visible optical radiation, which qualifies them to be radiation-emitting electronic products" and instructed that entry data was expected for light-emitting diodes used for general or local area illumination, such as lamps and lightbulbs, classified under tariff number 8541.40.2000 and flagged accordingly. It further instructed that entry data was not expected for finished products using light-emitting diodes only as indicator lights, such as toys, telephones, appliances and remote controls.

The Foundation makes two observations and resists a third. The first is that the instruction is operative rather than advisory: it told importers what this Department expected to receive, and the expectation rested on the characterization of visible optical radiation as electronic product radiation. The second is that the line it drew, between illumination and indication, is a line of administrative convenience at the border and is not a line this comment adopts; Part VI.G treats the appliance indicator at length, and the class is in any event classified under its own product code, reproduced at Appendix F.1.20. The observation the Foundation resists is that the exclusion of indicator products from entry reporting amounts to a determination that such products fall

outside 21 U.S.C. § 360hh(1)(A). Nothing in the message says so, and an instruction about what data an agency wishes to receive should not be read back into the statute as a jurisdictional line.

4. The tariff number in that instruction designated a different article, and has since ceased to exist

Subheading 8541.40 was a subheading of the international Harmonized System and it was divided in the 2022 revision of that system. New subheadings 8541.41 through 8541.49 were created and light-emitting diodes are now provided for at 8541.41. The Foundation records why the division was made, because it bears on how little attention the relocation is likely to have received: the new subheadings were created to provide for solar energy products, on a proposal of the International Renewable Energy Agency, and the separation of light-emitting diodes into a subheading of their own was incidental to that purpose. The revision took effect in the United States on January 27, 2022, under Proclamation 10326 of December 23, 2021, 86 Fed. Reg. 73,593 (Dec. 28, 2021), which incorporated the modifications set out in Publication 5240 of the United States International Trade Commission.

The specific number the message of June 6, 2017 gave, 8541.40.2000, no longer exists, and the Foundation does not rest that on a commercial tariff database. Proclamation 10339 of February 4, 2022, 87 Fed. Reg. 7,357 (Feb. 9, 2022), amended a note of the schedule by deleting 8541.40.60 and inserting 8541.42.00 in its place, and by deleting 8541.40.6025 and inserting 8541.42.0010. The United States Trade Representative deleted 8541.40.95 from another note by notice of October 14, 2022. And Customs and Border Protection told the trade, in a message of October 18, 2022 numbered CSMS 53676546, that the 8541.40 numbers it listed no longer exist, in light of changes to the schedule made by the Commission in accordance with Proclamation 10326.

There is a second difficulty with that number, and it is the more serious of the two because it does not depend on anything having changed. The message described light-emitting diodes used for general or local area illumination, such as lamps and lightbulbs. Heading 8541 is the semiconductor heading: it covers semiconductor devices, photosensitive semiconductor devices and light-emitting diodes as such. Finished lamps are not there and were not there in 2017. They are in heading 8539, which in the revision in force when the message issued read, in its closing words, light-emitting diode (LED) lamps, and carried subheading 8539.50 for them. The 2022 revision changed those closing words to light-emitting diode (LED) light sources and divided 8539.50 into 8539.51 for modules and 8539.52 for lamps, the distinction resting on whether the article has a cap allowing it to be installed in or replaced within a luminaire.

So the position is not that an instruction was overtaken by a change in the nomenclature. It is that the tariff number on which this Department's entry screening for light-emitting diode illumination products was keyed designated the component rather than the lamp, at a time when the nomenclature already carried a subheading for the lamp, and that the number has since been deleted as well.

The Foundation asks rather than asserts, and states its questions precisely. Whether an import flag of this Department presently attaches to any subheading of heading 8539, and to 8539.52 in particular. Whether one ever did. Whether a flag was carried across from 8541.40.2000 to 8541.41 in January 2022, and if so what articles it is now understood to reach. And what entry data this Department presently expects for a finished light-emitting diode lamp imported for general illumination. If the arrangement is in good order the Department can say so in a few sentences. If it is not, then the only routine mechanism by which a light-emitting diode illumination product is identified to this Department as a radiation-emitting electronic product does not work, and nobody has said so.

The Foundation states the limit of its own research rather than leaving it to be discovered. It has read the headings and subheadings of the nomenclature of the World Customs Organization, which the United States follows at the six-digit level, and the federal instruments recited above. It has not been able to read the printed article descriptions of the Harmonized Tariff Schedule itself,

or the ten-digit statistical reporting numbers beneath the subheadings discussed, because the Commission's schedule could not be retrieved in the working environment in which this comment was prepared. The six-digit descriptions above are therefore given from the international nomenclature with which the schedule must conform, and not from the schedule. This Department and Customs and Border Protection can read both.

One fact makes the question current rather than historical, and the Foundation puts it last because it is the one that matters. This Department's own public instruction to importers, on its page concerning the importation of radiation-emitting electronic products, presently reads:

> For additional information on reporting LEDs to FDA, review the CSMS message that was issued on June 6, 2017.

That is the operative published guidance. It directs an importer to a message whose only tariff number was deleted from the schedule on January 27, 2022, and whose number, while it existed, designated the semiconductor component rather than the lamp. The Foundation does not infer from this that no screening occurs, and it does not suggest that the guidance was written carelessly; it was accurate as to the message it described. What it observes is that the guidance has not been revised in the four years since the number it depends upon ceased to exist, and that a program which had looked at its own import mechanism in that period would have noticed. Part II.H.20 describes this arrangement as the program's one sustained liaison of record with another federal agency. The Foundation does not withdraw that description. It asks the Department to state what the present arrangement is.

Two features of the question make it worth asking in this forum rather than elsewhere. It is answerable from this Department's own records and requires no research, no standard and no new authority. And the answer bears directly on paragraph 360ii(a)(4), because entry data is a source of information about what is entering the country and in what volume, and Part V.J describes at length how little this Department is shown to know about either.

VII. REPORTS OF HARM

A. The Soft Lights Foundation LED Incident Report Database [RFI Q3]

1. Method of collection and the submission form

The existence of the form and the Foundation's practice of transmitting what it collects are described at Part IV.B.1. This subsection describes the instrument itself, because the shape of the data in Appendix A follows from it and four other subsections of this Part depend on what the form captured.

Each reproduced report in Appendix A carries four elements and no others: a date, a location, a condition category, and a narrative written by the reporter. The Foundation describes each as the reproduced record shows it.

The date. Every one of the 593 reports carries a date in a single uniform form, which indicates a date captured or normalized by the system rather than typed by the reporter. Where a reporter writes a date inside a narrative it appears in whatever form that reporter chose, and those forms vary; the header dates do not.

The location. This was not a constrained field. Of the 593 entries, 547 take the form of a place followed by a two-letter state abbreviation, 33 give a place and a country, 9 have three elements, and 4 consist of a single word, among them USA, Japan, Netherlands and Anonymous. Two entries give a United States place with the state name written out in full where the great majority abbreviate it. Several reporters entered Anytown. No menu of states or countries could produce that range, so the location was entered by the reporter as free text and some reporters used it to withhold their location rather than to give it.

The condition category. Every one of the 593 reports carries at most one value. No entry in the dataset contains two categories, a separator or a conjunction, so a reporter who had more than one relevant condition could record only one of them. Eight reports carry no value at all, so the field was not required. Part VII.A.4 sets out the distribution.

The narrative. Free text, with no length limit apparent in the result. The median report runs to about 480 characters, a quarter run to 260 or fewer, twenty-four exceed 2,000, the longest runs to 5,464, the shortest to 8, and one report has no narrative at all. Part VII.B explains how these narratives were grouped and Appendix A reproduces every one.

The form collects no name, no street address, no telephone number and no electronic mail address. That is the primary protection of the reporters' privacy and it is a property of the instrument rather than of anything the Foundation did afterwards. Part VII.A.6 describes the screening applied to what the form did collect.

One feature of the record that the Foundation cannot explain, and states because it bears on the figures

The condition values are not distributed as a wholly unconstrained text field would distribute them. Two hundred and fifty-seven of the 593 entries fall on exactly two strings, Other and None, and the remainder fall on a further eight. Free text would ordinarily produce many more variants than that.

But four entries do carry variant spellings of three of the categories: two give Electromagnetic Sensivity where twenty-six give Electromagnetic Sensitivity, one gives None with a terminal period, and the three entries for Sjogren syndrome appear under two spellings. The Foundation tested whether those variants cluster in time, which would indicate a label on the form that was misspelled and later corrected. They do not. The correctly spelled entries run from August 2024 to the end of the period and the variants fall in November 2025 and June 2026, interleaved with them; the two spellings of Sjogren both appear in August 2024.

The Foundation therefore states a negative finding rather than an explanation. At some point in the chain between the reporter and the reproduced record, the condition value was not constrained by a fixed list. It cannot say from the reproduced record whether the form offered free text, offered a list with an alternative, or whether the variants were introduced later when the reports were compiled for transmittal. The consequence for the reader is the one that matters: the table at Part VII.A.4 is a table of the values recorded in the 593 reports, and not a table of the options the Foundation offered. Nothing in Appendix A discloses which options existed and were never chosen.

2. Transmittal of the reports to the FDA and NHTSA, and the agencies' acknowledgments

Part IV.B sets out the transmittal record in full and this subsection does not repeat it. The transmittals to the Food and Drug Administration were made to the customer service address of the Center for Devices and Radiological Health, periodically, from April 2024 onward; the letter of December 1, 2025 was addressed jointly to the Commissioner of Food and Drugs and to the Administrator of the National Highway Traffic Safety Administration; and the acknowledgments returned are the subject of Part IV.B.3. Part IV.B.8 carries the transmittal table.

One consequence belongs here rather than there, because much of this Part depends on it, and the Foundation states it with the precision it requires. The reports in Appendix A were not collected for this comment. They were collected as they arrived over two and a half years and transmitted to the Department periodically as they arrived. The great majority were therefore in the Department's own records before this request for information issued. The most recently received reports were not, because the form continued to receive them after the request issued and the latest in Appendix A is dated October 14, 2026; those come before the Department for the first time in this comment.

The distinction matters for one argument and not for the rest. Where this comment submits that the Department cannot answer without addressing material it already held, that submission runs only to the reports transmitted before the request issued. The remaining reports are offered as what they are, which is information supplied in response to a request for information. Part IV.B.7 states what follows from the former and Part VII.A.5 states what the whole dataset does and does not establish.

3. Volume, date range, and geographic distribution

The database contained 593 reports as at October 14, 2026. The earliest bears the date April 21, 2024 and the latest October 14, 2026. Appendix A reproduces all 593 in full, in chronological order, numbered A.1 to A.593.

Distributed by calendar year, with the first and last years partial:

2024, from April 21: 233 reports.

2025, the only complete year: 218 reports.

2026, to October 14: 142 reports.

The Foundation states a consequence of those figures that is not favorable to it, because a reader will compute it. Expressed as a daily rate the three periods run at approximately 0.9, 0.6 and 0.5 reports a day, so the rate of reporting has fallen across the period. The Foundation cannot attribute that decline to anything and does not know its cause. It notes only that the rate at which members of the public find and complete a voluntary form maintained by a small organization is a fact about the form and its visibility, and is not evidence about the incidence of the experiences reported. The same is true of the increase that would have appeared had the numbers run the other way. Subsection 5 sets out the limits of this dataset in full, and this is one of them.

Geographic distribution

Of the 593 reports, 540 give a location ending in a United States state or District abbreviation, and those 540 are distributed across 46 states and the District of Columbia. Two further reports give a United States location with the state written out, and are not counted in the table below. Forty-five reports give locations outside the United States. Six give locations that cannot be placed, being two entered as Anytown, USA, two as Anytown, NA, one as USA and one as Anonymous; the Foundation reads the first four as reporters withholding their own locations, and has not altered them.

Six states are not represented at all: Mississippi, North Dakota, South Dakota, West Virginia, Wyoming, and no report was received from Puerto Rico or any other territory.

Table. Reports by United States state or District, n = 540

State	n	State	n	State	n
California	107	Illinois	35	Pennsylvania	31
Texas	30	New York	28	Florida	23
Ohio	23	Oregon	22	Washington	21
Michigan	20	New Jersey	16	North Carolina	14
Colorado	12	Massachusetts	12	Maryland	11
Minnesota	11	Wisconsin	10	Arizona	8
Georgia	8	Tennessee	8	Maine	7
South Carolina	7	Indiana	6	Oklahoma	6
Virginia	6	Alaska	5	New Hampshire	5

State	n	State	n	State	n
New Mexico	5	Alabama	4	Connecticut	4
Idaho	3	Iowa	3	Missouri	3
Montana	3	Utah	3	Vermont	3
Delaware	2	District of Columbia	2	Hawaii	2
Kansas	2	Kentucky	2	Nevada	2
Rhode Island	2	Arkansas	1	Louisiana	1
Nebraska	1				

The reports from outside the United States come from fifteen countries and territories. Canada supplies 17, the United Kingdom 8, New Zealand 6, Australia and the Netherlands 2 each, and France, Guadeloupe, Japan, Jamaica, Malaysia, Norway, Poland, Russia, Serbia and Sweden 1 each. The Foundation includes them because they were received, and draws no inference from them about conditions in the United States. They bear on this proceeding in one respect only, which Part VI.V develops: the products described are supplied by the same manufacturers into the same global market.

4. Self-identified condition categories recorded by reporters

The submission form invites the reporter to select a condition category. The categories are the reporter's own selection, made about themselves, from the choices the form presents together with a free Other. They are not diagnoses, no clinician reviewed them, and the Foundation has not verified any of them. Subsection 5 states what follows from that and subsection 6 describes the screening the Foundation applies.

Across the 593 reports the categories are distributed as follows.

Table. Self-identified condition categories, n = 593

Category as recorded	n	Share of 593
Other	130	21.9%
None	128	21.6%
Migraine	99	16.7%
Astigmatism	90	15.2%
Autism	54	9.1%
Photophobia	43	7.3%
Electromagnetic Sensitivity	28	4.7%
Epilepsy	10	1.7%
(none entered)	8	1.3%
Sjogren's	3	0.5%

Four features of that distribution should be stated before anything is made of it.

The two largest entries carry the least information. Other and None together account for 258 of the 593, which is more than two fifths. Other records that the reporter did not find their condition in the list, and None records that the reporter claimed no relevant condition at all. Neither tells the Department anything about a condition, and the second is in one respect the more interesting of the two, because 128 people who reported an effect from light-emitting diode products did not attribute it to any condition of their own.

The categories are not of one kind. Astigmatism is a refractive condition of the eye, migraine and epilepsy are neurological, autism is a developmental condition, photophobia is itself a symptom rather than a diagnosis, and Sjogren's syndrome is an autoimmune disease. The list mixes mechanism, diagnosis and symptom, which is a feature of how the form was built and not of the population.

Spelling variants have been consolidated and the consolidation is stated so that a reader recounting from Appendix A reaches the same totals. Two reports give Electromagnetic Sensivity and are counted with Electromagnetic Sensitivity; one gives None. with a period and is counted with None; and the three entries for Sjogren's syndrome appear under two spellings. The reproduced reports in Appendix A retain whatever the reporter entered.

Eight reports record no category. They are counted in the 593 and shown in the table as none entered.

The Foundation draws one observation from the table and no more. The categories most often selected after Other and None are migraine at 99 and astigmatism at 90, and those two conditions are the ones for which a mechanism connecting them to this kind of light source is best described in the published literature: photophobia and photic trigger in migraine, treated at Part V.E, and the effect of refractive error on the retinal image of a small, high-luminance source, treated at Part V.C.3 and Part V.C.5. That the self-selected categories and the mechanisms described in the literature point the same way is worth the Department's attention. It is not proof of anything, for the reasons subsection 5 gives, and the Foundation does not present it as proof.

5. What the database establishes, and what it does not

This subsection is the one the Foundation asks the Department to read before relying on anything in Parts VII.B through VII.F. Those subsections state figures, and figures invite a reader to treat them as measurements. These are not measurements. The Foundation sets out what the database establishes, which is narrow, and then what it does not establish, which is a longer list and includes several things that count against the Foundation.

What the database establishes

Three things, and the Foundation claims no more than these.

That 593 people took the trouble to find a form, complete it and describe an experience they attribute to light emitted by light-emitting diode products, between April 21, 2024 and October 14, 2026. That is a fact about the reports and it is not in dispute.

What those people said. The accounts are reproduced in full in Appendix A, so the primary material is before the Department and every figure in this Part can be recounted against it.

That the great majority of this material was in the Department's possession before this request for information issued, having been transmitted periodically as it arrived in the manner Part IV.B records. The reports received after the request issued, of which the latest is dated October 14, 2026, are before the Department for the first time in this comment; Part VII.A.2 draws the distinction and explains which argument depends on it. As to the material the Department already held, it is not receiving that for the first time, and a response which does not address it is not a response made in ignorance of it.

What the database does not establish

Six things, in the order of how much each matters.

It is not a sample of any population. Every report is self-selected. The reporters found the form because they were already looking for somewhere to report, which means they had already concluded that light was the cause of what they experienced. No inference about the general population can be drawn from a set assembled that way, and the Foundation draws none.

There is no denominator. The Foundation does not know how many people encountered the conditions described and were unaffected, because it has no means of counting them. Every

figure in this Part is a numerator with nothing beneath it. No rate, prevalence, incidence or risk can be computed from this database, and the Foundation has computed none.

Five hundred and ninety-three reports are not 593 people. The form collects no identifier, so the Foundation cannot establish how many distinct individuals are represented. The 593 reports carry 445 distinct location entries, and several locations recur in a pattern that suggests repeated submission by the same person: one location supplies 29 reports, another supplies 6 all in the same condition category, and one reporter states in the body of a report that they had submitted an earlier one. The number of distinct reporters is therefore smaller than 593 and the Foundation cannot say by how much.

No report is verified. The Foundation has no authority to request a medical record, to contact a clinician, to inspect a product, to measure an emission or to visit a location. It has not attempted to confirm any account, and Part VII.J explains why it could not. Where a reporter asserts that light-emitting diode products caused a condition, that is the reporter's statement of their own belief and the Foundation does not adopt it.

The geographic distribution is not representative, and one feature of it requires particular disclosure. Part VII.A.4 records 54 reports in the autism condition category. Thirty-one of those 54 come from Yolo County, California and the adjacent Sacramento area, which is where the Foundation's officers are located and where the Foundation has conducted local advocacy. A reader should treat the autism figure as reflecting the Foundation's own locality and network and not a national pattern, and should treat the condition-category distribution in Part VII.A.4 generally as shaped by where the form was known about.

The method detects acute encounters and is poor at detecting chronic exposure. Part VII.B.5 sets this out in full. The effect with the strongest support in the scientific literature, which is circadian and sleep disruption, is the effect least often reported here, and the Foundation believes that is a property of the instrument rather than of the world.

What follows

The Foundation does not ask the Department to treat these 593 reports as proof that light emitted by light-emitting diode products injures people. They are not capable of proving it and the Foundation does not advance them for that purpose.

It asks for two things, and both are consistent with every limitation above.

The first is that the reports be answered rather than passed over. A body of 593 particularized accounts in an agency's possession is a part of the record before that agency, whatever its evidentiary weight, and an explanation which does not mention it is not a reasoned explanation of a decision not to act. Part II.H.20 sets out the authority for that proposition and it is the Foundation's principal submission on this Part.

The second is that the Department build the instrument that would answer the question properly. Every defect listed above is a consequence of who is doing the collecting. A private organization cannot establish a denominator, cannot verify a clinical account, cannot compel a measurement and cannot reach a population that does not already suspect the cause. This Department can do all four. The Foundation therefore offers this database not as a substitute for federal surveillance but as the reason for it, and Part VII.J and Part IX.D make the request.

6. Screening of reports for personally identifiable and health information

The Foundation describes the screening it applied, because a body of 593 first-hand accounts of personal experience placed on a public docket requires it and because the Department should know exactly what was and was not done.

What the instrument itself prevents

The first and most important protection is a property of the form rather than of any later screening: it never collected a name, a street address, a telephone number or an electronic mail address. Part VII.A.1. There is accordingly no contact detail in the dataset to remove.

What the Foundation searched for, and what it found

The Foundation searched the full reproduced text of all 593 reports as they appear in Appendix A. The results were as follows.

Electronic mail addresses and telephone numbers: none. No report in the dataset contains either.

Web addresses: eighteen, across fourteen reports. Most are references to published research or to news coverage and are left as the reporters gave them. One was different in kind and has been removed, as described below.

Personal names: the great majority of capitalized name-like terms in the dataset are places, vehicle makes, retailers, utilities, public officials or public figures, and those are left. Four entries required a decision about an identifiable individual.

The four entries, and what was done

The Foundation sets these out individually rather than describing them in general terms, because a reader who finds one of them should be able to see that it was considered.

One report named a private individual as the owner of a light, asserted that she had defamed the reporter on a social media platform, and included a web address that appeared to be devoted to her by name. The name and the web address have been removed and the possessive now reads as a bracketed description of the relationship, which marks the alteration on the face of the entry. The remainder of the report stands as written. The Foundation has not investigated the dispute the report describes and expresses no view on it, and it did not consider it right to place a private person's name, or a link to material about her, into a federal docket inside an allegation to which she is not a party.

One report names the reporter's own optometrist, as a doctor, and attributes to him a clinical confirmation of the effects described. That is a named private professional credited with a professional opinion that he has not been asked to confirm.

One report contains what appears to be the reporter's own name, volunteered together with an invitation to search for it.

Two reports contain the name of the Foundation's president, and one of those a further personal name.

Health information, which is a different question

The reports contain self-reported health information throughout, and the Foundation has not removed it. That is not an oversight and the Foundation states the reasoning rather than leaving it to be inferred. The health information is the substance of the reports. Each reporter wrote it for the purpose of having it reach a federal agency, and each report was in fact transmitted to the Food and Drug Administration in the form in which it appears here. Part IV.B. To strip it would be to reproduce nothing.

The Foundation has added nothing. It holds no medical record for any reporter, has sought none, has not contacted any clinician, and has not sought to confirm or to elaborate any account. Part VII.A.5. The condition categories are the reporters' own selections about themselves and are not diagnoses.

One residual risk should be stated because the Foundation cannot eliminate it. A location and a condition together may be identifying where the location is a small community, even though neither element alone identifies anybody and no name is given. The Foundation has retained city

and state because the geographic distribution at Part VII.A.3 is responsive to the Department's question and because a report without a location cannot be assessed, and it judges the residual risk acceptable on that footing. A reporter who wished to withhold a location could and did do so, as Part VII.A.1 records.

No report in the dataset is identifiably from a person under eighteen. Part VII.K.

B. Reported Effects, by Category [RFI Q3.c, Q3.d]

This subsection groups the reported effects. Before the groups, the Foundation states how the grouping was done, because the method bears on what the figures are worth and a reader is entitled to test both.

The 593 reports are free text. No reporter selected an effect from a list; each wrote a description. To group them the Foundation searched the reproduced text of Appendix A for defined terms, which are given with each group below, and counted the reports in which a term appears. Four consequences follow and the Foundation states all four.

A report may appear in several groups. The groups are not exclusive and the figures must not be added together.

This is a word search and not a clinical classification. Nobody with medical training coded these reports, and the Foundation makes no claim that the groups correspond to diagnostic categories.

The method undercounts. A reporter who describes being unable to see without using any of the searched words is not counted, and the Foundation has not attempted to count such reports.

The method also overcounts, because a searched term may appear in a negation, in a description of somebody else, or in a sentence about a different subject. The Foundation has not excluded such instances, so each figure should be read as the number of reports in which a word appears rather than as the number of people who had the experience.

Every figure below is therefore recountable against Appendix A, which is the reason the reports are reproduced in full. The Foundation presents these as counts of what the reports say. It does not present them as prevalence, as incidence, or as a rate of anything, and Part VII.A.5 states why no such figure can be derived from this dataset.

1. Ocular pain, glare, afterimage, and temporary loss of vision

This is the largest group by a wide margin. Terms searched: blind, blinds, blinded, blinding, blindness; glare, glares, glared, glaring, glary; eye pain, eyes hurt, eyes ache, eyes burn, eyes sting, pain in or behind the eyes; afterimage, seeing spots, spots in my vision; and the phrases cannot see, could not see, unable to see, momentary blindness, and vision goes white or black. At least one such term appears in 341 of the 593 reports, which is 57.5 percent.

Within that group the individual term counts are:

a form of the word blind, 267 reports;

an inability to see, stated in one of the phrases listed above, 80 reports;

a form of the word glare, 67 reports;

pain or burning in the eyes, 29 reports;

an afterimage or spots in the visual field, 25 reports.

The first of those figures is the single most important number in this Part. A form of the word blind appears in 267 of 593 reports, which is 45 percent, and it is the word the reporters reached for more often than any other. Three examples give its ordinary use.

"Makes me blind and hard to see road. Especially oncoming traffic when the lights are elevated higher than me."

— Appendix A, A.4 (Dallas, Texas, April 23, 2024)

> “LED headlights are blinding to the point where I have almost hit deer and other vehicles because I cannot see when the LED lights are coming at me”
> — Appendix A, A.21 (Marshfield, Wisconsin, April 28, 2024)

> “Momentary blindness is caused when hit with bright LED lights. Which in effect can cause a car accident either with another vehicle or pedestrian.”
> — Appendix A, A.274 (Phoenix, Arizona, March 9, 2025)

The Foundation reads that word as the reporters plainly mean it, and the reading is both the honest one and the one that matters. They are not asserting permanent loss of sight. They are describing a temporary inability to see, during and shortly after exposure to a bright source. That is not a lay exaggeration of a clinical condition. It is a description of disability glare, which is a measurable optical phenomenon with an established photometric treatment, and Part V.C.3 sets out that treatment and the quantities that govern it, veiling luminance and intraocular straylight among them. The reporters are describing, in their own words, the effect that the published literature predicts from a small source of high luminance.

The Foundation asks the Department to hold that figure against the proposition in the Final Response of May 24, 2024 that light-emitting diode products have a long history of safety with respect to the visible wavelengths they emit. Part I.C.7. Two hundred and sixty-seven people in the Department’s own possession used the word blind to describe what these products did to them. Whatever answer the Department gives to this comment, the Foundation asks that it be an answer which addresses those reports rather than one which does not mention them. Environmental Health Trust holds that an agency may not satisfy its obligation by saying nothing at all about the specific effects in the record before it. Part II.H.20.

2. Headache and migraine

Terms searched: headache, headaches, head ache; migraine, migraines. At least one appears in 164 of the 593 reports, which is 27.7 percent. A form of the word migraine appears in 118 reports and a form of headache in 73.

One comparison within the data is worth the Department’s attention. Ninety-nine reporters selected Migraine as their condition category, as Part VII.A.4 records, but 118 reports mention migraine in the narrative. The narratives therefore describe migraine more often than the category was selected, which means some reporters who did not identify themselves as migraine sufferers described migraine as an effect. The Foundation does not press the point further, because the categories permitted only one selection so far as it is aware and a reporter with both migraine and astigmatism could record only one of them. Part VII.A.4.

> “Instant trigger of chronic migraines. Can’t even function at all.”
> — Appendix A, A.44 (Kuala Lumpur, Malaysia, May 28, 2024)

> “Poorly designed LED lights impact my health severely. Flickering LED lights induce migraine headaches, and this affects my health nearly every day. Overly bright LED headlights and street lights impair my night vision and make driving more dangerous.”
> — Appendix A, A.93 (Beaverton, Oregon, August 5, 2024)

The second of those reports names the characteristic treated at Part V.D, which is temporal modulation of the emitted light rather than its intensity alone, and which Part V.E connects to the neurological and photosensitive responses at issue here. Ninety-nine of the 593 reports use a form of the words flicker, pulse, strobe or flash. The Foundation draws attention to that figure because a performance standard addressed only to brightness would not reach what those ninety-nine reports describe, and Part IX.I accordingly asks for a standard that addresses modulation as well as magnitude.

3. Seizure and photosensitive response

Terms searched: seizure, seizures; epilepsy and its forms; convulsion and its forms. At least one appears in 31 of the 593 reports, which is 5.2 percent. A form of the word seizure appears in 23 reports and a form of epilepsy or convulsion in 13.

This group requires more care than any other in this Part, and the Foundation states its limits before its contents. Ten reporters selected Epilepsy as their condition category, as Part VII.A.4 records, while 31 reports mention seizure, epilepsy or convulsion. The excess is not evidence that light-emitting diode products caused seizures in twenty-one additional people. On reading the reports, the excess is accounted for by three things: reporters describing a sensation they liken to a seizure without asserting that one occurred; reporters expressing fear that a seizure might occur; and reporters mentioning epilepsy in connection with somebody else, or in general terms. The Foundation has not attempted to separate those uses and does not rely on the figure of 31 for any proposition about seizures having occurred.

Two reports illustrate the character of the group.

> "Debilitating headaches, dizziness and seizure like response when exposed to LED lighting. Increased sensitivity to any lighting type after prolonged exposure in LEDs."
> — Appendix A, A.41 (Portage, Michigan, May 25, 2024)

> "Causes nervous system dysregulation which impacts motors skills & orientation, migraines, seizures, nausea, ability to digest food, vomiting"
> — Appendix A, A.136 (Brooklyn, New York, October 11, 2024)

The first says seizure like response and not seizure, and the Foundation quotes it in that form for that reason. The second asserts a causal relationship which the Foundation does not adopt. Part VII.A.5 states the general position and it applies with particular force here: these are the reporters' accounts of their own experience and the Foundation advances them as nothing else.

What this group does bear on is a matter of regulatory structure rather than of causation, and on that the Foundation does rely on it. Photosensitive seizure response to modulated light is not a disputed phenomenon. It is the reason the Access Board's guidelines cap the flash rate of visible alarm appliances, and the reason the Board's own technical assistance warns that flash rates above 5 Hz may trigger seizures and that composite rates above 5 Hz should be avoided. Part VIII.D.4. The Department is therefore not being asked to accept a novel mechanism. It is being asked why the one federal scheme that addresses this mechanism caps the rate of flashing while leaving the intensity of the flash with a floor and no ceiling, and why no comparable limit of any kind applies to the light-emitting diode products these 31 reports describe.

4. Acute autonomic and panic responses

Terms searched: panic; anxiety, anxieties, anxious; palpitation and its forms, racing heart, heart rate, heart racing, heart pounding. At least one appears in 46 of the 593 reports, which is 7.8 percent. A form of anxiety appears in 26 reports, panic in 22, and a cardiac description in 4.

The Foundation identifies the objection to this group before presenting it, because the objection is obvious and reasonable. Distress on encountering a stimulus one expects to be painful is a response to anticipation, and does not by itself establish that the stimulus acts on the body in any particular way. A reader may therefore set this group aside as describing a reaction rather than an effect. The Foundation does not contest that reading for the group as a whole.

Two reports are nevertheless worth the Department's attention, for different reasons.

> "I was standing in a room and another person's cell phone buzzed with a message notification. The iPhone also pulsed its LED camera flash, which struck me in the eyes. I fell to my knees, breathing hard, and trying to fight off a panic attack."
> — Appendix A, A.28 (Roseville, California, April 30, 2024)

That report describes an exposure the reporter did not anticipate and could not have anticipated, from a consumer product in a domestic setting, at an emitted power far below anything a headlamp produces. The anticipation objection does not reach it. It bears on Part VI.H, which concerns displays, screens and personal devices, and on the fifth matter at Part IX.I, because the product that caused it is not one any performance standard presently addresses in respect of its optical output.

> "Full fledged anxiety because being blinded puts me into fight or flight adrenaline mode, because if I am not vigilant I could crash. LED lights are so bright, I cannot see in front of me, beside, or behind me. I am not at fault for being blinded, they are at fault for blinding me."
> — Appendix A, A.246 (Scappoose, Oregon, January 13, 2025)

The second report sets out its own causal chain, and the chain runs the other way from the objection. The reporter does not describe fear of the light. The reporter describes loss of vision, and then describes the physiological response to driving a vehicle while unable to see. On that account the anxiety is downstream of the ocular effect in Part VII.B.1 and of the traffic consequence in Part VII.E, and it is reported as such by the person who experienced it.

5. Sleep disruption

Terms searched: sleep and its forms, sleepless, sleeplessness, insomnia; circadian; melatonin. At least one appears in 28 of the 593 reports, which is 4.7 percent. A form of sleep or insomnia appears in 22 reports, and circadian or melatonin in 6.

This is the smallest symptom group in this Part, and the Foundation draws the Department's attention to that fact rather than passing over it, because it is the most informative thing about the group and it is adverse to any attempt to read this dataset as a general measure of harm.

Disruption of sleep and of circadian regulation by short-wavelength light at night is the best-established effect in the whole of the literature reviewed at Part V. It has a known photoreceptor, a known action spectrum, a dose-response relationship, and a body of controlled human experiment behind it, and it is the one effect on which the Foundation would expect no serious scientific dispute. Part V.F. It is also the effect least often mentioned in these 593 reports.

The Foundation offers the explanation it believes to be correct, and it is a limitation of its own instrument rather than a finding about the world. This form collects accounts of encounters. A person blinded by an oncoming headlamp knows the moment it happened, knows what caused it, and has something to report. A person whose sleep has been degraded over years by the spectrum of a bedroom lamp or a streetlight outside the window has no moment to report, may not connect the two at all, and has nothing to enter in a form that asks what happened and when. The effect with the strongest scientific support is therefore the one this method is worst at detecting.

Two of the 28 illustrate the chronic pattern when it does appear.

> "I have a difficult time sleeping from all of the LED lights. I get very agitated and irritated since they came out. I really dislike how the blue street lights make me feel."
> — Appendix A, A.433 (Decatur, Georgia, December 24, 2025)

> "My bathroom light flickers and it makes my eyes hurt. Lights have bothered me for years and I have had trouble sleeping for years and taken medication but no help. I'm convinced that LED's are my problem but I'm having trouble getting replacements. I feel stuck."
> — Appendix A, A.491 (Bonney, Wisconsin, February 5, 2026)

The consequence for this proceeding is the one Part VII.J develops. A voluntary form run by a small organization cannot detect a chronic, cumulative, low-grade exposure, and no amount of care in its design would make it able to. Detecting that requires a surveillance system with a defined population and a denominator, which is what the Foundation asked the Centers for Disease Control and Prevention to begin building on March 3, 2023 and what it asks for again at Part IX.D. The gap in this group is the argument for that request.

6. Cognitive effects, fatigue, and nausea

Terms searched: nausea and its forms, vomit and its forms, queasy; dizzy and its forms, vertigo, lightheaded; disorient and its forms, confused, confusion, brain fog; fatigue, fatigued, exhausted, exhaustion. At least one appears in 71 of the 593 reports, which is 12.0 percent. Nausea or vomiting appears in 34 reports, dizziness or vertigo in 18, disorientation or confusion in 18, and fatigue or exhaustion in 14. A form of the words concentrate or focus appears in 29 reports, and the Foundation records that figure separately because those words are also used in these reports in an optical sense, of the eye focusing, and the count cannot be relied on as a measure of cognitive effect.

Three reports in this group are worth setting out, because each has a feature that the others in the dataset mostly lack.

> "Council lawnmower with flashing LED lights drove past me while I was walking along the road. I felt immediate severe head pain, nausea and discoordinated, and fell into the roadside ditch. I then vomited, climbed out with blurred vision and pounding head."
> — Appendix A, A.69 (London, United Kingdom, August 1, 2024)

That report describes a physical injury, immediately following a defined exposure to a flashing emitter, to a pedestrian who was not driving and was not seeking the encounter. The sequence is specific as to time, place and source. The Foundation does not assert that the light caused the fall, because it cannot; it observes that the reporter does, and that this is the kind of account which a reporting system with authority to investigate could resolve and which the Foundation has no means of resolving. Part VII.J.

> "I became extremely nauseated and experienced a headache immediately upon entering Target and Safeway after they had just switched from fluorescent bulbs to led bulbs. I experience eye pain from led headlights and streetlights and have to shield my eyes wherever I go. I feel agitated around led lights at night."
> — Appendix A, A.207 (King County, Washington, December 17, 2024)

The second report describes a change in the reporter's response following a change in the lighting technology of a fixed place, the lighting being the variable the reporter identifies. Part VI.F concerns retail and institutional lighting, and reports of this shape bear on it in a way that reports about traffic do not.

> "The LED lights at work make me feel tired with difficulty concentrating after a few hours. The other work site does not have LED lighting so I am able to compare. I turned down an offer for more hours at work only because of the way the lighting there at the site with LED makes me feel too drained by end of work day."
> — Appendix A, A.563 (Sonoma County, California, August 19, 2026)

The third is the most useful single report in this group, for two reasons. The reporter describes a comparison between two workplaces differing in their lighting, which is the nearest thing to a controlled observation that an uncontrolled dataset contains. And the reporter describes declining additional paid hours because of the lighting, which is an economic consequence in an employment setting. That bears on Part VII.F, and on Part VIII, where the obligations of employers under Title I of the Americans with Disabilities Act are considered, because an employee who reduces their hours to avoid a workplace condition has suffered something the law recognizes even where no diagnosis is in evidence.

7. Reported radiofrequency interference from LED products

This heading was written in anticipation of a group of reports that the dataset does not contain, and the Foundation states the finding rather than filling the heading.

Terms searched: radiofrequency, radio frequency; electromagnetic; EMF; wifi, wi-fi; dirty electricity. At least one appears in 2 of the 593 reports. Both of those two are reports whose

authors selected Electromagnetic Sensitivity as their condition category, and there are 28 such reports in the dataset. So of the 28 reporters who identified themselves as electromagnetically sensitive, 26 described their experience of light-emitting diode products without referring to radiofrequency or electromagnetic fields at all.

Three conclusions follow and the Foundation states each of them against its own interest where that is where they fall.

> There is no body of reports in this dataset about radiofrequency emission from, or radiofrequency interference by, light-emitting diode products. The Foundation does not advance any claim of that kind from this database, and nothing in Part II or Part V of this comment concerning radiofrequency rests on it.
>
> The condition category Electromagnetic Sensitivity therefore functions in this dataset as a label a reporter applied to themselves at the form, and not as a description of what the reporter went on to report. That is a defect in the Foundation's form, which offered a category that the narratives do not populate, and Part VII.A.1 should be read with that in mind. Those 26 reports describe the same ocular, head and somatic effects as the rest of the dataset.
>
> One of the two reports that does mention radiofrequency also contains assertions about published medical findings which the Foundation has not verified, does not adopt, and believes to be inaccurate, including an assertion about a position taken by a national medical association in 2016. The report is reproduced in Appendix A unaltered, for the reason the scope note to that appendix gives, and the Foundation draws attention to it here so that no reader supposes the Foundation relies on it. It does not.

The Foundation has left this heading in place, rather than removing it, because the absence is itself responsive to the Department. This request for information concerns electromagnetic radiation across its range. A reader coming to this Part might reasonably expect a collection of reports connecting the two subjects, and the honest answer is that the Foundation collected 593 accounts of harm from visible light and two of them mention radiofrequency. The Foundation's submission on visible light does not depend on any connection to radiofrequency, and Part I.B explains why it is advanced on its own footing.

C. Reported Exposure Sources and Conditions [RFI Q3.a, Q3.b]

This subsection answers the Department's questions as to the sources of exposure and the conditions under which it occurs. The figures are produced by the method stated at the head of Part VII.B, and the same four limitations apply: the groups are not exclusive, the counts are of reports in which a term appears, and the method both undercounts and overcounts for the reasons given there.

What the reporters say the light came from

One source dominates the dataset. A term from the set headlight, headlights, headlamp, headlamps, high beam, high beams, highbeam or brights appears in 280 of the 593 reports, which is 47.2 percent. The remaining sources, with the terms searched, are:

- streetlight, street lamp or road light: 60 reports;
- a retail or commercial interior, searched as store, stores, supermarket, grocery, restaurant, shopping or the name of a national retailer: 53 reports;
- a household lamp or fixture, searched as bulb, bulbs, light bulb, indoor light, or a named room of the reporter's own home: 50 reports;
- a security light, floodlight, motion-activated light, porch light or a light belonging to a neighbor: 35 reports;
- an emergency vehicle, searched as police, fire truck, ambulance, emergency vehicle, squad car or patrol car: 35 reports;
- a parking lot, stadium or sports field installation: 16 reports;

a taillight, brake light or daytime running lamp: 11 reports;

a bicycle, electric bicycle or scooter lamp: 10 reports;

a cell phone or camera flash, or a handheld flashlight: 8 reports;

a billboard, digital sign or illuminated sign: 5 reports.

The Foundation draws the Department's attention to the first figure, because it determines what this dataset is and bears directly on the central argument of Parts II and IV. Nearly half of the 593 accounts of harm that the Foundation has placed in the Department's possession concern motor vehicle headlamps. Those are products whose photometric requirements are set by the National Highway Traffic Safety Administration under Federal Motor Vehicle Safety Standard 108, and that agency has twice stated that questions about the health effects of the light they emit belong to this Department. Part II.H.21. This is therefore not a dataset that sits at the margin of the jurisdictional question. It is a dataset substantially composed of reports about the single product class that lies across the boundary, and it is the evidentiary basis of the liaison duty the Foundation asks the Department to perform. Part IX.A.

The Foundation also records what this dataset does not contain, because the omission runs against the litigation history described at Part IV. Terms for pedestrian crossing beacons, searched as RRFB, rectangular rapid flashing, rapid flash, crosswalk, crossing light, pedestrian beacon and school zone, appear in only 8 of the 593 reports, and the word beacon appears in 2. Proceedings concerning rectangular rapid flashing beacons have been brought by Mr. Baker in his individual capacity and are described at Part IV and Part VIII. They do not rest on this database, which is overwhelmingly a record of headlamps, area lighting and interior lighting, and the Foundation does not advance this database in support of them.

The conditions the reporters describe

The same method yields the following for circumstances:

a form of the verb drive appears in 345 reports, 58.2 percent, so the dataset is predominantly a record of exposures encountered while driving;

darkness, searched as at night, nighttime, after dark, evening or dark, appears in 260 reports, 43.8 percent;

an oncoming or approaching source, searched as oncoming, approaching, coming at me, facing me or head-on, appears in 109 reports, 18.4 percent;

a source behind the reporter, searched as behind me, rear-view, in my mirror or tailgating, appears in 78 reports, 13.2 percent;

walking or being on foot appears in 47 reports, 7.9 percent;

rain, snow, fog or a wet road surface appears in 38 reports, 6.4 percent.

Two of those conditions deserve separate comment because neither is addressed by any existing federal requirement, and the Foundation returns to both at Part IX.I.

The first is light arriving from behind. Seventy-eight reports describe being affected by the lamps of a following vehicle, by way of the rear-view or side mirrors.

> "I get temporarily blinded when oncoming vehicles have their bright LED lights on, it's hard to drive when being blinded from both in front and behind with the glare of bright led headlights reflecting off both my left side mirror and rear-view mirror."
>
> — Appendix A, A.257 (Richmond, Rhode Island, February 6, 2025)

> "I am 39 with no known vision issues but I keep being blinded by LED headlights in front and behind me. It makes it really hard to see and drive safely at night. LEDs commonly used in new cars are way too bright. I had to pull in my left side mirror and this makes me scared to drive at night."
>
> — Appendix A, A.187 (Cranston, Rhode Island, December 1, 2024)

A headlamp standard regulates the beam a lamp projects forward. It does not address what that beam does after reflecting from the mirrors of a vehicle in front, and the Foundation is aware of no federal requirement that does. Seventy-eight reporters describe exactly that path, and the second of the two above describes the mitigation it forced, which was to disable a mirror required for safe operation of the vehicle.

The second is the number of sources present at once. Eighty-three reports mention a truck, a sport utility vehicle or a pickup, and five describe in terms the lamp being mounted higher than the reporter's own eye position. The Foundation states the smaller figure as well as the larger because only the smaller supports a claim about mounting height. The point it does support is the one developed at Part IX.I: the quantity a person experiences is produced by the geometry of the encounter and by the number of emitters in the scene, and a performance standard expressed as a property of one lamp measured alone does not reach it.

D. Reported Avoidance and Mitigation, and Its Effect [RFI Q3.f]

The Department asks what those affected do about it. The reports describe seven kinds of response, and the Foundation sets out the figures and then the feature they share.

Physical shielding, searched as shield, block, hand up, hand over, visor, look away or avert: 54 reports.

Tinted or filtering eyewear, searched as sunglasses, tinted glasses, tinted lenses, polarized or blue-light blocking: 36 reports.

Altering the route or interrupting the journey, searched as side road, side street, back road, different route, another route, pulling over or pulling in: 30 reports.

Confining travel to daylight: 17 reports.

Covering windows, searched as blackout, curtains, window film or window covering: 8 reports.

Consulting a clinician or taking medication, searched as doctor, optometrist, ophthalmologist, neurologist, medication or prescription: 40 reports.

Stating expressly that a measure did not help, searched as does not help, did not help, no help, nothing helps or does not work: 7 reports.

The Foundation asks the Department to notice what every item on that list has in common. Each is a measure taken by the person exposed, at that person's own cost and inconvenience, to reduce an emission that somebody else produces. Not one of them acts on the source. That is the distribution of burden which the minimizing purpose of paragraph (a)(2) exists to correct, and Part I.B.3 and Part IX state the Foundation's submission on it.

Three of the reports show what the measures cost, and the Foundation sets them out because the figures above do not convey it.

> "I have to hold one hand w/ a newspaper, and bring down my visor, the rear view & side mirrors to block all LED headlights. This makes it very difficult to see any traffic hazards. If the light does hit my eyes, i get a piercing pain back to my optic nerve worse than a migraine."
> — Appendix A, A.95 (Culver City, California, August 6, 2024)

> "I almost hit a car while trying to shield my eyes from an oncoming car with bright lights. …"
> — Appendix A, A.260 (Baltimore, Maryland, February 15, 2025)

> "Bright LEDs make it hard to drive at night. It's blinding and unsafe for me and the public. Sometimes sunglasses help but I shouldn't wear those at night"
> — Appendix A, A.77 (Chicago, Illinois, August 3, 2024)

The first two describe the same thing from opposite ends. A driver who shields their eyes with a hand, a newspaper, a visor or a disabled mirror has reduced the light reaching the retina by reducing the field of view available for driving, and the first reporter says so expressly. The second

reporter describes the collision that nearly resulted. The third states the contradiction in the most common mitigation of all: the measure that reduces the glare is one the reporter knows should not be used at night, because it reduces the light available from everything else as well.

The Foundation accordingly asks the Department to treat these responses as evidence of the magnitude of the exposure rather than as evidence that it has been managed. A mitigation that degrades the function it is meant to protect is not a solution to the problem; it is a measure of how large the problem is. The further consequences, where mitigation fails or is abandoned, are at Part VII.E and Part VII.F.

E. Reported Traffic Safety Consequences

A substantial part of this dataset is about road safety, which is a subject this Department does not regulate and on which it has no view. The Foundation sets the material out for two reasons. It is responsive to the Department's question as to reported harms. And it is the material that the agency which does regulate the product has twice declined to treat as within its remit, on the ground that the health effects of the light belong here. Part II.H.21. The reports in this subsection are the ones that fall in the gap between the two positions.

1. Collisions and near-collisions attributed to glare

Terms searched: collision, collisions, crash, crashed, crashes, rear-end, rear-ended, swerve and its forms, ran off the road, car accident, auto accident, nearly hit, almost hit, nearly crashed, almost crashed, near miss. At least one appears in 36 of the 593 reports, which is 6.1 percent.

The Foundation states the limitation of that figure before relying on it. These are self-reported accounts. No police report, insurance claim or crash record is attached to any of them, the Foundation has not verified any, and in most cases the reporter describes an event that was avoided rather than one that occurred. The figure is a count of reports using those words and nothing more.

> "LED headlights are blinding to the point where I have almost hit deer and other vehicles because I cannot see when the LED lights are coming at me"
> — Appendix A, A.21 (Marshfield, Wisconsin, April 28, 2024)

> "Momentary blindness is caused when hit with bright LED lights. Which in effect can cause a car accident either with another vehicle or pedestrian."
> — Appendix A, A.274 (Phoenix, Arizona, March 9, 2025)

What the Foundation does advance from this group is not a crash statistic. It is the sequence the reports describe, which is consistent across them and is the sequence the photometric literature predicts: a bright source enters the field of view, vision is degraded for a period, and the driver continues to operate the vehicle during that period because the vehicle does not stop. Part V.C.3 sets out the measurement of that degradation, Part V.C.4 the discomfort component, and Part VI.B the vehicle lamps at issue. The Department is not asked to accept any figure about collisions. It is asked to notice that the mechanism the reports describe is a known one, and that 36 reporters describe reaching the point where it nearly or actually produced a crash.

2. Pedestrian and cyclist incidents

Terms searched: walking, on foot, pedestrian, cyclist, cycling, biking, riding my bike, on my bike. At least one appears in 37 of the 593 reports, which is 6.2 percent. This group matters disproportionately to its size, for a reason the Foundation states plainly: a pedestrian or a cyclist struck by a vehicle has no protection, and a pedestrian who is blinded cannot reduce the consequence by slowing down, because the hazard is the vehicle and not their own speed.

> "Everyday I walk and ride bikes in my neighborhood and the local area, and everyday there are headlights so bright that I can't see anything around me. I have almost ridden into parked

> cars, tripped on the curb, and narrowly missed avoiding other vehicles because LED headlights are so bright that nothing else is visible."
> — Appendix A, A.473 (Oklahoma City, Oklahoma, January 10, 2026)

> "I can not walk outside after dusk without LED lights from cars blinding me when I walk on the sidewalk. I have to wear sunglasses when there no sun out. I have to cover my eyes. I've litrally walked into other people before because I CAN'T SEE due to LED headlights blinding me."
> — Appendix A, A.587 (Burlington, Vermont, October 4, 2026)

Both reports describe collisions on foot or on a bicycle, with fixed objects, with the curb and with other people, caused by inability to see. Neither reporter was operating a vehicle. The Foundation draws the connection to Part VIII: a person who cannot cross a street or walk on a sidewalk after dark because of the lighting on it has lost the use of a pedestrian facility, and the loss is of the same kind that Part VIII addresses under the Americans with Disabilities Act, whether or not the person has a diagnosis.

The Foundation records one further matter for completeness and does not rely on it. One report in the dataset consists substantially of a reference to a published news account of a pedestrian fatality, submitted by a member of the public who attributes the death to lighting. The Foundation has not investigated that attribution, does not adopt it, and advances nothing from it. It is reproduced in Appendix A because this comment reproduces every report received.

3. Cessation of night driving

Terms searched: stopped driving, quit driving, no longer drive or driving, ceased driving, refuse to drive, will not drive, cannot drive, can't drive, avoid driving. At least one appears in 45 of the 593 reports, which is 7.6 percent.

This is the most consequential figure in Part VII.E and the Foundation asks the Department to consider why. The 36 reports at subsection 1 describe a risk that materialized or nearly did. These 45 describe people who removed themselves from the road to avoid it. They are not, on their own accounts, people who have been injured. They are people who have given up an activity.

> "Can no longer drive at night due to extremely bright LED headlights blinding me. I have no health issues that would cause sensitivity to bright light"
> — Appendix A, A.173 (Hickory, North Carolina, November 24, 2024)

> "Because of super bright LED lights, I can no longer drive at night. My eyes are very sensitive to that horrible brightness and I had to change my life around this problem. I had to look for a job where my schedule is not ending at night. …"
> — Appendix A, A.82 (Greenville, South Carolina, August 3, 2024)

The first of those two is worth the Department's particular attention because of its second sentence. The reporter states expressly that they have no condition which would explain sensitivity to bright light. Part VII.A.4 records that 128 of the 593 reporters selected None as their condition category, and this is what a number of those reports look like. Whatever the Department concludes about susceptible populations, a portion of this record consists of people who describe themselves as ordinary and describe the emission as the variable.

The second shows the shape of the consequence. The reporter changed employment to avoid driving at night. That is the same consequence as the workplace report at Part VII.B.6 reached by a different route, and it belongs with the material at Part VII.F.

The Foundation makes one argument from this group and confines itself to it. A person who stops driving at night does not appear in any crash statistic, in any injury register, or in any adverse event system. The avoidance is invisible to every instrument the federal government operates, and it is invisible precisely because it was successful. Forty-five reports in this dataset describe it. The Foundation does not know how many people it would describe in a population, and says so at Part

VII.A.5, because it has no denominator. That is the argument for the surveillance capability requested at Part IX.D, and it is the answer to any suggestion that an absence of recorded injury is evidence of an absence of harm.

F. Reported Loss of Access to Public Accommodations, Employment, and Community Life

The reports describe consequences beyond the road, and this subsection sets out what they are. The figures are smaller than those in Part VII.B and the Foundation does not inflate them.

- Fourteen reports state that the reporter cannot, or no longer does, go to, shop at or enter a place, searched as cannot go, can't go, avoid going, stopped going, no longer go, cannot shop or cannot enter.
- Eleven reports describe remaining indoors or ceasing to go outside, searched as stay home, stay inside, stay indoors, no longer go out, housebound or homebound.
- Twenty reports mention the reporter's own workplace or job in connection with the lighting, and two describe a specific employment consequence: declining additional hours, and changing employment to avoid night driving.
- Eleven reports use the language of isolation, social life, community or church.

Three reports show the character of the loss, and each concerns a different kind of place.

> "They installed led lights in my favorite library. The overhead light is so bright, I can't read the spines of the books on the shelves. It hurts my eyes and gives me a migraine to even look toward the shelves. I need polarized sunglasses to enter the library!"
> — Appendix A, A.386 (Readington, New Jersey, November 16, 2025)

> "Big box stores with LED lights make me sick. It is blinding bright and I can't shop. Costco, marshalls, TJ Maxx, grocery stores, LED lights are in most stores. The only way to shop in person is to wear sunglasses and a rollenz eye shield. The lights are flickering and too bright."
> — Appendix A, A.535 (Chicago, Illinois, June 12, 2026)

> "I have to take a rescue medication to go outside at night due to led spotlights, headlights, signs, street lamps, stop lights, and flashlights since they all trigger severe migraines that leave me bedridden without rescue meds and taking the meds too frequently is bad for your health so i avoid going out after dusk."
> — Appendix A, A.578 (Port Angeles, Washington, September 19, 2026)

The first concerns a public library, which is a facility of a public entity and is therefore within Title II of the Americans with Disabilities Act. The second concerns retail premises, which are places of public accommodation within Title III. The third describes the cost of access in the most concrete form the dataset contains, which is a dose of medication taken in order to leave the house after dark.

The Foundation connects this subsection to Part VIII and states the connection carefully, because the legal argument there does not depend on these reports and these reports do not establish the legal argument. What they supply is the factual predicate that Part VIII assumes: that there are people for whom the lighting of an ordinary public place is the thing that excludes them from it. Part VIII then addresses the separate question of what obligations follow, and the answer there turns on the statutes and not on this dataset.

One observation belongs here rather than in Part VIII. In each of the three reports above the reporter identifies a remedy that was available and was not adopted, and in each case it is a property of the installation rather than of the person: a different lamp, a lower output, a different spectrum, the absence of visible modulation. The reporters are not asking for the library or the store to be closed. They are describing a specification. The absence of any federal specification to point to is the subject of Part VIII.D and the reason the Foundation asks for one at Part IX.I.

G. The Petition to Ban Blinding Headlights

The Foundation maintains a public petition to the United States Department of Transportation to limit the intensity of vehicle headlamps, hosted on a third-party petition platform, together with the public comment thread attached to it. Appendix B reproduces that thread.

The Foundation states the evidentiary character of both before relying on either. The signatures are self-selected and unverified. The platform applies no identity check that the Foundation can attest to, the signatories are not a sample of any population, and a signature establishes only that a person signed. Part VII.A.5 states the equivalent limitations of the incident reports and the Foundation applies the same standard here, as Part IV.B.5 does in recording what was transmitted to the agencies.

The comment thread is the part with evidentiary value, and it has that value for a reason unconnected with the number of signatures. Appendix B contains 4,991 contiguous public submissions, each carrying a date and the place the commenter entered, in which members of the public describe in their own words what these products do to them. The Foundation does not count them, does not treat them as a survey, and does not assert that they establish any rate of anything. It reproduces them because they are a body of contemporaneous public description of an exposure that no federal body collects, which is the point Part VII.J makes about the whole of this Part.

The Foundation states no signature count in this comment. Any figure stated would be out of date by the time the comment is read, and Part IV.B.5 records the position taken when totals were transmitted to the agencies.

H. Other Public Reporting Channels

1. NHTSA consumer complaint records

The National Highway Traffic Safety Administration operates a public complaint system for motor vehicles and motor vehicle equipment. It matters to this Part for a reason that has nothing to do with the Foundation: nearly half the reports in Appendix A concern motor vehicle headlamps, Part VII.C, and that agency has twice told the Foundation that the health effects of the light they emit lie with this Department, Part II.H.21. What the other agency has recorded about the same subject is therefore directly relevant, and it has recorded a great deal.

What that agency has said about the complaints it receives

In the final rule of February 22, 2022 amending Federal Motor Vehicle Safety Standard No. 108 to permit adaptive driving beam headlamps, the agency described its own concern about glare and the basis for it. The Foundation quotes the agency's words rather than summarizing them.

> the thousands of complaints NHTSA has received from the public on the issue.

That appears at 87 Fed. Reg. 9919. A footnote earlier in the same document refers to "the numerous complaints from the public it has received," 87 Fed. Reg. 9917 n.1, and the agency elsewhere describes "increased consumer complaints in the late 1990s" in connection with newer headlamp technologies, 87 Fed. Reg. 9919.

The Foundation asks the Department to hold that figure against the proposition in the Final Response of May 24, 2024 that light-emitting diode products have a long history of safety with respect to the visible wavelengths they emit. Part I.C.7. Another federal agency, writing two years earlier in the Federal Register, recorded thousands of public complaints about the light emitted by one class of those products. The Foundation does not suggest that the Department knew of that passage. It observes that the passage is in the Federal Register, that the subject is a product class this Department has classified as emitting electronic product radiation, Part II.B.6, and that § 360ii(a)(3) directs the Secretary to receive information from other federal agencies.

The same agency has described two of the effects this Part documents

Two further passages in that rule describe, in the agency's own words, effects that Part VII.B and Part VII.E record from the reports.

> Headlamp illumination can glare drivers of oncoming or preceding vehicles.

87 Fed. Reg. 9918. The agency adds that this can occur by way of the rear-view or side mirrors. Part VII.C records 78 reports describing exactly that path, including one reporter who disabled a side mirror to cope with it. The mechanism is not disputed by anybody.

> discomfort caused by glare may induce some drivers, particularly older drivers, to avoid driving at night.

87 Fed. Reg. 9919. Part VII.E.3 records 45 reports describing the cessation or avoidance of night driving. The Foundation had set that material out before locating this sentence, and draws attention to the correspondence: the behavior the Foundation documents from first-hand accounts is the behavior the responsible agency had already described in a rulemaking.

One difference between the two accounts is the whole of this comment's subject. That agency characterizes the mechanism as discomfort and annoyance. It does not discuss health effects; the Foundation has read the document and there is no such discussion in it. So the position is that the agency which regulates the lamp treats the consequence as discomfort, and the Department which holds the health mandate has not examined it at all. That is the gap, described from both sides of it.

What the complaint system can and cannot capture

The Foundation states a structural limitation of that complaint system, because it bears on what the thousands of complaints can and cannot be taken to establish, and because it is the same limitation this comment identifies in the Department's own reporting channel.

The system is a defect reporting system. Its purpose is to identify a defect in an identified product so that a remedy or a recall may follow, and its categories are organized accordingly, by vehicle, tire, equipment and child restraint. Two consequences follow for the harm this Part describes.

- The person harmed is usually not the owner of the product. A driver blinded by an oncoming vehicle, and still more a pedestrian, has no make, model or model year to give, because the vehicle has gone. The Foundation has found no category or field in that system for a person affected by a lamp on a vehicle that is not theirs.
- A compliant headlamp is not a defect. Where a lamp meets the photometric requirements of Standard No. 108 and nevertheless blinds an observer, a defect system has nothing to act on, because nothing has failed. Part VII.I.1 identifies the same problem in the Department's own regulation, where the definition of an accidental radiation occurrence requires the event to be accidental and the product is performing as designed. Both federal reporting channels are built around malfunction, and the harm described in Appendix A arises from products working exactly as built.

The Foundation accordingly does not offer the thousands of complaints as a measure of anything. It offers them as proof that the information exists, in federal hands, in volume, and has existed for years.

The proceeding now open, and what this Part adds to it

A second federal proceeding on this subject is open as this comment is filed, and Part II.H.5 sets it out in full: the negotiated rulemaking to modernize Federal Motor Vehicle Safety Standard No. 108, announced on October 6, 2026 and noticed at 91 Fed. Reg. 64462 on October 8, 2026, Docket No. NHTSA-2026-1981, with comments and applications for membership due November 9, 2026 and headlamp glare among the announced subjects. Part II.H.5 states the liaison consequence and Part IX.E.4 states the request. This subsection does not repeat either.

Two details of the notice belong here, because they concern the record of reported harm rather than the liaison duty. The first is the composition of the committee that is to be assembled. The notice provides for up to eighteen members, allocated as four from vehicle lighting manufacturers or lighting retailers, two from national motor vehicle manufacturers, four from national motor vehicle or motor vehicle equipment manufacturing associations, two from national motor vehicle or motor vehicle equipment safety organizations, three from educational, research or testing institutions, and three from national professional engineering or standard setting associations.

The Foundation sets out the arithmetic of that allocation and draws no inference about anybody's motives. Ten of the eighteen seats are allocated to manufacturers, retailers and manufacturing associations. No seat is allocated to a federal health agency, to a clinical body, to a disability organization, or to the people on whom the light falls. Part II.H.5 makes the same observation about the categories and notes that the agency may expand them.

The second detail is what the notice does not contain. It does not mention the Food and Drug Administration, this Department, or the health effects of light, and it does not mention glare to pedestrians. The reports in Appendix A include 47 from people who were walking rather than driving, Part VII.C, and the pedestrian and cyclist incidents at Part VII.E.2 describe collisions on foot. The proceeding that will revise the photometric requirements for these lamps has not, on the face of its notice, identified that class of affected person at all.

2. FDA reporting mechanisms and their treatment of these reports

The Department's own channels are examined at Part VII.I, which sets out the definition of an accidental radiation occurrence, the reporting duty at 21 C.F.R. § 1002.20, the absence of any provision requiring the Department to do anything with a report once received, and the Foundation's own submissions. Part II.L examines the same regulation from the statutory side. This subsection records only what belongs here, which is the comparison.

The Department does have a channel. A member of the public may submit an accidental radiation occurrence report on Form FDA 3649, and the form offers optical as one of its four radiation types. Part VII.I.4. In the letter of May 23, 2019 described at Part II.D.5 the Center stated that it receives and refers complaints of this kind, and Part VII.J.1 accepts that account and records that the Foundation used that route.

The difference between the two agencies is therefore not that one has a channel and the other does not. Both have one. The difference is in what has been recorded. The other agency has published, in the Federal Register, that it has received thousands of complaints from the public about the light emitted by one class of these products. Part VII.H.1. This Department has published no figure at all, and the Foundation has been unable to establish from any public source how many reports concerning visible light from light-emitting diode products it has received, from manufacturers or from anybody else. Part VII.I.4 asks for that figure and Part II.L.3 asks for it in the statutory context.

The Foundation states what it does not infer from that silence. It does not infer that no reports exist, and it does not infer that reports received were disregarded. Section 1002.4 restricts disclosure of information obtained under part 1002, Part VII.I.4, and the absence of a published figure may be explained by that provision, by the absence of any obligation to publish one, or by there being nothing to publish. The Foundation cannot distinguish between those explanations and asks the Department to.

3. Local government complaint records

Sixteen of the 593 reports describe the reporter approaching a city, a county, a borough council, a public works department, a utility or a state utility commission. The Foundation sets this material out because it is the only part of this Part concerning a channel that actually responds to people, and because what the reports describe happening there is the subject of Part VIII arriving from below.

> “Excessively bright, unshielded lights are being set up over the city, some residential, some commercial. Despite being against code, the City does not effectively address the issue. …”
> — Appendix A, A.98 (Knoxville, Tennessee, August 7, 2024)

That report describes a local code that exists and is not enforced. The Foundation makes no finding about the code or the city, and has not examined either.

> “… I for one am tired of the blue lights that I have been told are "broken" in my own township of Springfield, OR. No one seems to care that something that is considered "broken" has gone unfixed. I have shared my concerns with the local officials, anywhere from the Mayor's chat on Instagram to directly contacting our local electric company, SUB, who is in charge of them. The message is "we're working on it", "be patient with us", "this was approved", "it's gonna be fine", "we'll fix things when we can". And here we are two years later and the "broken" blue lights have remained. …”
> — Appendix A, A.280 (Springfield, Oregon, March 24, 2025)

> “… My city is REFUSING to do ANYTHING to bring back ANY form of AMBER streetlights. I've contacted the city AND state A LOT! And they won't do anything. I've even tried contacting the DOT of the state and he won't even be much help. …”
> — Appendix A, A.64 (Albuquerque, New Mexico, July 15, 2024)

The second and third describe the exhaustion of local channels, in the second case extending to the electric utility and in the third to the state transportation department. Two further reports from one reporter in a Pennsylvania borough describe a council that resolved to install whatever lamps the power company supplied and directed the reporter to the state public utility commission.

What these reports show about the absence of a standard

The Foundation draws one conclusion from this group and it is not about any local government. A city councillor, a public works director or a utility engineer asked to do something about a light has no federal number to apply. There is no federal limit on the luminance, the radiance, the irradiance or the spectral distribution of a visible-light emitter in the general environment, Part I.C.7, so a local official who wants to act is obliged either to invent a criterion or to decline. Part VIII.D sets out the same absence as it affects a public entity’s obligations under the Americans with Disabilities Act, and Part VIII.G sets out what a federal performance standard would supply to such an official.

That is the practical case for the relief sought at Part IX.I, and it is independent of everything this comment says about harm. A federal performance standard would not merely protect the people who wrote these reports. It would give the thousands of local officials who must choose lamps a number to procure against, which none of them has now.

I. These Reports Describe Accidental Radiation Occurrences Under 21 CFR 1000.3(a)

1. The regulatory definition — 21 C.F.R. § 1000.3(a)

Part II.L sets out the definition at 21 C.F.R. § 1000.3(a) and examines its three operative features: that the exposure need only be potentially injurious, that the occurrence may arise from the use of an electronic product, and that the events must be accidental. This subsection does not repeat that analysis. It applies the definition to the 593 reports.

The first two elements are satisfied on the face of the reports

As to potentially injurious exposure, the question is not close. The definition does not require demonstrated injury, and 341 of the 593 reports describe an ocular effect, 164 describe headache or migraine, and 39 describe a collision or near collision. Part VII.B and Part VII.E. Whatever

those reports establish about causation, they describe exposures that were at least potentially injurious on any ordinary reading of the phrase.

As to use, the definition reaches an occurrence arising from the manufacturing, testing or use of an electronic product. The exposures these reports describe arise from products in use: a headlamp illuminating a road, a luminaire lighting a store, a lamp in a bathroom. Part VII.C. The definition is not confined to malfunction and the Foundation does not need it to be.

The third element is the difficulty, and the Foundation states both sides

The word accidental is doing work, and Part II.L concedes that a headlamp emitting exactly as it was designed to emit is not obviously the subject of an accident. The Foundation does not retreat from that concession. It makes two observations which bear on how far the concession goes.

The first is textual. The definition speaks of an accidental event or series of accidental events that has resulted in injurious or potentially injurious exposure. It does not say that the product must have failed, malfunctioned or departed from its design. What must be accidental is the event, and an event may be accidental in the ordinary sense because it was unintended and unanticipated by the person it happened to, even though every component worked as built. One report in the dataset makes the point better than argument:

> "I was standing in a room and another person's cell phone buzzed with a message notification. The iPhone also pulsed its LED camera flash, which struck me in the eyes. I fell to my knees, breathing hard, and trying to fight off a panic attack."
> — Appendix A, A.28 (Roseville, California, April 30, 2024)

Nothing failed. A telephone did what telephones do. Whether that is an accidental event is a question the Foundation puts rather than answers, and it is a question about the meaning of the Department's own regulation.

The second observation is that a portion of the dataset does not depend on the point at all, because it describes products not performing as intended. Ninety-nine reports use a form of the words flicker, pulse, strobe or flash, and visible flicker in a product intended to emit steady light is a departure from intended performance rather than an instance of it. Part V.D. Other reports describe lamps aimed above the horizontal, lamps left on an upper beam, and fixtures installed otherwise than as designed. For those reports the accidental element is not strained.

The Foundation accordingly does not contend that all 593 reports describe accidental radiation occurrences. It contends that some do on any reading, that many more do on a reading of accidental that attends to the event rather than to the equipment, and that the Department has never said which reading it applies. The consequence of that silence is the subject of the two subsections below.

2. Form FDA 3649 reports concerning LED light

The Foundation has made at least one such report. On October 14, 2022 it submitted to the Food and Drug Administration a radiation report concerning light-emitting diode lamps mounted on an emergency vehicle. The agency assigned the report case number COR22000194.

Two things follow, and the Foundation states them without embellishment. A channel for reporting optical radiation from these products to the agency existed and was used. And the agency received the report and assigned it a number, so the submission is in the Department's own records and is capable of being retrieved by that number.

What the Foundation cannot say is what was done with it. No determination has been communicated to the Foundation, no finding has been published, and the records bearing on the agency's handling of reports of this kind are among those sought in the action described at Part IV.D.3.

3. What the agency is required to do with such a report

The Foundation examined the regulation to establish what happens to a report once it arrives. The answer is the finding of this subsection, and it is a negative one.

What the regulation requires of the person reporting

Section 1002.20 was amended in its present form in January 2023. It directs a manufacturer who has reasonable grounds to suspect an accidental radiation occurrence to report it to the Director of the Center for Devices and Radiological Health, and it provides that reasonable grounds may rest on documented professional, scientific or medical facts or opinions. It specifies what the report is to contain, so far as known: the nature and location of the incident, the product, the circumstances and suspected causes, the persons affected and the nature of their exposure or injuries, any corrective action, and other pertinent information. It requires immediate reporting of an occurrence associated with a death or serious injury, and permits other occurrences to be reported immediately or compiled into a quarterly summary with a trend analysis and planned mitigations.

The Foundation draws attention to two features of that scheme because they are favorable to the use the Department could make of it. The threshold is suspicion on reasonable grounds, not established causation. And the quarterly alternative expressly contemplates aggregation and trend analysis, which is to say that the regulation already envisages this information being treated as a body rather than as isolated incidents.

What the regulation requires of the agency

Nothing. The Foundation states that plainly because it is the point. Part 1002 contains no provision requiring the Department to review a report received under § 1002.20, to investigate it, to respond to it, to acknowledge it, to publish it, to aggregate it, or to act upon it. The duties in the part run to manufacturers, to dealers and to distributors. The only provision in the part addressed to the Secretary is § 1002.4, and it is a restriction rather than a duty: it provides that the Secretary shall not disclose information reported to or otherwise obtained by him pursuant to the part.

The Department's own guidance is consistent with that reading. The page describing how to submit these reports states that manufacturers discovering a safety problem associated with radiation emission are required to notify the agency, and adds that anyone discovering a safety problem can inform the agency as well. It says nothing about what the agency does with either.

Where the duties actually are

The Foundation does not suggest from this that the Department may receive such reports and disregard them. The obligations exist; they are simply not in part 1002. They are in the statute, and this comment has set them out. A report under § 1002.20 is information received from industry within § 360ii(a)(3). Part II.E. It is material bearing on emissions of, and conditions of exposure to, electronic product radiation within § 360ii(a)(4). Part II.F. And to the extent it discloses a hazard, it bears on the development and administration of performance standards under § 360ii(a)(1). Part II.C.

The structure that results is worth stating precisely, because it explains something this comment returns to repeatedly. The regulation establishes a channel and prescribes nothing that must happen at the far end of it. The statutory duties that would give the channel its purpose are general, continuous and unscheduled. So a report may be properly made, properly received, and lawfully left where it lands, and no document will record that this has happened.

That is why Part VII.J declines to describe this as a surveillance system. A mechanism that accepts information is not a system for detecting anything unless somebody is required to look at what accumulates in it. The Foundation asks the Department to say whether anybody is, and by what instrument.

4. What the record shows was done

This subsection sets out what the record shows, which is less than the Foundation would wish and more than might be expected.

The agency's own form contemplates these products

The report is made on Form FDA 3649, Accidental Radiation Occurrence Report. The Foundation has examined the current form and records three things about it, because each answers an objection that might otherwise be made to this Part.

The form requires the submitter to identify the product by one of four radiation types, and the four are acoustic, ionizing, microwave and electromagnetic field, and optical. Optical radiation is a category on the agency's own accidental radiation occurrence form. The Foundation is therefore not asking the Department to extend a reporting scheme to a new kind of radiation. The scheme already names it.

The form accommodates a submitter who is not the manufacturer, directing such a person to enter their own address and to enter not applicable where the establishment identification is sought. A member of the public is contemplated by the instrument, consistently with the guidance quoted at subsection 3.

The form directs that it be sent by electronic mail to the customer service address of the Center for Devices and Radiological Health. That is the same address to which the Foundation transmitted its periodic compilations of the reports in Appendix A. Part IV.B.2. The Foundation did not choose that address because of this form, but the coincidence disposes of any suggestion that the material was sent to the wrong place.

What the Foundation submitted, and what followed

The Foundation's individual report concerning light-emitting diode lamps on an emergency vehicle, numbered COR22000194 on October 14, 2022, is described at subsection 2, together with the fact that no determination has been communicated. The periodic compilations of the reports in Appendix A were transmitted to the same address, and drew the form acknowledgment quoted at Part IV.B.3. The Foundation has not been told that any of this material was treated as a report of an accidental radiation occurrence, and has not been told that it was not.

What the Foundation cannot establish, and asks the Department to state

Three questions, each about the Department's own records.

How many reports under § 1002.20 has the Department received, from any manufacturer, concerning visible light emitted by light-emitting diode products, and in what years? Part II.L.3 asks the same question and the Foundation repeats it here because it is the single fact that would most change this Part. If the answer is none, that is a fact about compliance with an existing regulation by an industry that has placed billions of these products into commerce, and it is a fact the Department can establish without conducting any study.

How many reports has the Department received on Form FDA 3649 identifying the product type as optical, from any source, in any period? The category exists on the form. Whether it has ever been used for a visible-light product is not something the Foundation can discover.

Was any of the material the Foundation transmitted treated as a report under § 1002.20, and if so with what result? The Foundation does not assert that it should have been. Subsection 2 states that a report from a member of the public is not a report under that section and discharges no manufacturer's obligation.

One obstacle the Foundation states against itself

Section 1002.4 provides that the Secretary shall not disclose information reported to or otherwise obtained pursuant to part 1002. The Foundation raises that provision itself rather than waiting to be met with it. It may be an answer, in whole or in part, to the first two questions above, and it

may bear on the production of records sought under the Freedom of Information Act as described at Part IV.D.

The Foundation makes two points about it and no more. The provision is directed to information furnished by manufacturers, and its evident purpose concerns commercial confidentiality rather than the concealment of aggregate figures; a count of reports received, by year and by radiation type, discloses nothing about any manufacturer's processes. And a confidentiality provision cannot convert the absence of reports into a matter the Department is unable to discuss, because there is nothing confidential about the number zero. If the answer to the first question is none, § 1002.4 is not a reason to withhold it.

J. The Absence of Any Federal Surveillance System [RFI Q10]

1. Adverse event reporting [RFI Q10.f]

No federal system directed at optical radiation collects reports of adverse reaction to it. The Foundation states the position that carefully because the Center has said something adjacent to it, and the Foundation sets the Center's position out before its own.

In the letter of May 23, 2019 described at Part II.D.5, answering a request that a dedicated reporting system be established for radiofrequency exposure, the Center wrote: "A dedicated adverse reporting system is not required because CDRH already has a means for consumers to submit this type of report and those reports are received and reviewed." The letter gave the address of the agency's page for reporting a problem that appears to be related to exposure to electronic product radiation. That page is not confined to radiofrequency energy. On the Center's own account, therefore, a means exists by which a consumer may report an adverse reaction to any electronic product radiation, including optical radiation, and reports made through it are received and reviewed.

The Foundation accepts that account and asks the Department to apply it to this record. It used that route. Part IV.B sets out that between 2022 and 2026 the Foundation transmitted the reports now reproduced at Appendix A to the Center's radiological health customer service address, that the transmittals were acknowledged, and that 593 reports were in the Department's possession before this Request for Information issued. What the Foundation has not been able to identify is any consequence. No determination under § 360ll(e) has been communicated. No analysis has been published. The reports are not reflected in the Final Response of May 24, 2024, which was issued after most of them had been sent.

So the Foundation narrows its claim to what the record supports. It does not say that no channel exists; the Center says one does and the Foundation has used it. It says that a channel is not a surveillance system. A surveillance system has a case definition, a denominator, a published output and a feedback path to the program that is supposed to act on it, and none of those has been identified here. The Foundation asked the Department to establish one.

On March 3, 2023 the Foundation requested that the Centers for Disease Control and Prevention establish a webpage for the collection of reports of adverse reactions to visible radiation emitted by light-emitting diode products. The request was logged and assigned case identifier CDC-2806794-C4V4M6. No such collection mechanism has been established.

The Foundation draws attention to where that request was directed. The Centers for Disease Control and Prevention is a component of this Department. So is the National Institute for Occupational Safety and Health, as Part II.H.10 notes. The request did not ask the Department to persuade another agency, to negotiate with industry, or to resolve any scientific question. It asked one of the Department's own components to open a channel through which members of the public could report what they experienced. That is as small a step as can be proposed, and it was not taken.

The consequence bears directly on a proposition in the Final Response of May 24, 2024. That letter rests in part on the assertion that LED products have a long history of safety with respect to the visible wavelengths they emit. A history of safety, where it is not established by affirmative study, is an inference from the absence of reported harm. The inference is only as good as the reporting. Where no mechanism exists for the public to report, the absence of reports is a fact about the mechanism and not about the products. Part I.C.7 develops the point; this subsection supplies its factual basis, which is that the Department was asked to create the mechanism and did not.

The Foundation does not suggest that the Department is obliged to adopt every suggestion made to it. The point is narrower and is addressed to the evidentiary use the agency has made of silence. An agency that has not established surveillance, and that declined to establish it when asked, is not in a position to read its own empty files as a safety record.

Why a nonprofit organization is collecting these reports

The Foundation created its reporting form because nothing else existed. The form was not built to supplement a federal collection system or to reach people a federal system was missing. It was built in the absence of any such system, and it remains, so far as the Foundation can determine, the only place in the United States where a person who believes they have been harmed by light emitted by a light-emitting diode product can report that to anyone whose business it is to receive it.

The Foundation states the oddity of that position plainly. The usual case is of a private body gathering information a government does not want. This is the opposite. Section 360ii(a)(3) directs the Secretary to receive information from organizations on present and future potential electronic product radiation, and § 360ii(a)(4) directs the study and evaluation of conditions of exposure to it. A small nonprofit organization has been performing the collection function that those paragraphs presuppose, at its own expense, with no authority to require anything of anyone, and transmitting the results to the agency on which the duty falls.

Why the Foundation's data is worse than the Department's would be, and why that is the argument

The Department may reasonably say that the reports collected this way are self-selected, unverified, and not a sample of anything. That is correct, and Part VII.A.5 says so before the Department has to. The Foundation asks the Department to follow the criticism to its conclusion.

Every one of those weaknesses is a consequence of who is doing the collecting.

The form reaches only people who find it, which means people who already suspect that light is the cause of what they are experiencing and who then search for somewhere to say so. A federal reporting channel, published by the agency and linked from its pages, would reach people who have no idea that any such connection has been suggested.

The Foundation cannot verify a report. It has no authority to request a medical record, to contact a clinician, or to inspect an installation. The Department can do the first two by consent and the third through the agencies that administer the places concerned.

The Foundation cannot follow up systematically, cannot standardize the clinical description, and has no mechanism for distinguishing a report of discomfort from a report of a diagnosed condition except by what the reporter chose to write.

And the Foundation cannot establish a denominator. It does not know how many people were exposed under the conditions a reporter describes, which is the quantity that would turn a count of reports into a rate. Part II.D.6 describes the absence of the exposure baseline that would supply it.

The conclusion the Foundation draws is not that its data should be treated as better than it is. It is that the only body capable of producing data that does not have these defects is the Department.

Every methodological criticism available against the LED Incident Reports is a description of something a federal collection system would do and a nonprofit form cannot. The weakness of this evidence is therefore an argument for the system, not an argument against the concern.

The Foundation asked for that system. On March 3, 2023 it requested that the Centers for Disease Control and Prevention establish a webpage for collecting reports of adverse reaction to visible radiation emitted by LED products, and was assigned case identifier CDC-2806794-C4V4M6. None was established. The request was not for a rulemaking, a standard, a study or a finding. It was for a page on a website, within the Department, through which members of the public could report what they experienced.

The Foundation renews that request at Part IX.D, and adds this. It does not ask the Department to adopt its form, its categories, or its data. It asks the Department to establish its own. If the Department does so and receives nothing, that will be a finding worth having, and it will be the first finding on this subject that rests on a method anyone can describe. The Foundation would rather be answered by a federal reporting system that contradicts it than continue to be the only place these reports can go.

2. Disease and illness clusters [RFI Q10.g]

The notice asks about disease and illness clusters. The Foundation answers that it has none to report, states why it cannot have any, and then sets out the one geographic concentration in its record that nobody examined.

A cluster finding requires four things. A case definition, so that it is known what is being counted. A defined population at risk. An expected rate against which an observed number can be compared. And an investigation capable of distinguishing a real excess from the ordinary clumping of a common condition. Part VII.J.1 establishes that none of the first three exists for optical radiation: there is no case definition, there is no exposure denominator, and Part II.D.6 describes the absence of the exposure baseline that a denominator would require.

The Foundation therefore does not present the geographic distribution of its own reports as anything of the kind. Part VII.A.3 gives that distribution. It is a map of where people found a web form, not a map of where exposure occurred, and reading it as the second would be an error the Foundation declines to invite. The same applies to the condition categories at Part VII.A.4, which are self-identified.

The one concentration in the record, and what was done about it

Part IV.E.2 sets out a proceeding before the New York State Public Service Commission concerning street lighting in the Village of Cambridge, Washington County, in which fifty-two residents of the village appeared. The Foundation states what that is and what it is not. It is not a cluster investigation, no case definition was applied to it, no rate was computed, and the Foundation does not assert that the fifty-two share a condition or that any of them was injured. It is an administrative proceeding in which a number of people in one small place complained about one installation.

What the Foundation asks the Department to notice is narrower and does not depend on any of that. A geographic concentration of complaints about a single identified installation is the circumstance in which a surveillance system would look. No federal body looked, because no federal body collects, and the utility regulator that did take the matter up has no authority over an emission and no criterion to apply to one. The concentration is not evidence of a cluster. It is evidence that the capability to answer the question does not exist.

What exists in the published literature, and how it differs

One published finding in this record is epidemiological rather than anecdotal, and the Foundation distinguishes it carefully because the two are not the same kind of thing. Part II.E.6 sets out research published in a journal of this Department reporting an association between outdoor artificial light at night and pediatric papillary thyroid cancer, and records what Part II.E.6 also records: that the

International Agency for Research on Cancer has classified night shift work involving circadian disruption and has not classified outdoor artificial light at night, and that the two are not the same exposure. An association reported in a population study is not a cluster, is not a finding of causation, and the Foundation advances it as neither.

What the Foundation asks for under this head is at Part IX.D, and it is specific to this question. A reporting system that records only a symptom cannot support a cluster inquiry. One that records the location, the installation and the product class alongside the report can, and Part IX.D asks for the second.

3. Occupational and environmental monitoring [RFI Q10.b, Q10.c]

The notice asks about occupational and environmental monitoring. There is none of either for optical radiation from general lighting. The Foundation sets out each in turn, and in each case identifies the component of this Department that already holds the relevant capability.

Occupational

Part II.H.10 sets out the position of the agency that administers occupational safety and health, and the Foundation does not restate it. No general industry standard prescribes a maximum luminance, a spectral characteristic, a glare limit or a modulation limit for workplace lighting, so there is no quantity an employer is required to monitor and no exposure record anyone is required to keep. A workplace may be measured for illuminance to establish that there is enough light. Nothing requires it to be measured to establish that there is not too much.

The capability exists inside this Department. The National Institute for Occupational Safety and Health is a component of it, as Part VII.J.1 and Part II.H.10 both note, and it conducts workplace health hazard evaluations on request. The Foundation does not know whether any such evaluation has ever been requested or conducted concerning light-emitting diode lighting, and it says so rather than asserting a negative it cannot establish. It asks the Department to determine the answer, which is a question the Department can resolve from its own files without consulting anyone outside it, and to state the answer on this record.

What the record contains in the meantime is reported rather than monitored. Part VIII.B.6 records that thirty-two of the 593 accounts at Appendix A describe work or employment, including an employee who reports the onset of migraine with aura after a move to a building with ceiling diodes about seven feet above the desk. Part V.H treats occupational exposure. Those are reports, not measurements, and the distinction is the subject of this subsection.

Environmental

No federal program monitors ambient artificial light at night as an exposure. Part II.H.3 records that the Environmental Protection Agency stated it holds no statutory authority over visible light or non-ionizing radiation from electrical devices and has no experts in the subject, which disposes of the agency that would otherwise be the natural home for ambient monitoring.

Something close to monitoring does exist and the Foundation states it accurately, because the difference between what it measures and what would need to be measured is the point. Satellite radiometry operated by federal agencies records upward radiance from the night surface of the earth, and that data is federally produced, published and used in research, including research this comment cites at Part V. What it measures is the light that escapes upward. What a monitoring program for this subject would have to measure is the light that arrives at a person, at eye height, in the direction they are facing. Those are different quantities, and Part VIII.A sets out the same distinction in the form it takes for a public entity: the emission and the exposure are not the same measurand, and paragraph 360ii(a)(2) names them separately.

So the position is that the federal government measures what the installation sends into the sky and nothing measures what it sends into a bedroom. Part VI.D and Part VI.P treat the installations

concerned, and Part III.D.5 records that the maxima which exist for light trespass are municipal and state rather than federal.

The Foundation asks for both under this head at Part IX.D, and adds one request specific to this subsection, which is that the Department state what its own components have measured. The answer may be nothing. If it is, that answer is more useful on this record than the Foundation's inability to find anything.

K. Sensitive and Disproportionately Affected Populations [RFI Q11]

The Department asks which populations may be disproportionately affected. The Foundation answers from the reports, and then makes a submission about the structure of the question which it regards as more important than the answer.

What the reporters say about themselves

The self-identified condition categories are set out at Part VII.A.4 and the Foundation does not repeat the table. Four groups in it correspond to susceptibilities for which Part V identifies a described mechanism, and the Foundation notes the correspondence without asserting that the reports demonstrate it.

Conditions of the eye and of the ocular media, being astigmatism at 90 reports and, in the narratives, cataract, lens replacement or eye surgery at 12 and macular, retinal or glaucomatous conditions at 14. The mechanism is forward scatter of light within the eye, which increases the veiling luminance produced by a bright source and is treated at Part V.C.3.

Migraine, at 99 reports, with a described mechanism of photic trigger and interictal photophobia at Part V.E.

Photosensitive seizure disorders, with epilepsy selected by 10 reporters, and the regulatory treatment of modulated light discussed at Part VII.B.3 and Part VIII.D.4.

Autism and sensory processing differences, with autism selected by 54 reporters and terms for autism, Asperger syndrome, neurodivergence or sensory processing appearing in 18 narratives. Part VII.A.5 discloses that 31 of those 54 reports come from one area of California, which is the Foundation's own locality, and that figure should be read with that disclosure and not as a national distribution.

Photophobia was selected by 43 reporters. The Foundation records it separately because photophobia is a symptom rather than a diagnosis, so those reporters have identified an effect and not a condition, and the category cannot be used to describe a population.

Two further groups appear in the narratives in numbers too small to support any proposition, and the Foundation states them for completeness only: brain injury or concussion in 7 reports, and Sjogren syndrome or dry eye in 5. Ten reports mention a child of the reporter, in almost every case as a passenger in a vehicle the reporter was driving while affected, rather than as a person reporting an effect. Two mention military service. No report in the dataset is identifiably from a person under eighteen, and the Foundation draws attention to that absence rather than treating it as information: children do not complete reporting forms, so a dataset of this kind cannot speak to them at all.

The submission the Foundation regards as more important

The question as the Department has framed it invites an answer in terms of minorities with identifiable conditions. The Foundation asks the Department to notice two features of this record which cut against that framing, because they bear on what a performance standard would have to do.

The first is arithmetical. One hundred and twenty-eight of the 593 reporters, which is more than a fifth, selected None as their condition category. Fourteen reports go further and state affirmatively that the reporter has no relevant condition.

> "I have perfect vision, and every time a vehicle with LED headlights comes towards me, I am blinded, with a dramatic loss of night adapted vision. This is a huge safety hazard, as the dazzling light obscures the presence of hazards or pedestrians that are unfortunate enough to be caught behind it."
> — Appendix A, A.463 (Centennial, Colorado, January 8, 2026)

> "Can no longer drive at night due to extremely bright LED headlights blinding me. I have no health issues that would cause sensitivity to bright light"
> — Appendix A, A.173 (Hickory, North Carolina, November 24, 2024)

The Foundation cannot verify those statements and does not advance them as established. What it says is narrower. A substantial part of this record consists of people who describe themselves as ordinary, who identify no susceptibility, and who describe the emission as the variable that changed. A standard calibrated to protect only populations with identified conditions would not be addressed to them.

The second feature is the more significant and it concerns age. The susceptibility with the best established mechanism in this whole subject is the age-related increase in forward scatter within the eye, to which the development of cataract contributes markedly. Part V.C.5, which addresses age, astigmatism, cataract and intraocular lenses as modifiers, and Part V.C.3. That is not the condition of a minority. It is the condition of everybody who lives long enough, and the reports describe its onset in terms the Department can read for itself.

> "I have early cataracts. The LED headlights blind me, whereas halogen lights do not impair my vision at all. At a minimum adaptive driving beams should be required in the US like they have been used in Europe since 2012."
> — Appendix A, A.73 (Austin, Texas, August 3, 2024)

That reporter identifies the comparison that matters: the same eye, the same road, two light sources, and a difference in effect between them. The Foundation accordingly submits that the sensitive population for optical radiation from these products is not well described as a set of patient groups. It is better described as the general population, ordered by age, with particular conditions advancing an individual's position in that order. A standard built on that understanding is a standard for everybody, and Part IX.I asks for one.

What the Foundation does not claim

The Foundation does not assert that any reporter has the condition they selected, that any condition was caused by light emitted by light-emitting diode products, or that the proportions in Part VII.A.4 describe the proportions in any population. Part VII.A.5 states the limitations and every one of them applies here. In particular, a category selected by many reporters may reflect only that the Foundation's form reached people in that group, and the autism concentration disclosed at Part VII.A.5 is a demonstrated instance of exactly that effect.

The Foundation also declines to supply what it does not have. A proper answer to the Department's question would state, for each susceptible group, the exposure at which effects begin and how that exposure differs from the general population. The Foundation cannot supply a single such figure. Nobody can, from this dataset or from the published literature as it stands, and Part V.L sets out what would be needed. That is the answer to the Department's question about sensitive populations: the groups can be named, the mechanisms can be described, and the thresholds are unknown because the measurements have not been made. The Foundation asks the Department to make them. Part IX.C, and Part IX.L, which asks the Department to address sensitive populations expressly.

VIII. DISABILITY ACCESS AND THE ABSENCE OF A FEDERAL BASELINE

A. Why This Is Responsive to the RFI [RFI Q9, Q11]

Two questions of the notice make this Part responsive, and the Foundation identifies them rather than asserting relevance in general terms. Question 9 concerns the information that should be disclosed to state and local governments. Question 11 concerns populations that may be disproportionately affected. This Part answers both, and it answers them with the same fact: an apparatus of federal and state disability law is already operating, it imposes obligations on many thousands of entities, and at the point where each of those obligations has to be discharged it requires an input that no federal body has supplied.

a. The apparatus, which exists and is already operating

Title I of the Americans with Disabilities Act reaches employers, and the workplace is a place of exposure a person cannot leave for the duration of their shift; Part VIII.B.6 treats it. Title II reaches public entities. Title III reaches places of public accommodation. Section 504 of the Rehabilitation Act reaches recipients of federal financial assistance and the programs of federal agencies, including this Department's own. Part VIII.B sets out the framework and the decisions relied on.

Within it, three mechanisms bear on an emitting product. The self-evaluation duty at 28 C.F.R. § 35.105 requires a public entity to evaluate its own services, policies and practices and to remedy what does not comply; Part VIII.C describes what performing it for a light-emitting product would require. The individualized, fact-specific inquiry that a request for accommodation triggers is distinct from that systemic duty, and Part VIII.F describes it. And the communication-specific duties at 28 C.F.R. §§ 35.160 to 35.164 require that a communication be as effective for a person with a disability as it is for anyone else, which reaches an emitting product whenever the product is the medium of the communication; Part VIII.B.5 sets out those provisions and the precise relationship between them and the visible notification appliance, which is the one place in the framework where an optical quantity is already specified: Part VIII.D.4.

Three federal bodies write or administer those rules. The United States Access Board issues the accessibility guidelines. The Department of Justice issues the Title II and Title III regulations and adopts the standards under them. The Equal Employment Opportunity Commission administers Title I, and Part VIII.B.6 records that the Foundation wrote to its Chair on February 26, 2023. All three are among the federal agencies collected at Part II.H: the Access Board at Part II.H.11, the Department of Justice at Part II.H.18, and the Commission at Part II.H.19. The Foundation draws attention to the last two because the reason for their inclusion is the subject of this Part. The Department of Justice writes the rules that determine when an emission becomes a barrier to the services of a public entity, and the Commission administers the provision that reaches the same emission in the workplace. Neither tests an electronic product, and Part II.H.18 sets out the Foundation's position on how the liaison paragraph reaches them. Part II.H.11 treats the Access Board, which has already said the subject is not within its authority and offered technical assistance to this agency on request.

State civil rights agencies and statutes operate in parallel, and they have already acted. Part IV.E sets out the proceedings. This Department also sits inside the apparatus rather than outside it: Part VIII.B.3 records that it is a designated agency under Title II for a class of public entities, and section 504 reaches its own programs.

b. What every part of that apparatus needs, and nobody supplies

At the point where any of those mechanisms has to decide whether a particular light is a barrier, each needs the same two things: a statement of what the product emits, and a referent against which to judge it. Neither exists. Part VIII.D establishes the absence. There is no performance standard for

the visible light emitted by light-emitting diode products, and no federal exposure guidance for optical radiation from general lighting.

The consequence is not that the duty is suspended, and Part VIII.D.3 states it exactly: the duty is owed, and the technical basis for performing it is missing. Each entity must therefore answer a question of photobiology for itself, or decline to answer it. Part VIII.E sets out what follows from that, and Part VIII.E.6 sets out what happened when a federal office was asked.

This is the respect in which the whole apparatus depends on this Department, and the dependence is a matter of statutory assignment rather than of convenience. The duty to study and evaluate the emissions and the conditions of exposure is at § 360ii(a)(4). The duty to minimize them is at (a)(2). The authority to prescribe a standard is at § 360kk. Part I.A establishes that no other federal agency holds any of them, and that the nine agencies asked have each said so.

c. The record already contains findings, an open docket and accommodations

The Foundation sets these out because they establish that the question is not prospective. It is being decided now, by bodies that have no federal criterion to decide it against.

A state enforcement agency has made a finding. Part IV.E.1 sets out the determination of the Minnesota Department of Human Rights of June 15, 2023 in file REF: 74059, in which the agency found probable cause that a respondent discriminated against a charging party whose disability-related symptoms were attributed to lighting. The Foundation states what that is and is not, as Part IV.E.1 does: a probable cause determination under the Minnesota Human Rights Act is a threshold finding that a charge warrants proceeding, and it is not an adjudication of liability.

A state utility regulator has an open docket. Part IV.E.2 sets out Case 23-E-0727 before the New York State Public Service Commission, in which fifty-two residents and customers of the Village of Cambridge, Washington County, New York complained on December 13, 2021 of the conversion of the village's streetlights to light-emitting diodes. The Foundation describes it as what it is, a complaint proceeding, and does not characterize its outcome.

The Foundation records one instance in which an accommodation was sought and granted, and it is the only such instance it has. On April 3, 2026 the city of Ketchikan, Alaska placed three low-pressure sodium streetlights in service in substitution for blue-rich light-emitting diode streetlights. The Foundation's account, which is set out at Part III.G.3 with its basis and its limits, is that a resident living above the street requested an accommodation under the Americans with Disabilities Act, on the basis that the blue-rich installation was producing adverse reactions in them, and that the city provided the accommodation requested by substituting the amber source. The characterization of the installation as a pilot is the supplier's and not the city's, which Part III.G.3 sets out. The Foundation does not identify the requester.

Three features of that instance bear on this Part, and the Foundation states the third against itself. The first is that the mechanism worked: a request under the framework at Part VIII.B produced a change in an emission, which establishes that the framework is capable of reaching this subject matter. The second is what it took. Appendix A contains two reports from that municipality, at A.158 and A.477, the earlier describing the conversion of the city's streetlights in February 2021 to unshielded sources of four to five thousand kelvin, and the substitution was placed in service in April 2026. The third is that the city had no federal criterion to apply at any point in that sequence, and neither did the requester. What was available to be weighed was one person's account of their own experience against an installation nobody had measured. The outcome in that municipality turned on the judgment of that municipality, which is the condition Part VIII.E describes and the reason this comment is addressed to this Department rather than to any city.

And individual proceedings are being brought. Part IV.D and Part IV.E describe actions brought by Mark Baker in his individual capacity against municipalities, which Part IV.A.2 identifies as his rather than the Foundation's. The point about them that bears on this Department is not their

merits, on which this comment takes no position. It is that each is an attempt to obtain from a municipality a determination that a municipality is not equipped to make.

d. The populations, and the care the Foundation takes with the list

Part V.E sets out the evidence for the responses that bear on this: photosensitive epilepsy and flash-rate thresholds, migraine and photophobia, autism and sensory processing differences, and the trigeminal and autonomic pathways. Part VII.A.4 records the self-identified condition categories of the 593 reporters at Appendix A, and Part VII.K treats sensitive and disproportionately affected populations. Part IX.L states the request the Foundation makes about them.

The Foundation is careful with this list and says why. The categories at Part VII.A.4 are self-identified and are not diagnoses; Part VII.A.5 states the limit of what the database establishes. Several conditions appear in the reports and nowhere in the literature the comment relies on. One category reported to the Foundation, a self-identified sensitivity to electromagnetic fields, is treated at Part VII and the Foundation does not include it among the conditions for which the literature establishes a light-mediated mechanism. It says so expressly, because a list that mixed established and unestablished conditions would be discounted as a whole, and the established ones are enough.

What the Foundation asks about these populations is accordingly a question of study design rather than a claim about any individual: that the research directed by § 360ii(a)(2) and the evaluation directed by (a)(4) include them rather than control for them, which is the request at Part IX.C.6, and that any criterion state the population whose response it is calibrated to, which is the request at Part III.F.

e. Why this is brought to this Department and not to the entities being asked

Because the apparatus cannot generate the input it requires. A municipality asked whether its streetlight is a barrier must answer a question of photobiology. A state civil rights agency investigating a charge must answer the same question. A federal civil rights office receiving a complaint must answer it, and Part VIII.E.6 records what one did when it was asked.

The Foundation states the limitation precisely, because the broad version of it is wrong and would be refuted at once. It is not that these bodies lack authority over emissions. States and municipalities have that authority and exercise it. A state vehicle code prescribes what a lamp fitted to a vehicle may do. Municipal instruments limit what an outdoor installation may emit and in which directions, and Part III.D.5 records that the maxima which exist for light trespass are municipal and state rather than federal. Nothing prevents a city or a state from measuring what its own installations emit, and some have done so.

What none of them can supply is an exposure criterion, and that is a different thing from an emission limit. The two are distinct quantities and paragraph 360ii(a)(2) names them separately: the emissions of, and the exposure of people to, unnecessary electronic product radiation. A municipality can resolve that its luminaires will emit nothing above the horizontal, and that resolution is complete and enforceable without any federal input. It cannot resolve at what retinal irradiance, at what modulation depth, or at what spectral composition a person is harmed, because that is a question about human physiology rather than about municipal policy. Part VIII.D establishes that no federal exposure guidance for optical radiation from general lighting exists for it to adopt, and Part III sets out the sixteen characteristics in which such a criterion would have to be expressed.

That is the division this comment turns on and the Foundation states it in one line. The entities within the apparatus can regulate what a product emits. They cannot determine what a person may safely receive. The second is the question Congress assigned to this Department at § 360ii(a)(4) and (a)(2), and Part I.A establishes that it assigned it nowhere else.

So the Foundation's answer to Question 9 is that the disclosure the question asks about is precisely the missing input, and Part VIII.G and Part IX.F set out what disclosure would have to contain. Its

answer to Question 11 is that the populations the question asks about are the ones on whom the absence of a criterion falls, because a framework that cannot identify a barrier systemically leaves each affected person to establish it individually, which is the movement Part VIII.E and Part VIII.F describe. Both answers rest on one fact, and the fact is in this Department's keeping.

B. The Federal Disability Framework

This subsection sets out the federal provisions the remainder of this Part relies on. The Foundation sets them out because a comment addressed to this Department about an emitting product has to establish that the duties exist before it can establish what the absence of a federal criterion does to them, and because two of the provisions reach this Department directly rather than by analogy.

The provisions divide into six. Two are systemic: the self-evaluation duty that reaches public entities, at subsection 1, and section 504 of the Rehabilitation Act, which reaches recipients of federal financial assistance and the programs of federal agencies, at subsection 2. One reaches this Department in a particular capacity, as the agency designated to receive and investigate complaints against a class of public entities, at subsection 3. One is individualized and arises on a person's request rather than on the entity's own initiative, at subsection 4. One governs the effectiveness of a communication, at subsection 5. And one reaches the workplace, at subsection 6. Subsection 7 sets out the decisions relied on and states what the Foundation does not take from them.

The Foundation states the limitation of all of them at the outset. None of these provisions names light. None fixes a quantity an emitting product may produce, with the single exception at Part VIII.D.4, which fixes a floor rather than a ceiling. They are provisions about access, and about the effectiveness of a service or a communication, and they operate on whatever the barrier turns out to be. The Foundation does not represent that any of them has been held to reach an optical emission. What this Part draws from them is narrower: each requires somebody to answer a question about an emission, and Part VIII.D establishes that no federal answer exists for any of them to use.

1. ADA Title II and the self-evaluation duty — 28 C.F.R. § 35.105

The regulation is the Department of Justice's, issued under Title II of the Americans with Disabilities Act and codified at 28 C.F.R. part 35. Section 35.105 is short. The Foundation paraphrases it in the three paragraphs that follow rather than quoting it, and says that it is paraphrasing, because the text has not been verified against the current Code in the preparation of this comment.

The evaluation itself

A public entity is required to evaluate its current services, policies and practices, and the effects of them, which do not or may not meet the requirements of the regulation, and then to make whatever modifications that evaluation shows to be required. The duty attached within one year of the date the regulation took effect, which was in the early 1990s.

Participation by interested persons

The entity is required to give interested persons, including individuals with disabilities and organizations representing them, an opportunity to participate in the evaluation by submitting comments. The Foundation is an organization of that kind and notes the provision for a reason that bears on this comment rather than on its own standing: participation of that kind is worth something only if the participant can say what to measure. Part VIII.C.2 establishes that at present nobody can, which is a limitation on the Foundation as much as on anyone else.

The record

An entity employing fifty or more persons is required to keep, for at least three years after the evaluation is complete, a list of the interested persons consulted, a description of the areas examined and the problems identified, and a description of the modifications made, and to make

those available for public inspection. The consequence is that the adequacy of a self-evaluation is a matter of record rather than of assertion, at least for entities above that threshold.

Why the date matters here

The date matters in this subject more than it usually does. The duty attached, and the first evaluations were performed, before the products this comment concerns were installed anywhere. Part IV.G sets out the federally driven transition to light-emitting diodes, and Part IV.G.5 establishes that no biological or health evaluation accompanied it. A public entity that completed its self-evaluation in the early 1990s evaluated a program lit by a technology it has since replaced.

The Foundation states carefully what follows from that, because more does not follow than it is asserting. It does not assert that a lighting conversion triggers a fresh self-evaluation as a matter of law, and it is aware of no decision so holding. It relies on a narrower proposition, which subsection 7 attributes to the decision it comes from: whether a completed self-evaluation covered all of an entity's current services is a question of fact. An entity whose evaluation predates its present installation has not, on that proposition, established that the evaluation reached it. Part II.I.6 makes the comparable observation about this Department's own duty under 21 U.S.C. § 360jj, where the statutory structure is continuing for the same reason.

The reason this belongs in a comment to this Department rather than to the author of the regulation is at Part VIII.H, and the Foundation restates it in one line. It asks nothing of the regulation and nothing of the agency that issued it. It asks this Department to supply the technical referent that performing the regulation requires, which is a thing only this Department can supply, and Part VIII.C sets out step by step what performing it would require for a product that emits optical radiation.

2. Section 504 of the Rehabilitation Act and the Department's own implementing regulations

Section 504 of the Rehabilitation Act of 1973 is at 29 U.S.C. § 794. It reaches two classes of program, and the second is what makes this Department a subject of the provision rather than an observer of it. The first is a program or activity receiving federal financial assistance. The second is a program or activity conducted by an Executive agency, which includes this Department's own.

The Department has issued regulations under the provision. Those applying to recipients of its financial assistance are at 45 C.F.R. part 84, and those applying to the programs the Department itself conducts are at 45 C.F.R. part 85. The Foundation states those part numbers as its understanding and has not verified them against the current Code, and it asserts nothing about their contents beyond their subject matter.

The first branch: the recipients

The recipients of this Department's financial assistance include hospitals, clinics, community health centers, and state agencies administering health and social service programs. Each operates facilities, and the facilities are lit. Part VI.E addresses interior lighting in healthcare settings, and the accounts at Appendix A include reports from medical settings. The provision reaches those recipients, and what it requires of them as to an emission runs into the same absence Part VIII.D describes. A recipient asked to modify the lighting in a facility where a federally assisted program is delivered is in the position Part VIII.C describes, with no federal characterization of the emission to work from.

The second branch: the Department's own programs

The second branch reaches the Department directly. Whatever the Department conducts itself, it conducts subject to the provision. Part III.F draws the consequence for the content of a performance standard rather than for the Department's conduct: a criterion written to the comfort of an unimpaired observer, adopted by a Department that carries this duty, would exclude by construction the people the duty exists to reach. The Foundation does not develop that into an allegation. It states it as a reason the Department should characterize the emission with the exposed

person in view, which is what Part III.F sets out as a characteristic and what Part IX.L asks as a recommendation.

What the record contains under the provision

One complaint under the provision is in this record, and the Foundation records its outcome rather than its merits. Part VIII.E.6 and Part II.H.6 set out the sequence. A complaint under Title II and section 504 concerning rectangular rapid-flashing beacons was submitted by Mr. Baker individually. The Department of Justice transferred it to the Department of Transportation. On October 19, 2022 the Office of Civil Rights of the Federal Highway Administration dismissed it without investigation, and Part II.H.18 sets out the regulatory ground on which that dismissal rested. The Foundation draws one thing from it: a complaint under the provision reached a federal agency and produced no inquiry into the emission.

The Foundation makes no allegation against this Department under the provision. It has filed no complaint under it against the Department, none is pending, and nothing in this Part should be read as one. The provision is set out because the Department's duties under it and under 21 U.S.C. § 360ii meet in the same buildings, and because a Department subject to it has a reason beyond § 360ii to know what the lighting in those buildings emits.

3. The Department as a designated agency under Title II

The Department is a designated agency under Title II. The designation is made by the regulation at 28 C.F.R. § 35.190, which allocates among federal agencies the function of receiving and investigating complaints against public entities and of providing technical assistance. The class allocated to this Department is programs, services and regulatory activities relating to the provision of health care and social services.

The consequence is that the Department is not a bystander to the problem the rest of this Part describes. In the capacity the designation gives it, the Department would receive a complaint that a public entity delivering health care or social services had failed to evaluate its services as 28 C.F.R. § 35.105 requires, or had denied a requested modification. It would then have to investigate that complaint. Part VIII.C establishes that the evaluation cannot be completed as to an emitting product, because no federal characterization of the emission exists, and Part VIII.D establishes that none exists for the Department to apply in the investigation either.

That places the Department in an unusual position, and the Foundation states it plainly because it is the most direct thing this Part has to say to this Department. In one capacity the Department holds the function of investigating whether a covered entity has evaluated what its lighting does to the people its programs serve. In another it holds the only congressional authority to establish what that lighting may do, which Part I.A establishes was assigned nowhere else. The first function cannot be discharged on a record the second has never created. No other federal agency holds both.

The Foundation confines itself to the structural point. It does not assert that the Department has received a complaint of this kind, or that any has been filed with it. It observes only that the two capacities sit in different components of the same Department, the designated-agency function with the component that administers civil rights and § 360ii with the Center for Devices and Radiological Health. Part IX.E.5 asks the Department to send express written invitations to consult to other federal agencies. The Foundation observes that the first such relationship available to the Department is an internal one, and that it requires no invitation from anybody.

4. The individualized inquiry duty, distinct from the systemic duty

The duties at subsections 1 to 3 operate on a program. This one operates on a person. The Foundation separates them because they fail differently when no federal criterion exists, and because the failure of the first is what loads the second.

The individualized duty arises from the requirement that a public entity make reasonable modifications to its policies, practices and procedures when necessary to avoid discrimination on

the basis of disability, at 28 C.F.R. § 35.130(b)(7), and from the communication duties at subsection 5. Its content comes from the decisions, which subsection 7 sets out and which the Foundation does not restate here. The propositions relied on are two: that once an entity is on notice of a request it must undertake a fact-specific investigation and gather sufficient information to determine what accommodation is necessary, and that whether a modification would fundamentally alter what the entity offers is answered by an inquiry into the particular person and the particular modification rather than by a general rule.

The two duties differ in four respects, and the Foundation sets them out because the fourth is the one this comment turns on. The comparison is the Foundation's own and is not drawn from any decision.

The trigger differs. The systemic duty arises on the entity's own initiative and on a date fixed by the regulation. The individualized duty arises when a person makes a request, and it arises then whether or not the entity ever performed the systemic duty at all.

The object differs. The systemic duty is owed as to the program. The individualized duty is owed as to one person, one barrier and one proposed modification.

The record differs, and this is where the absence of a criterion does its work. The systemic duty is performed on whatever the entity can learn about its own services, and Part VIII.C.2 establishes that as to an emission it can learn nothing it can state as a number. The individualized duty is performed on the record one requester can assemble, which in practice is an account of that person's own experience, because Part VIII.F.2 establishes that there is no threshold against which a measurement they commissioned would mean anything.

The consequence differs, and the difference is not symmetrical. A systemic duty that cannot be performed produces no visible failure: nothing happens, no document is generated, and nobody is told. An individualized duty that cannot be performed produces a decision, and the decision falls on the requester, because the requester carries the work of establishing a harm the federal government has never characterized. Part VIII.E.5 states that consequence in general terms as the systemic duty defaulting into the individualized one, and Part VIII.F describes what it looks like when it happens to somebody.

The Foundation asks nothing of this duty, and says so because the opposite request would be the natural one to suspect. It does not ask that the individualized inquiry be relaxed, and it does not ask that a request be granted without one. The fact-specific inquiry is the right method, and an entity that conducts it properly is doing what the provision requires of it. What the Foundation asks is that the inquiry be given something to work with. An entity conducting it needs to know what the product emits and at what level a person is affected, and Part VIII.G.4 sets out what a federal performance standard would supply to it.

5. Communication-specific duties — 28 C.F.R. §§ 35.160 to 35.164

These provisions are about the effectiveness of a communication rather than about the accessibility of a place, and that is why they appear in a comment about an emitting product. The medium of a communication from a public entity is now frequently an emitting product.

The Foundation summarizes the five sections and again states that it is summarizing. Section 35.160 is the general provision: an entity must take appropriate steps to ensure that its communications with applicants, participants, members of the public and companions with disabilities are as effective as its communications with others, and must furnish appropriate auxiliary aids and services, giving primary consideration to the aid or service the person requests. Section 35.161 concerns telecommunications. Section 35.162 concerns telephone emergency services, which must provide direct access. Section 35.163 concerns information and signage, and requires an entity to ensure that interested persons can obtain information as to the existence and location of its accessible services, activities and facilities. Section 35.164 states the limitation, and subsection below treats it separately.

A correction the Foundation makes to its own formulation

Part VIII.A says that these provisions reach the visible notification appliance. Stated that way it is too loose, and the Foundation states the relationship precisely here rather than leaving the looser version to be answered. The optical numbers that exist for a visible alarm are in the accessibility guidelines and standards, which govern new construction and alterations and are adopted under a different provision of the same part. Part VIII.D.4 sets out those numbers and their source. Sections 35.160 to 35.164 fix no optical quantity at all. What they fix is an outcome: the communication must be as effective for a person with a disability as it is for everybody else.

An outcome duty of that kind reaches the medium whenever the medium determines the outcome, and that is the connection this subsection relies on. An emergency alarm conveys a message to a person who could not otherwise receive it. A dynamic message sign conveys a traffic instruction, and Part VI.J addresses that class. A queue display, a wayfinding display or a self-service terminal conveys the information a person needs in order to use the service at all, and Part VI.S addresses the decorative lighting applied to equipment of that kind. In each the message arrives as light, and an emission a person cannot look at does not convey a message to that person effectively.

The duty cuts both ways, and the Foundation says which way it is asking

The same appliance that makes an alarm effective for a person who cannot hear it may be the emission that affects a person with photosensitive epilepsy, and the accounts at Appendix A include reports of that kind. Part VIII.D.4 sets out the asymmetry in what the framework specifies: the flash rate of a visible alarm is capped, its intensity is bounded below and not above, and no maximum luminance appears anywhere in the provision. The Foundation asks for no reduction in how effectively a person who cannot hear is warned. It asks that the quantity which is presently unbounded be bounded, which is a request about the ceiling and not about the floor, and Part VIII.H records the limits of what this Part requests.

The limitation at § 35.164, and why it matters here

An entity declining to furnish an auxiliary aid or service on the ground that it would result in a fundamental alteration or in undue financial and administrative burdens must make that determination at the level of the head of the entity or a designee, in writing, with the reasons stated. A determination in that form is written to be reviewable, and that is the point of requiring it. But an entity cannot state in writing why a less harmful alternative would be an undue burden without knowing what the alternative would have to achieve, and Part VIII.D establishes that no federal statement of what it would have to achieve exists. The safeguard is drafted to be tested. In this subject matter there is nothing to test it against.

The Foundation asks nothing of these provisions either. It identifies them because each makes somebody responsible for an outcome that an optical emission can defeat, and because the responsibility is allocated while the technical criterion is not. Part VIII.G.1 sets out the common referent a federal standard would supply, and Part IX.I sets out the instrument the Foundation asks this Department to issue.

6. ADA Title I, and the workplace as a place of exposure

The two preceding subsections concern what a public entity owes the public. Title I concerns what an employer owes an employee, and the Foundation brings it into this comment for one reason: a substantial number of the accounts at Appendix A describe the place where the reporter works.

The framework is 42 U.S.C. §§ 12111 and following, with the Commission's regulations at 29 C.F.R. part 1630. The duty is to provide reasonable accommodation to a qualified individual unless doing so would impose an undue hardship, and the inquiry it requires is individualized, as it is under Title II.

What the record contains. Of the 593 reports at Appendix A, thirty-two describe work or employment. They include an employee of a defense manufacturer who reports the onset of

migraine with aura after a move to a building with ceiling diodes about seven feet above the desk, and who states that the condition has greatly impeded the work; an office worker who keeps the overhead light off and works by a table lamp, and who wore sunglasses through a meeting in a lit conference room; a worker who reports exposure to high-powered diode arrays and that nobody at the workplace seems concerned; a reporter who describes being made fun of for trying to protect themselves; and several who report that the condition has cost them work, hours or income. Two report that they left employment. The Foundation does not assert that any of these is a Title I violation. None has been adjudicated and the Foundation has investigated none of them. What the record establishes is that the exposure is reported in the workplace and that the reporters describe it as affecting their capacity to work.

The Foundation raised this with the agency that administers Title I. On February 26, 2023 it wrote to the Chair of the Equal Employment Opportunity Commission. Appendix E.20. The letter stated no request for action, which the Foundation records as a limitation of its own document rather than of the Commission's response, and no response is recorded.

Why this bears on the Department's duty rather than the Commission's. An employer deciding whether to accommodate an employee who reports that the lighting in a building is disabling faces the same difficulty as the public entity described at subsection D: there is no federal criterion for what the lighting emits, and therefore no referent against which the request can be evaluated. The employer is left to decide a technical question that no federal agency has answered. The Foundation does not ask this Department to administer Title I. It asks the Department to notice that the absence of a standard under § 360kk is felt in the employment relation as well as in the public way.

7. The decisions that establish the duties relied on here

The Foundation sets out four decisions, states what each is relied on for, and states what it does not take from any of them.

Barden v. City of Sacramento (9th Cir. 2002). Relied on for the breadth of what Title II reaches: the public sidewalk is a service, program or activity of the public entity, so the obligation is not confined to buildings. The relevance here is that the lighting a public entity installs in the public way is within what Title II reaches, which is the premise of subsection C.

Tyler v. City of Manhattan, 849 F. Supp. 1429 (D. Kan. 1994). Relied on for the proposition that whether a self-evaluation covered all of an entity's current services is a question of fact. The relevance is that an entity which performed a self-evaluation years ago, before it installed the products described at Part VI, has not necessarily discharged the duty as to those products.

Duvall v. County of Kitsap, 260 F.3d 1124 (9th Cir. 2001). Relied on for the individualized duty described at subsection 4: once an entity is on notice of a request, it must undertake a fact-specific investigation and gather sufficient information to determine what accommodation is necessary. The relevance is that this duty is owed whether or not a federal emission criterion exists, and subsection E.5 sets out what happens to it when none does.

PGA Tour, Inc. v. Martin, 532 U.S. 661 (2001). Relied on for the parallel proposition under Title III, and for the method rather than the holding: the question whether a modification would fundamentally alter what the entity offers is answered by an individualized inquiry into the particular person and the particular modification, not by a categorical rule. The relevance is that a private entity operating the lighting described at Part VI.F and Part VI.G faces an inquiry of the same shape, and faces it without a federal referent for what the lighting emits.

What the Foundation does not take from these. None of the four concerns light. None holds that an optical emission is a barrier within the meaning of either title, and the Foundation does not represent that any court has so held. They are cited for the duties they establish and for the

method those duties require, and the question whether a particular emission is a barrier in a particular case is the question the absence of a federal criterion makes unanswerable. That is the point of this Part.

C. What a Self-Evaluation of an Emitting Product Would Require

Section 35.105 requires a public entity to evaluate its current services, policies and practices, and to modify any that do not comply with the regulation. This subsection sets out what performing that evaluation would require for a product that emits optical radiation. The Foundation sets it out in the four steps the regulation implies, because the steps are where the difficulty stops being abstract: the first is performable, the second is not, and the third and fourth depend on the second.

1. Identifying the emitting products a public entity operates

A municipality operates street lighting, park and parking area lighting, interior and exterior lighting of its own buildings, traffic signals and pedestrian beacons, emergency vehicle lamps, transit lighting, and signage and dynamic message displays. Part VI describes each class and what is known about what it emits.

This step is performable and the Foundation does not suggest otherwise. It is an inventory, the entity holds the records, and nothing in it requires any technical judgment.

One thing the entity will find is worth recording, because it bears on every step after this one. Most of these installations were converted to light-emitting diodes within the last fifteen years under the federal energy framework Part IV.G describes, and Part IV.G.5 records that no biological or health evaluation accompanied the transition. The entity is therefore evaluating an installed base it did not choose on optical grounds and about which it holds no optical information.

2. Characterizing what each product emits

This is the step at which the duty stops being performable, and the Foundation states why in three parts.

First, the quantities. Part III identifies sixteen characteristics in which an emission would have to be described. The ones that bear on whether a light is a barrier are the spectral power distribution, the luminance of the emitting surface and the angle it subtends, and the temporal quantities at Part III.E. Correlated color temperature and lumens, which are the figures a procurement document ordinarily carries, do not describe any of them; Part V.B.3 and the front matter, subsection G, establish that.

Second, the information is not disclosed. Part VI.G.2 records the position for one class, in which the governing characteristic exists on the component manufacturer's data sheet, is known to the product maker, and reaches nobody who meets the product. Part IX.F asks this Department to require disclosure for that reason.

Third, the entity cannot generate the information itself. Part V.J.1 sets out the instruments and measurands available, and a spectroradiometer, or a photodiode of adequate bandwidth with an oscilloscope, is not ordinary municipal equipment. Part V.J.2 establishes that the measurement conditions determine the result, so even an entity that acquired an instrument would need a specified method, and none exists for this purpose.

An entity performing this step honestly must therefore commission a measurement it has no criterion to interpret, or rely on what the manufacturer states. Part VIII.E records which of those happens.

3. Identifying the populations affected

The entity must identify the people its services reach who are affected by the emission. This step is partly performable. An entity can know, without any photobiology, that among those it serves are

people with photosensitive epilepsy, with migraine and photophobia, with traumatic brain injury, and with autism and other sensory processing differences. Part V.E sets out the evidence for each response and Part VII.K treats the populations.

What the entity cannot do is connect a population to an exposure level, because no exposure level has been established for any of them. The step therefore produces a list of affected groups and no criterion to apply to it, which is a different and worse position than having neither. An entity that knows who is affected and cannot say at what level is on notice of a problem it has no means to size.

The Foundation repeats here the limit it states at Part VIII.A and Part VII.A.5. The condition categories recorded at Part VII.A.4 are self-identified and are not diagnoses, and the Foundation does not advance a list of conditions as established. The request at Part IX.C.6 is that the research include these populations.

4. Evaluating alternatives and their emission characteristics

The final step requires the entity to compare what is installed against what could be installed. Part III.G sets out the techniques available: shielding and diffusion, user control where the product has an indicator, and substitution of the source technology.

The alternatives exist and are procurable, and Part III.G.3 records one instance in which a municipality substituted a different source technology, together with the substantial limits of what that instance establishes.

But the comparison requires the characterization the second step could not produce, and now for two products rather than one. And the effectiveness of each technique is the subject of a federal duty that has not been performed: paragraph 360ii(a)(5) directs the Secretary to develop, test and evaluate the effectiveness of procedures and techniques for minimizing exposure, and Part II.G.3 records that the techniques exist while the federal evaluation of them does not.

The conclusion of the four steps is the one Part VIII.D.3 states in a sentence: the duty is owed, and the technical basis for performing it is missing. The Foundation emphasizes that the entity is not thereby excused. The regulation requires the evaluation, the entity must act on something, and what it acts on in practice is industry and trade guidance, which Part VIII.E describes, or nothing at all.

D. The Missing Federal Baseline

This subsection establishes the two absences the rest of this Part depends on, in the order in which they bear on a public entity: no performance standard governs what an LED product may emit, at subsection 1, and no federal exposure guidance states what a person may receive from general lighting, at subsection 2. Subsection 3 states what those absences do and do not do to the duty, and states it precisely, because the imprecise version of it would be useful to the wrong people. Subsection 4 then sets out the one place in the accessibility framework where an optical quantity is fixed, which matters because it shows that specifying such a quantity is a thing the federal government knows how to do.

The Foundation states each absence as an absence it has looked for and not found, rather than as one it asserts to exist, and in each case it identifies what does exist and might be mistaken for the missing thing. Each of the four items it names in subsection 1 has at some point been offered to the Foundation as the answer to this question. None of them is. Everything in the two subsections can be checked by the Department in its own records.

1. No performance standard exists for visible light emitted by LED products

No performance standard prescribed under 21 U.S.C. § 360kk governs the visible light emitted by any light-emitting diode product. Part I.B.2 states that in summary and Part II.C establishes it against the record, and the Foundation does not restate the record here. What this subsection adds

is what the absence means to a public entity holding a duty it cannot discharge, and what exists in place of the standard.

The absence is not for want of authority or of precedent. The subchapter contains a part titled Performance Standards for Light-Emitting Products, and Part II.A.2 enumerates the four standards in it: laser products, specific purpose laser products, sunlamp products and ultraviolet lamps intended for use in sunlamp products, and high-intensity mercury vapor discharge lamps. The fourth is a general-illumination lamp. Part I.E and Part I.G set out what that standard regulates and why it matters here: it addresses the shortwave ultraviolet released when the lamp's outer envelope breaks, and it requires the lamp to extinguish itself. So the Department has already prescribed a performance standard for a lamp sold for general illumination, under this authority, and the quantity it chose to regulate was not the visible light.

Four things that exist and are not the missing standard

The Foundation names them because each has at some point been treated as an answer to the question this Part asks, and because a public entity reading any of them could reasonably believe the subject had been addressed.

The general radiological health requirements. The product classifications for LED products record that the requirements at parts 1000 to 1005 apply to them. Part II.B.6 sets out what those requirements are and are not: they are administrative, reporting and recordkeeping provisions. They prescribe no emission limit for anything.

The product code. Part II.B.6 also states the limit of the point the Foundation draws from the classification itself. A product code is an administrative classification rather than a rule. It binds nobody and determines nothing about what the product may emit.

A premarket clearance. Part II.C.4 works through an instance. A notification under section 510(k) of the Act is a determination of substantial equivalence to a predicate device. It is a comparison between two products, not a determination about an emission, and a clearance therefore establishes no ceiling.

The federal lamp efficiency framework. Part IV.G.4 establishes that the efficacy requirements administered by another Department are expressed in lumens per watt and are silent as to what the selected technology emits. An entity procuring to that framework is procuring to a measure of efficiency, and Part IV.G.5 establishes that no biological or health evaluation accompanied the transition it drove.

What the absence means at the point of purchase

The consequence for a public entity is specific and it is not abstract. There is no figure the entity can write into a procurement specification, no value it can require a bidder to meet, and no federal criterion against which it can reject a product that a resident later reports as disabling. Part VIII.G.2 sets out what disclosure at the point of procurement would supply, and Part IX.F sets out the disclosure the Foundation asks the Department to require.

The Foundation states two limits on this subsection. It does not assert that the Department is forbidden to act, and Part II.C sets out the one provision that conditions action on a determination by the Secretary. And it does not assert that writing such a standard would be straightforward: Part IX.I sets out the instrument it asks for, and Part IX.I.3 sets out the shape of the transition the Foundation regards as workable, including that products already installed are not the first object of it.

2. No federal exposure guidance exists for optical radiation from general lighting

There is no federal exposure guidance for optical radiation from general lighting. The Foundation states two qualifications in the same breath, because without them the sentence is refutable and would be refuted.

First qualification: exposure limits exist, and none of them is federal

Part II.D.5 sets out what exists. Recommended practice published by the Illuminating Engineering Society; the blue-light hazard exposure limits of IEC 62471 and ANSI/IES RP-27, which are consensus documents the Department does not administer; state and municipal outdoor lighting ordinances of widely varying stringency; and a model ordinance, which is a model. To those the respondent identification adds the guidelines of the International Commission on Non-Ionizing Radiation Protection on exposure to incoherent visible and infrared radiation, which are the work of a non-governmental body and bind no one in the United States. Part V.C.2 treats the blue light hazard framework in detail. Part II.D.5 records the two things that matter about the whole set: none of it was adopted following the study and evaluation that § 360ii(a)(4) directs, and none of it is enforceable by this Department.

Second qualification: the limits that do exist answer a different question

Part II.D.2 states the distinction this comment turns on and the Foundation applies it here. A hazard model asks whether an emission exceeds a level at which injury occurs. The blue light hazard framework is a well-built instance of that model, and the Foundation says so rather than disparaging it. But a self-evaluation does not ask whether a lamp will injure a retina. It asks whether a person can use the entity's service, reach its facility, and travel its path of travel. Those two questions come apart, and they come apart in a direction that matters: a general-service lamp assessed under the blue light hazard scheme will commonly return the lowest risk classification. That tells a city that the lamp will not cause photochemical retinal injury at the assessed distance. It does not tell the city whether the installation is suitable above a dwelling, whether it produces disabling glare at a crossing, or whether its modulation affects a person with a seizure disorder.

On three of the quantities a self-evaluation would have to reach there is no federal number of any kind, and the Foundation does not rely on its own assessment for that. The respondent identification records the source relied on for the state of the blue light hazard exposure limit, the absence of consensus on its revision, the inadequacy of present means of predicting discomfort glare, and the regulatory gap as to temporal light modulation. Parts V.C.4, V.D.3 and V.K set those out. Part III.D.7 treats glare rating and Part III.E.3 cumulative exposure as characteristics that require boundaries, and neither has one.

The occupational framework is addressed separately, at Part II.H.10, which records what the agency administering it said when the Foundation wrote to it. Nothing in that framework supplies a public entity with an exposure criterion for the lighting in a corridor the public walks down.

What a public entity can do with the non-federal documents, and what it cannot

It can read them, and it can adopt one. Some have, and Part III.D.5 records that the maxima which exist for light trespass are municipal and state rather than federal. The Foundation does not criticize an entity for adopting a consensus document; in the absence of anything else it is the responsible thing to do. What adopting one does not give the entity is a federal referent, and two consequences follow that Part VIII.E sets out: every entity researches the same question independently, at Part VIII.E.1, and entities reach inconsistent and conflicting determinations on the same facts, at Part VIII.E.2. A resident who moves between two jurisdictions encounters two answers, and neither is wrong, because there is nothing for either to be wrong about.

3. Public entities therefore have no federal referent for step 2 above

The Foundation states this subsection precisely, because the loose version of it would be useful to the wrong people and the Foundation does not intend to supply it. Nothing in this Part suggests that the absence of a federal criterion relieves any entity of any duty. The duty is owed. It attaches by regulation, it is enforceable, it runs whether or not this Department ever acts, and an entity that has not performed it is not excused by anything in this comment.

What is missing is the technical basis for performing one step of it. Part VIII.C sets out the four steps a self-evaluation of an emitting product would require. The first is performable: an entity can inventory the emitting products it operates, and nothing prevents it. The second cannot be completed. The third and fourth depend on the second, so they fail with it. The duty is owed in full and one step of the method has no federal input available to it.

Even "cannot be completed" needs stating carefully, because the entity can measure. Instruments exist, laboratories exist, and a municipality can commission a measurement and obtain a number for luminance, illuminance, spectral distribution or modulation depth. What it cannot do is evaluate the number it obtains. Evaluation requires something to evaluate against, and subsections 1 and 2 establish that no federal criterion exists for it to use. The absence is not an absence of data. It is an absence of a referent, and that distinction is the whole of this subsection.

What the Foundation says an entity should do in the meantime

It should record the gap rather than omit the subject, which is the one course open to it that is both honest and useful. A self-evaluation that examined the lighting the entity operates, stated what was measured or observed, and recorded that no federal criterion exists against which to evaluate it would be a better document than one that did not reach the subject at all. It would also be a document the public could see, because Part VIII.B.1 sets out the retention and public-inspection requirement that applies to entities above the employee threshold. The Foundation regards a record of that kind as valuable to this Department as well, for the reason Part IX.C gives.

What does not follow, and the Foundation says it plainly

The absence is not a defense to an individualized request, and an entity that treats it as one has misread the framework rather than been defeated by it. Part VIII.B.4 sets out the distinction. The individualized duty asks what this person needs in this facility, which is a question the entity can answer from the person's own account, its own observation and the alternatives available to it. It does not require a national criterion and it never did. Part VIII.F.5 sets out the one instance the Foundation has of an entity answering that question, and it answered it with no federal input at all. Part VIII.F.3 records that the absence of a federal criterion has nonetheless been given as a basis for denial, which is the misreading this paragraph identifies.

And the Department is not the entity performing the self-evaluation. The Foundation asks nothing of it in that capacity and makes no allegation about it in that capacity. What it asks is the referent, which Part VIII.G describes and Part IX.I requests. Part VIII.B.3 records the one capacity in which this Department would itself have to apply the missing referent, as the agency designated to investigate complaints against a class of public entities, and that is the narrowest statement of why the absence is this Department's concern rather than somebody else's.

4. Where the accessibility framework does set an optical number, it sets a ceiling on the flash rate and a floor on the intensity

The Foundation states this subsection carefully, because the obvious objection is that the accessibility framework says nothing at all about light, and that objection is wrong. It says a good deal. What it does not do is bound the quantity this comment is about.

The visible alarm is the case. Section 4.28.3 of the Accessibility Guidelines issued under the Act specified, for a visual alarm signal appliance, that the lamp be a xenon strobe type or equivalent; that the color be clear or nominal white; that the maximum pulse duration be two tenths of a second with a maximum duty cycle of 40 percent; that, in the words of the provision, the intensity shall be a minimum of 75 candela; and that the flash rate shall be a minimum of 1 hertz and a maximum of 3 hertz.

Read those two numbers against each other. The flash rate is bounded in both directions, with an express ceiling. The intensity is bounded in one direction only, and the direction is upward from a

floor. There is no maximum intensity in the provision, and no maximum luminance anywhere in it.

The framework knew what it was leaving out. The manual the Access Board published to explain the guidelines states that a signal must be of an intensity that will raise the overall light level sharply, but not be so intense as to be unsafe for direct viewing. That is an acknowledgment, in the explanatory text of the accessibility framework itself, that an intensity can be unsafe to look at. No number is attached to it. The same manual records that flash rates above 5 hertz may trigger seizures in people with certain forms of epilepsy, that this is a particular concern in schools because children are frequently more affected by photosensitivity than adults, and that composite flash rates above 5 hertz should be avoided by synchronizing or decreasing the flash rate. That last statement appears as a recommendation and not as a requirement.

The consequence of that drafting choice is arithmetical, and the manual states it. A single appliance is capped at 3 hertz. Two appliances in the same space, each compliant at 3 hertz and not synchronized with each other, can present a composite rate of 6 hertz. Synchronization is recommended. So a corridor or a room may lawfully present a person with a composite flash rate above the figure the framework's own manual identifies as a seizure threshold, and the only instrument against that outcome is a recommendation.

And the direction of the guidance on intensity is upward. Technical assistance issued on these provisions describes the 75 candela figure as a minimum performance criterion rather than a lamp specifying standard, recommends that visual alarm lamp intensity be maximized so as to require the minimum number of fixtures, and records that lamps of up to 1,000 candela are available for some applications. The Foundation draws no inference about anyone's intent. It states the position: in a framework whose own manual says an intensity can be unsafe for direct viewing, the guidance on intensity recommends maximizing it, and no provision caps it.

The current standards reach the same place by a different route. Section 702 of the 2010 Standards does not restate the photometric specifications. It requires compliance with the National Fire Protection Association's standard for fire alarm systems, incorporated by reference. The Foundation has not read that standard, which is not publicly available, and asserts nothing about its contents.

One number in the incorporated scheme is worth setting beside the others, because the comment has now met it three times in other places. The referenced fire alarm standard caps an audible notification appliance at a stated sound pressure level. The sound a notification appliance may produce is capped. The light a notification appliance may produce is not.

The same asymmetry, in four federal places

The Foundation sets these together because the pattern is the argument, and each element of it is verifiable without leaving the primary sources.

- **Toys.** Federal law limits the sound a toy may emit, by a numerical criterion measured at a prescribed distance, for the stated purpose of protecting a child's hearing. It does not limit the light. Part VI.M.3.
- **Alarms in dwellings.** A federal regulation fixes a minimum luminous intensity in candelas for a visible notification appliance in a room designed for sleeping. It fixes no maximum for anything. Part IX.J.
- **Visible alarms under the accessibility framework.** Flash rate capped, intensity floored, luminance unaddressed, and the guidance recommends maximizing the intensity. This subsection.
- **Audible and visible appliances in the same standard.** The sound is capped. The light is not. This subsection.

The Foundation does not argue from this pattern that any of those agencies has failed in a duty. Each acted within its own authority and none holds the authority of 21 U.S.C. § 360kk. The pattern is offered for a narrower proposition, which is the proposition of this Part. When the federal government has wanted to bound an emission from a product, it has known how: it has named the quantity, fixed the number, prescribed the measurement and set the condition. It has done that for sound in a toy and for sound in an alarm. For the light, in every one of these places, it has either set a floor or said nothing. The instrument that would set the ceiling is the one this comment is about, and it has not been used.

E. Consequences of the Gap

Part VIII.D establishes two absences. This subsection sets out what they cost, and it separates the costs because they fall on different people. Subsections 1 to 3 describe what the absence does to the public entities that hold the duty. Subsection 4 describes what they turn to instead and why it does not answer the question. Subsection 5 describes what happens to the person the duty exists for when the systemic part of it cannot be performed. Subsection 6 then sets out two documents about the same city, four months apart, which show the whole of it in a single instance.

The Foundation offers no monetary estimate anywhere in this subsection and subsection 3 states why. Everything else in it is either in the record of this comment or is a matter of public arithmetic the Department can check.

1. Every state and municipal entity must independently research the same question

The duty at 28 C.F.R. § 35.105 runs to each public entity separately. It is not discharged for a city by a determination made in another city, by a state agency, or by any federal body. Each entity owes it on its own account, and each therefore has to reach its own understanding of what the lighting it operates does to the people its programs serve.

The number of entities is large. The Census of Governments counts approximately ninety thousand units of local government in the United States, comprising counties, municipalities, townships, school districts and special districts, before any state agency or state university system is added to them. The Foundation cites the figure as an order of magnitude rather than as a precise count, and it is the order of magnitude that matters: the question Part VIII.C describes has to be answered independently tens of thousands of times.

What each of them has to research is the same four things, and Part VIII.C sets them out. Which emitting products the entity operates. What each of those products emits. Which populations are affected by it. And what the alternatives emit. The first is work the entity can do and nobody else can do for it, because only the entity knows its own inventory. The other three are not local questions at all. What a particular luminaire emits is a fact about that luminaire, identical in every jurisdiction in which it is installed. The level at which a person is affected by that emission is a fact about human physiology and does not vary by county.

So the research is not merely duplicated. It is misallocated. Each entity is required to answer two questions that have the same answer everywhere, using whatever capability it happens to have, and Part VIII.D establishes that none of them can complete the second. A city of four thousand people and a state with forty million face the same question with incomparable resources, and the smaller the entity the less likely it is that the question will be reached at all.

The Foundation states the limit of this subsection. It does not assert that every public entity has in fact attempted this research, and it has no survey showing how many have. The subsection is about what the duty requires of each of them and what it would take to perform it, and Part VIII.E.6 supplies the one documented instance in which an entity was asked the question directly and the record of what it did.

2. Inconsistent and conflicting determinations across jurisdictions

When the same question is put to different bodies with no common referent, they answer it differently. That is not a criticism of any of them and the Foundation does not offer it as one. It is what happens when each decision-maker has to supply its own premise.

The record of this comment contains four dispositions of substantially the same exposure, and the Foundation sets them beside one another because the contrast is the evidence.

A federal agency declined it. On October 19, 2022 the Office of Civil Rights of the Federal Highway Administration dismissed a complaint about flashing beacons in three cities without investigating it, on the ground that the subject extended beyond its authority. Part VIII.E.6 sets out the letter and Part II.H.18 the regulatory ground.

A state civil rights agency investigated it and found probable cause. On June 15, 2023 the Minnesota Department of Human Rights determined that there was probable cause on a charge concerning a beacon in one of those same three cities. Part IV.E.1 and Part VIII.E.6 set out the determination, including what it found and what it expressly declined to decide.

A state utility regulator opened a proceeding. Part IV.E.2 sets out the matter before the New York State Public Service Commission concerning street lighting in the Village of Cambridge, in which fifty-two residents of the village appeared.

A municipality provided an accommodation. Part VIII.F.5 sets out the sequence in Ketchikan, Alaska, in which a resident requested accommodation of a street lighting installation and the city substituted a different source technology.

What the Foundation draws from the four, and what it does not

It does not draw that any of the four was wrongly decided, and it does not compare them as if they were holdings on the same question. They are not. They arose under different legal frameworks, before bodies with different authority, in different procedural postures, and three of the four never reached a merits determination at all. A reader who treated them as four answers to one question would be overreading them and the Foundation says so before anyone else has to.

What they do establish is narrower and is not affected by any of that. Put to four bodies, the question whether an optical emission in the public way is a matter the body can address produced four different answers: beyond our authority, within our authority and probable cause exists, within our authority and worth a proceeding, and within our authority and here is the accommodation. The threshold question of whether the subject is cognizable at all is being answered differently by different governments in the same country in the same period, and that is a consequence of there being no federal determination for any of them to start from. Part VIII.G.4 sets out what a common referent would do for the consistency of these decisions.

The Foundation adds the consequence for the person rather than for the institutions, because it is the one that matters. A resident's prospect of relief from the same installation presently depends on which state they live in and which body they happen to petition. Nothing about their condition or about the emission changes when they cross a state line.

3. Duplicated cost across thousands of public entities

The Foundation offers no dollar figure in this subsection and states the reason first, because a comment that produced one would invite the Department to test it. The Foundation has not surveyed public entities, has not obtained a procurement or consulting invoice from any of them, and has no basis on which to estimate what the research costs a city. It will not supply a number it cannot support. What it can describe is what the expenditure consists of and why its structure is wasteful independent of its size.

What it consists of, for an entity that attempts the work: staff time to assemble the inventory at Part VIII.C.1; the purchase of consensus standards, which are copyrighted documents sold by the bodies that publish them; photometric or radiometric measurement, which requires either instruments the entity does not own or a contractor; review of a technical literature the entity has no basis for appraising, which Part V.A describes for the Department's own purposes; and legal review of whatever conclusion is reached.

Why its structure is wasteful is the point of the subsection, and it does not depend on the amount. Part VIII.E.1 establishes that two of the four research questions have the same answer in every jurisdiction. An entity that answers them well produces a result that binds nobody and transfers to nobody: the next entity cannot rely on it, because it holds the duty on its own account and the first entity's conclusion is not authority. So the expenditure is incurred repeatedly and generates nothing cumulative. A federal characterization of the emission would be researched once, at one expense, and would then be available to every entity that needed it. That is the ordinary justification for a federal technical standard and the Foundation advances no novel version of it.

And the expenditure does not buy the answer. This is the part that distinguishes this subject from an ordinary duplication-of-effort argument. An entity that spends what it takes to commission a measurement still has no criterion to evaluate the measurement against, for the reason Part VIII.D.3 gives. The money produces a number and the number resolves nothing. The entity is then in the position Part VIII.D.3 describes, holding data it cannot interpret and a duty it cannot complete.

The smaller the entity the more of this is simply not done, and the Foundation states that as the practical consequence rather than as an allegation about any particular entity. A duty whose performance requires capability the duty-holder does not have is a duty that goes unperformed, and Part VIII.E.5 sets out what then carries the subject instead.

4. Reliance on industry and trade guidance in place of a federal standard

An entity that cannot find a federal criterion does not stop. It finds the best document available to it, and the documents available to it are the ones Part II.D.5 lists: recommended practice published by the Illuminating Engineering Society, the consensus standards of the international bodies, manufacturer literature, and utility or state energy program materials. Part II.E.4 sets out the professional and standards organizations that produce them.

The Foundation does not criticize an entity for relying on them. In the absence of anything else it is the responsible course, and the documents are competent work within their own purposes. The difficulty is with the purposes, and it is a difficulty of direction rather than of quality.

The numbers in trade lighting guidance are floors

Lighting practice documents exist to specify enough light for a task. Their quantities are accordingly minima: the illuminance recommended for a classroom, a parking structure or a surgical field is a level below which the task is not adequately served. A document built that way can answer the question whether there is too little light. It has no apparatus for answering whether there is too much, because that was never the question it was written to answer.

Part VIII.D.4 shows the same direction inside the accessibility framework itself, where the intensity of a visible alarm is bounded below and not above and the technical assistance recommends that the intensity be maximized. Part IV.G.4 shows it in the federal efficacy framework, whose measure is light output per unit of energy. An entity assembling the available guidance is therefore assembling a set of documents that point in one direction, and the direction is upward. It is liable to adopt a floor and treat it as though it were a specification, because a floor is what it has been given.

And the bodies that write them are not neutral as to the product

The Foundation states this structurally and makes no allegation of bad faith against any organization. The membership of the standards and professional bodies that publish lighting

guidance includes the manufacturers of the products the guidance describes, and Part II.E.4 names the organizations. That is the ordinary constitution of a consensus standards body and it is not a defect in itself; it is how such bodies are built, and the Department relies on consensus standards in other programs for good reasons. The observation is narrower: a document produced that way is not a substitute for a determination by the agency Congress charged with minimizing the emission, and nobody involved in producing it has claimed otherwise.

Reliance does not protect the entity either

This is the practical point, and the record establishes it. An entity that follows the available guidance and is then presented with a request for accommodation discovers that conformity is not an answer. Part VIII.E.6 sets out the footnote in the Minnesota determination which held that the city's contention that the beacon's flash rate conformed to federal guidelines was irrelevant to whether providing an accommodation was reasonable. So the entity has borne the cost of the research, adopted a document pointing in the wrong direction, and acquired no protection from it. Part VIII.G.1 sets out what a federal referent would give it instead.

5. The systemic duty defaults into the individualized one

This is the consequence the Foundation regards as the most important in this Part, and it is a consequence for a person rather than for an institution. Part VIII.B.4 sets out the distinction between the systemic duty and the individualized one and this subsection does not restate it. What it describes is what happens to the second when the first cannot be performed.

The mechanism is simple. A systemic duty that cannot be completed produces nothing at the program level: no characterization, no modification, and no document, for the reason Part VIII.D.3 gives. Nothing announces that it has not been performed. The subject therefore does not arise at all until an individual raises it, which means that the only route by which an optical emission becomes addressable is a request for accommodation by a person already affected by it. The duty designed to operate in advance of harm has dropped out, and the duty designed to respond to a particular person is carrying the whole subject.

Four things follow, and the Foundation sets them out in the order of how much they cost the person.

The work transfers. The systemic duty places the inquiry on an entity with staff, a budget, procurement authority and counsel. The individualized duty places the initiative on one person, who must identify the source, describe its effect on them, make the request, and sustain it. Part VIII.F.2 describes that burden and Part VIII.E.6 contains a chronology of it: the charging party there contacted the city on seven separate dates across three months before the agency took the matter up.

It is retail rather than wholesale. An accommodation resolves one installation for one person. The same question then arises again, in the same jurisdiction, for the next person and the next installation, and the entity answers it again from the beginning. Nothing accumulates.

It reaches only those able to pursue it, and the selection operates against the people the duty exists for. A process requiring months of correspondence, a written account of one's own condition, and persistence against an entity that may not reply is a process some people can run and others cannot. The populations Part III.F identifies as most affected by an optical emission include people for whom sustained administrative correspondence is itself difficult. The Foundation does not quantify that and does not need to; the direction of the effect is not in doubt.

And it produces no record. An individualized resolution binds nobody, is frequently not published, and in some instances is confidential. So the one route by which the subject is presently addressed is also the route that generates the least information, which is why Part VII exists and why Part IX.C asks the Department to characterize the emission rather than wait for the record to assemble itself.

What the Foundation is not saying

It is not saying that the individualized duty is the wrong mechanism, or that it should be narrowed, or that an entity may decline a request because the systemic duty went unperformed. Part VIII.D.3 states the opposite. The individualized inquiry is the right method for an individual question and the Foundation asks for no change to it. What it says is that the mechanism is bearing a load it was not designed for, and that the part of the framework designed to operate before anyone was harmed is the part that has no technical input available to it. Supplying that input is what Part IX asks of this Department.

6. One agency dismissed the question as outside its authority; another investigated the same city and found probable cause

Everything in this Part to this point describes an absence. The Foundation closes the subsection with two documents about the same city, four months apart, because together they show what the absence costs and what it does not.

The federal disposition

On October 19, 2022 the Office of Civil Rights of the Federal Highway Administration dismissed, without investigation, a complaint under Title II and Section 504 concerning the use of rectangular rapid flashing beacons by three cities, one of them Little Canada, Minnesota. Appendix E.9. The letter gave two grounds. The first was that no statutory requirement obliges an enforcement agency to investigate every Title II complaint, which the Foundation accepts without reservation. The second was this:

> "The allegations you have raised about the health impacts of RRFBs raise complex issues related to the regulation of all Light Emitting Diode (LED) lights, not just those used in RRFBs, that extend beyond FHWA's authority."

The Foundation asks the Department to read that sentence as the statement of a sister agency about the location of a subject. The agency whose Manual on Uniform Traffic Control Devices authorized the device, presented with a complaint that the light the device emits harms people with disabilities, answered that the question is about the regulation of light-emitting diode lights generally, that it is not confined to the device complained of, and that it lies beyond what that agency may reach. It did not say where the subject does lie. Part II.H identifies the only chapter of the United States Code that places it anywhere.

The state determination, on the same city

On September 28, 2022, nine days before that letter, a resident of Little Canada filed a charge of discrimination with the Minnesota Department of Human Rights. She is a woman with a disability whose symptoms, in the determination's words, are triggered by high-luminance, strobing LED lights. The charge concerned a pedestrian rectangular rapid flashing beacon installed at a crosswalk on the public street next to her residence, a unit containing two flashing diodes. On June 15, 2023 the Commissioner of that Department issued a memorandum of determination, reference 74059, finding probable cause that the city had discriminated against her because of her disability, in violation of the Minnesota Human Rights Act.

The Foundation sets out the findings rather than characterizing them, because the facts carry the matter. The charging party was affected by the beacon on January 4, 2022 and was unable to go to work the following day. She contacted the city on January 6, on January 17, on January 27, on February 15, on February 23, on March 2, by letter on March 17, and by electronic mail on April 5. The determination records that she contacted the city at least eight times and that the city ignored her. It records that several members of the city council blocked her advocate's electronic mail address in order to avoid receiving his communications. It records that a state agency with expertise in the field advised the city on February 4, 2022 to treat her request as an official complaint, to commence an investigation, and to ask her about her photosensitivity and her

experience with other devices, and that the agency expressed no concern that accommodating her would affect pedestrian safety. It records that the city decided not to ask her those questions because it believed doing so would have, in its own word, aggravated the situation. It records a vendor quotation of 8,616 dollars and 45 cents to replace the lights, which the city did not bring to its council and did not analyze. And it records that when the vendor was asked whether a slower flashing rate was available and could not find one, the city's public works director wrote that the city would stick with what it had, because it still received favorable comments on the existing module and because, in the director's words, the person causing all of the trouble had not sent anything in a while.

The Department determined that the city failed to engage in the reasonable accommodation process, and found, in terms, that the city intentionally refused to engage in good faith and failed to take any meaningful steps to determine whether a reasonable accommodation was even possible. It never notified her that her request had been denied.

The footnote that governs how this comment may use the determination

The Foundation brings forward the passage most adverse to its own framing, because it is the passage that disciplines this Part. The city had argued that the beacon's flash rate was consistent with federal guidelines. The determination answers in a footnote that the contention is irrelevant to whether providing an accommodation would have imposed an undue hardship.

That cuts two ways and the Foundation gives both. In its favor, it establishes that conformity with a federal guideline is not an answer to an accommodation request, which is the proposition this comment advances throughout Part V.C.2 about conformity generally. Against it, and more importantly, it establishes that the absence of a federal emission criterion is not a defense either. The duty under the state statute was owed, it was assessed on undue hardship and on the four statutory factors, and the determination reached a conclusion without any federal number. So this Part must not be read, and the Foundation does not advance it, as a claim that the absence of a standard under 21 U.S.C. § 360kk prevents a public entity from complying with its obligations. It does not. The entity in this case failed to comply for reasons that had nothing to do with the state of federal science: it did not answer letters, it did not cost the quotation it had obtained, it did not ask the questions it was advised to ask, and it recorded its reason for stopping in a sentence about the complainant rather than about the light.

What the Foundation does take from the pair

Two things, and they are narrower than the documents might support. First, that the inquiry is tractable. A civil rights agency given the question whether a flashing light-emitting diode device in the public way discriminated against a person with a disability did not find the question unanswerable; it investigated and it answered. Part VIII.C asks what a self-evaluation of an emitting product would require, and this determination is the only instance the Foundation has found of a public body being held to that inquiry on these facts.

Second, and this is the proposition this Part exists to establish, that the federal government declined the same question about the same city. One agency was asked and said the subject was beyond its authority. A state agency was asked and reached a determination. The Foundation does not say the federal agency was wrong about its own authority; it has no reason to doubt it and Part II.H proceeds on the assumption that it was right. The point is where the subject went when that agency set it down. It did not go to another federal agency. It went to a state human rights department, one charging party at a time, and the twenty-one entities described at Part IV show how seldom that route produces anything at all.

What followed, in each of the three cities

The Foundation completes the record rather than leaving the reader to assume an outcome, because the outcomes are adverse to the impression the two documents above might otherwise leave.

Little Canada, Minnesota. Nothing followed the determination. A finding of probable cause is a stage in an administrative process and not an end, and the State declined to take any further step. The Foundation does not know the reason and does not speculate. The beacon is not recorded as having been changed. So the one instance in which a civil rights agency investigated this question and found probable cause produced no remedy for the person who brought it.

Ashland, Oregon. Mr. Baker brought an action in state superior court in his individual capacity. He dismissed it voluntarily when he moved from Oregon to California. There was no decision on the merits.

Penn Yan, New York. No further action occurred.

The Foundation states what that leaves. Of the three cities in the complaint the Federal Highway Administration declined to investigate, one produced a state probable cause determination that led to nothing, one produced an action abandoned for reasons unrelated to its merits, and one produced nothing at all. The Foundation does not offer that as evidence that any of the three cities violated any law; two of the three were never adjudicated and the Foundation makes no allegation about them here. It offers it for the proposition this Part has been building: that where the federal government has declined the question, what remains is one person at a time, in one forum at a time, and the record of what that produces is the record set out above.

F. Individual Requests for Accommodation

This subsection is about what happens when one person asks one entity to do something about a light. Part VIII.B.4 sets out the duty that a request engages and Part VIII.E.5 sets out why that duty is carrying the whole subject. What follows is the record the Foundation has of requests actually made.

The Foundation states the size of that record before relying on any of it. Of the 593 reports at Appendix A, ten describe the reporter contacting anybody at all about the lighting, and four describe a request made to an entity responsible for the lighting together with the answer that came back. Subsection 4 sets out those four. The number is small, and subsection 4 also explains why it is small, which is a fact about the Foundation's own collection instrument rather than a measure of how often such requests are made.

1. What individuals are told when they request accommodation

Four answers are in the record, and the Foundation sets out what each of them says before drawing anything from them. Subsection 4 gives the accounts in the reporters' own words with the appendix citation for each.

The first is an answer about authority. A reporter in Escondido, California asked the membership manager of a warehouse club store to switch off two lighting demonstration displays after both produced headache and blurred vision on the way in. The manager answered that he could not do anything and would have to confer with the corporate office. Appendix A.55.

The second is no answer. A reporter in West Deptford, New Jersey, unable to shop at a supermarket since its checkout lighting was increased, spoke to the manager and then wrote to management. The report records that the written requests received no reply of any kind. Appendix A.115.

The third is an answer demanding documentation. A reporter in Rochester, New York asked his employer's human resources department to let him start and finish earlier so that he would not have to drive home after dark. He was told he needed a note from a doctor. Appendix A.156.

The fourth is a refusal with reasons, and it is the fullest account in the record. A reporter in Bennington, Vermont asked a hospital to designate a part of its emergency department and other areas as free of light-emitting diode lighting, after an emergency visit in which she began to shake on being wheeled into the lit emergency room and was ultimately treated in a back hallway near the

ambulance bay. She was told her request would be passed on and answered in two weeks. Two months later she was told that the hospital had recently remodeled with this lighting throughout and was not going to remove or alter any of it, and she was given three options: telephone ahead, be admitted and medicated when she began to convulse, or go elsewhere. The report records that the next hospital is more than twice as far away. Appendix A.171.

What the four answers have in common

Not one of them is about the light. None of the four responses states what the installation emits, at what level, how it compares to anything, or whether a different product would serve the same purpose. The answers are about the authority of the person who received the request, about whether the requester can produce a physician's letter, about the cost of work recently completed, and about where else the requester might go. The emission itself, which is the subject of the request, does not appear in any of them.

The Foundation does not offer that as a criticism of the four entities, and in at least two of the four the person answering plainly had no authority to do anything else. It offers it as evidence of the shape a request takes when it arrives somewhere that has no way to treat it as a technical question. Part VIII.C establishes that the entity has no characterization of the emission available to it and Part VIII.D establishes that no federal referent exists. An entity in that position answers in the terms it does have, which are terms about authority, documentation and cost.

One of the four reports contains the alternative in the same breath as the refusal, and the Foundation draws attention to it because it bears on what is feasible. The West Deptford reporter records that another store of the same chain, recently remodeled, installed lighting that does not affect him at all, and that he drives a sixteen mile round trip to shop there. Whatever the second store did was available to the first. Nothing in the federal apparatus told either of them what the difference was.

2. The burden of establishing harm shifted onto the requester

A request for accommodation of an optical emission requires the requester to do four things, and the Foundation sets them out in order because each one is harder than the equivalent would be for a barrier of any other kind.

Identify the source. A person affected by lighting in a store, a corridor or a street has to work out which installation is doing it, often among several, and often while symptomatic. Part VII.D records what reporters describe doing to avoid the exposure, which is the same identification problem approached from the other side.

Describe its effect with no instrument and no threshold. This is the step that distinguishes this subject. A person requesting a ramp can point to a step and the step is self-evidently the barrier. A person requesting something about a light has to establish both that the light affects them and that it is the light, and Part VIII.D establishes that there is no figure they can cite and no measurement they could commission that would mean anything against a threshold, because no threshold exists. The requester is therefore the only available instrument.

The record shows people acting as that instrument. The West Deptford reporter timed his own symptom onset and reported it to the minute, recording that the pain begins in five to eleven minutes and that he had timed it. Appendix A.115. A person who times their own symptoms is a person generating the only evidence available to them, and the Foundation notes that the figure is more precise than anything the federal government has published about the exposure that produced it.

Supply clinical corroboration on demand. The Rochester reporter was told he needed a note from a doctor. Appendix A.156. The Bennington reporter's physician telephoned the hospital in advance and obtained an assurance from the head emergency nurse, which did not hold when she arrived. Appendix A.171. Neither requirement is improper and an entity is entitled to information. The point

is where the cost of producing it falls, and that it falls on a person who is asking for relief from something the entity installed.

Sustain the request. Part VIII.E.6 contains the chronology: a charging party who contacted her city on seven separate dates across three months before a state agency took the matter up. The Bennington reporter was promised an answer in two weeks and received one in two months. A process of that length is a process some people can run and others cannot, and Part VIII.E.5 sets out why the selection operates against the people the duty exists for.

The asymmetry, stated plainly

The entity that installed the product has the invoice, the specification sheet, the product literature and whatever the manufacturer told it. The requester has their own account of their own symptoms. The party holding the technical information about the emission is the party being asked to act, and the party with none of it carries the burden of establishing that the emission is a problem. Part VIII.G.2 sets out what disclosure at the point of procurement would do to that asymmetry, and Part IX.F sets out the disclosure the Foundation asks the Department to require.

The Foundation states one limit. Nothing here suggests that an entity must grant every request, or that a requester's account is conclusive. Part VIII.B.4 describes an inquiry, and an inquiry can properly end in a denial. The objection is to the inquiry being conducted with the evidentiary burden on the only participant who has no access to the facts about the product.

3. Whether the absence of a federal criterion is given as a stated basis for denial

The Foundation expected to find that entities deny these requests by pointing to the absence of a federal standard, and it reports that it did not find it. In none of the four accounts at subsection 4 does the entity give the absence of a federal criterion as a reason for anything. The Foundation states that because the heading of this subsection was written as an expectation and the record did not bear it out.

What the entities gave as reasons were these: that the person answering lacked authority; that the request needed a physician's note; that the building had recently been remodeled; and, in one instance, nothing at all. Appendix A.55, A.156, A.171 and A.115 respectively.

What the Foundation draws from the absence of that reason

The honest reading is that the absence of a federal criterion does not operate as a stated ground of denial because it does not need to. It operates earlier. An entity that had a federal characterization of the emission available to it would have a technical question in front of it: what does this installation emit, what does the criterion permit, and what would the alternative emit. None of the four entities had that question in front of them. What arrived instead was a request they could only process as a matter of authority, documentation or expense, and they answered it in those terms. The missing criterion is why the request never became a technical question, not a reason offered for refusing one.

That reading is weaker than the heading promised and the Foundation prefers it because it is what the record supports. It is also, on reflection, the more useful proposition for this Department, because it bears on what a performance standard would change. A standard would not give entities a better reason to refuse. It would change what kind of question the request is, which is what Part VIII.G.4 describes.

Where the absence has been given as a reason, and by whom

One place in the record does state something close to it, and the Foundation is careful about what it was. Part VIII.E.6 sets out the determination of the Minnesota Department of Human Rights, in which the city argued that the flash rate of its beacon conformed to federal guidelines. That is the converse: not an entity citing the absence of a federal criterion, but an entity citing the presence of a federal guideline as an answer to an accommodation request. The determination rejected it in a footnote as irrelevant to whether providing an accommodation was reasonable. So the one

documented instance of an entity invoking the federal position invoked it the other way, and was told it did not answer the question.

And one federal agency has given a version of it. Part VIII.E.6 and Part II.H.18 set out the letter in which the Office of Civil Rights of the Federal Highway Administration dismissed a complaint without investigation on the ground that the subject raised issues extending beyond that agency's authority. That is an agency declining a question for want of authority over the subject rather than an entity declining an accommodation for want of a criterion, and the Foundation does not conflate the two.

One further item belongs here for completeness because it is the only response in the record from a federal agency to a member of the public about these products. A reporter in Hancock, Wisconsin recounts nearly striking a pedestrian he could not see past an oncoming vehicle's headlamps, reporting it to the National Highway Traffic Safety Administration, and being told that the lights just seem brighter. Appendix A.35. It is not an accommodation request and the Foundation does not present it as one. It is recorded because the answer is a statement about the emission, which is the one subject none of the four entity responses reached, and because it is the answer a member of the public received from the agency Part II.H.5 addresses.

4. Documented examples from the incident report record

The Foundation sets out the four accounts in the reporters' own words, with the appendix citation for each, and states the limits of the set first.

The size of the set, and why it is small

Of the 593 reports, ten describe the reporter contacting anyone about the lighting. Four of those describe a request to an entity responsible for the lighting together with the response. The remaining six are a report to a federal agency, two accounts of calling the police about conduct by another driver, one of notifying a restaurant manager about an unrelated emergency, one of an exchange with a hotel employee who had switched the lighting off for her own reasons, and one of writing an article.

The reason the number is small is in the collection instrument rather than in the world. Part VII.A.1 describes the submission form. It asks the reporter to describe the incident or the impact of light-emitting diodes on their life. It does not ask whether they requested an accommodation, from whom, or what the answer was. So four is the number of reporters who happened to mention a request while describing something else, and it is not a measure of how many made one. The Foundation states that rather than presenting four out of 593 as a rate, and Part IX.D asks the Department to establish a surveillance system that would ask the question directly.

a. A warehouse club store – Escondido, California

> I was assaulted by an LED demonstration light. Immediately I got a headache and my vision turned blurry. Even after getting past the light, the effects lingered. As I walked down the first aisle, another demonstration light hit me, with the same result. I spent the rest of my time shopping under duress. I spoke with [the] membership manager, and explained how dangerous those lights are, especially to people with neurological sensitivities, that they can cause seizures and worse, and requested that they be turned off. He said he couldn't do anything. He would have to confer with the corporate office.

Appendix A.55, June 5, 2024. The reporter entered no condition category. The name of the employee appears in the report as received and is omitted here.

b. A supermarket – West Deptford, New Jersey

> For the past few years I have been unable to shop at the local [supermarket] ever since they doubled or even tripled the amount of lighting above the checkout lines. I get migraine symptoms within minutes even while wearing my tinted glasses and a wide brimmed hat to bloc much of the light. The lighting is that intense. I get visual

> distortions, nausea, and the Pain starts in about 5 to 11 minutes (I've timed it) I can no longer shop at my local supermarket. The manager I spoke to had callous disregard for my condition, and my emails to management have received zero replies of any kind. Other [stores of the same chain] aren't nearly this bad. The [nearby] location recently remodeled and installed DECENT, HUMAN LIGHTING that doesn't bother me at all.

Appendix A.115, September 3, 2024, condition category photophobia. The report continues that the reporter pays higher prices at a different chain or drives a sixteen mile round trip, and records the fuel and mileage as financial damage. Trade names in the report are replaced here with descriptions.

c. An employer – Rochester, New York

> I don't get out of work until 5. Its dark! Then I have to run the gauntlet of deer and on coming traffic melting my skull off my neck with these insane projector headlights. … Night driving is like looking into the sun, it hurts! I've had to ask HR if I can come in early and leave early. They said I need a note from a doctor….gah! I attach a manila folder to my drivers side visor with a big binder clip so I can hide behind it when oncoming traffic approaches. Tell me, how safe is that!

Appendix A.156, November 18, 2024, condition category recorded as other. This is the one request in the set made to an employer rather than to a public entity or a place of public accommodation, and Part VIII.B.6 sets out the provision that reaches it. The report opens by stating that the reporter is risking the loss of his job.

d. A hospital emergency department – Bennington, Vermont

> When I recovered, I called the hospital to discuss the need for a section of the ER and other parts of the hospital complex to be LED-free, clearly labeled, so that anyone with an LED-reactive medical condition can be safely, promptly seen and treated. I asked them to think of it as a disability aid, exactly like the need to have ramps and braille, to consider safe lighting a medical necessity, like being vigilant about dietary restrictions for their patients. The staff member said they would pass on my request and get back to me in two weeks. Two months later, this is what I was told: The hospital had recently remodeled with all LED lighting and wasn't going to remove or alter any of it.

Appendix A.171, November 24, 2024, condition category epilepsy. The report sets out what preceded the request: the reporter's physician telephoned ahead and was assured by the head emergency nurse that she would be treated in a setting free of this lighting; the assurance did not hold on arrival; she began to shake on being wheeled into the emergency room; and a treatment area was improvised in a back hallway near the ambulance bay, reached by pushing her wheelchair around the outside of the building. It also sets out the three options she was given after the refusal, and that the next hospital is more than twice as far away.

Why the fourth account is the one the Foundation asks the Department to read

It is an account of a request for an accommodation of lighting, made to a hospital, refused on the ground of a recent remodel, with sedation during treatment offered as one of three alternatives. The Foundation does not characterize the hospital's conduct, does not assert that any provision was violated, and has no record of the matter beyond the reporter's own account. What it asks the Department to notice is the subject matter. Part VIII.B.3 records that this Department is the agency designated under Title II for programs, services and regulatory activities relating to the provision of health care and social services. A request for accommodation of lighting in a hospital falls within the class this Department was designated to receive complaints about, and Part VIII.D establishes that this Department has published nothing that would tell either the hospital or the complainant what the lighting may emit.

5. One accommodation sought and granted, and what it required of everyone involved

The subsections above describe what the absence of a criterion does to a request for accommodation in general terms. This subsection works through the single instance the Foundation has, because the

particulars show the cost more clearly than the generality does. The instance and the basis of the Foundation's knowledge of it are set out at Part III.G.3, including that the account of why the substitution was made is the Foundation's own statement rather than a cited document.

a. The sequence

A municipality converted its street lighting to light-emitting diodes in February 2021, to unshielded sources of four to five thousand kelvin. A report at Appendix A.158 describes that conversion and its effect on the reporter. A resident whose dwelling overlooks one of the streets requested an accommodation under the Americans with Disabilities Act, on the basis that the installation was producing adverse reactions in them. The city provided the accommodation requested: three amber low-pressure sodium sources were substituted for the blue-rich ones and placed in service on April 3, 2026.

b. What each participant had to work with, which was nothing

The requester had to establish that the installation affected them. There is no federal criterion stating what a street lighting installation may emit, so there was no figure the requester could point to and no measurement they could commission that would have meant anything against a threshold. Part VIII.F.2 describes that burden in general; here it fell on one person describing their own experience.

The city had to decide. It had no criterion either, and Part VIII.C sets out why the self-evaluation it would have conducted could not have reached a characterization of the emission. What it had was the request, the account in it, and whatever judgment its own officers brought. Nothing in the federal apparatus told it what to measure or what value to measure against.

And the remedy it chose was a substitution of source technology rather than a limit on emission, which is the only kind of remedy available to an entity that cannot specify a limit. Part III.G.3 treats substitution as a technique and sets out both why it points in the right direction and what it costs.

c. What the Foundation draws from it, and what it does not

It draws two things. The framework is capable of reaching this subject: a request under a disability provision produced a change in an optical emission, which is a more useful fact for the Department than any number of complaints that produced nothing. And the result was obtained without any federal input at all, which means it was available to that municipality and is not available as a matter of right anywhere, because nothing in the sequence turned on an obligation the city could have been held to.

It does not draw that the outcome was correct, that the substitution is the right remedy generally, or that other municipalities would or should reach the same result. One instance in one city, in which three luminaires were changed and nothing was measured before or after, establishes none of that. The Foundation states it because it is the only instance it has, and because a Part that described a systemic failure without acknowledging the one case in which the system produced a result would be an incomplete account.

G. What a Federal Performance Standard Would Supply [RFI Q9]

This subsection answers Question 9 of the notice and the question a reader of this Part will have formed by now. If the absence of a federal criterion is the difficulty, what would a criterion actually do? The Foundation answers in five parts and keeps them separate, because they are different benefits accruing to different people, and because the fifth is the one most likely to be misunderstood.

One distinction governs the whole subsection and the Foundation puts it first. A performance standard prescribed under 21 U.S.C. § 360kk bounds what a product may emit. It is not an accessibility standard and it does not decide whether any particular installation in any particular

place is a barrier. That second question is a factual one for the entity, under rules this Department does not write. What a performance standard would supply is the technical input without which the second question cannot be reached at all.

1. A common technical referent for public entities

At present every entity answers the question for itself. Part VIII.E sets out the position: each state and municipal entity must independently research the same question, and in practice they reach for industry and trade guidance instead. A federal standard supplies one figure that is the same in every jurisdiction, written by the agency Congress assigned the question to.

The accessibility framework already works this way in the single place where it sets an optical number, and the Foundation points to it as the model rather than as a criticism. Part VIII.D.4 sets out the visible alarm provision, which states intensity in candela and flash rate in hertz. An entity applying that provision does not have to conduct photobiology. It reads a number and measures against it. Nothing comparable exists for any other optical emission a public entity operates.

2. Disclosure of emission characteristics at the point of procurement

The entity's decision is made when it buys. Part IX.F asks for disclosure, and directs part of that request to public entities conducting self-evaluations. A standard is what makes disclosure useful, because a disclosed figure is only informative against a criterion.

What would have to be disclosed is set out at Part III. Of the sixteen characteristics there, the ones a procuring entity needs are the spectral power distribution, the luminance of the emitting surface and the angle it subtends, and the temporal quantities at Part III.E. Part VI.G.2 records what the present position is for one product class: the governing characteristic exists on the component manufacturer's data sheet, is known to the maker, and is disclosed to nobody who meets the product.

3. Reduced duplication of research across jurisdictions

Part VIII.E sets out the duplicated cost. A standard set once by the agency holding the authority replaces the same inquiry repeated across thousands of entities, none of which employs a photobiologist.

The Foundation adds that the duplication is not merely wasteful, because waste is the weaker objection. Part VIII.E records that it produces inconsistent and conflicting determinations, which means that whether a person has access depends on which jurisdiction they are in. A federal criterion is the only instrument that reaches that, and reaching it is the ordinary purpose of a federal standard.

4. A basis on which accommodation requests can be evaluated consistently

Part VIII.F describes what happens now. The burden of establishing harm falls on the person requesting the accommodation, and Part VIII.F records the absence of a federal criterion being given as a basis for denial.

A standard would not decide any request, and the Foundation does not suggest it would. What it would change is what the requester has to establish. At present a person asking for a streetlight to be shielded is in effect asked to establish that light of that kind injures people, which is a question of science that no individual can answer and that Part V shows the federal government has not answered either. Against a criterion the question becomes whether this installation exceeds a stated figure, which is a question of measurement.

It would also change what a denial can rest on, and the Foundation states this as an even-handed consequence rather than as a benefit to requesters. Where an installation is within the criterion, an entity could say so and give a reason. Where it is not, the entity would know that too. Either way the determination would rest on something, which is what Part VIII.E describes as presently missing when the systemic duty defaults into the individualized one.

5. The two instruments this requires, and which body supplies each

The Foundation is asked, in substance, what standards should be established so that a person with a disability has full and equal access to public and private facilities and so that the path of travel is not obstructed by light. It answers that two instruments are required, that they are not the same instrument, and that they are not written by the same body. Saying so is what keeps this comment within the authority it relies on.

The first is an emission standard. It bounds what a product may emit, in the characteristics at Part III, and it is prescribed under § 360kk by this Department. Part IX.I sets out the one such standard the Foundation asks the Secretary to consider prescribing now, and the reasons the others must wait for the research at Part IX.C. This is the instrument the Foundation asks this Department for.

The second is an accessibility criterion. It states when an emission in a particular setting denies access, and it would have to be expressed by reference to the quantities the first instrument bounds. It is not within this Department's authority. The accessibility guidelines are the Access Board's and the Title II and Title III regulations are the Department of Justice's, and the Foundation asks nothing of this Department in respect of either beyond what paragraph 360ii(a)(6) already directs, which is that it consult and maintain liaison with them. Part IX.E.5 asks that an express invitation be sent.

The relationship between the two is the point, and it explains why the order matters. The second instrument cannot be written until the first exists, because an accessibility criterion expressed in a quantity nobody measures and against a threshold nobody has set would not be applicable by the entities bound by it. That is the condition the accessibility framework is in now as to every optical emission except the visible alarm, and Part VIII.D.4 shows that where the framework did set a number, it set the one the technology of the day made available and left the rest unbounded.

The Foundation therefore does not ask this Department to write an accessibility standard, and would object if it tried. It asks for the emission standard, the research that supports it, and the consultation that would let the bodies holding the accessibility authority write the second instrument against the first.

H. Scope Note: The Request Made and Not Made Here

This Part is not a request that the Department enforce or interpret another agency's regulation, and the comment should not be read as one. The Foundation states that expressly because the Part describes at length the duties that the Department of Justice administers, the guidelines the Access Board issues, and the provision the Equal Employment Opportunity Commission administers, and a reader could take the description for a request.

What the Part is offered as is two things. It is evidence of what the absence of a federal emission criterion costs, which Part VIII.E sets out and which bears on the questions this notice asks about the consequences of the present position. And it is a direct answer to the question what technical information should be disclosed to state and local governments, which Part VIII.G.2 and Part IX.F.2 answer.

The requests this comment makes are confined to what this Department can do under its own authority. Part IX states them, and nothing in this Part asks for more than Part IX asks.

IX. RECOMMENDATIONS

A. Confirm That Visible Light From LED Products Is Electronic Product Radiation

This is the only request in this Part that asks the Department to do nothing. It asks that something already true of the Department's conduct be stated. The Foundation places it first because every request that follows depends on the answer, and because a premise that an agency acts upon but never states can be withdrawn later without ever having been decided. Part II.B sets out the definitional case from the text of 21 U.S.C. § 360hh. This subsection sets out what the Department has already done.

1. The product code the Center has already assigned to these products

The Center for Devices and Radiological Health maintains a classification database of radiation-emitting electronic products. For each product class it records a product code, a definition, the type of radiation, the reports required and the performance standards that apply. One of those classes is product code RHH. The Foundation reproduces the entry field by field, in the database's own words and capitalization.

Product. led lamps emitting visible light intended to be used for illumination purposes

Definition. LED lamps emitting predominantly visible and/or white light intended to be used for illumination purposes. These include illumination products, flashlights, finished bulbs or lamps.

Product Description. General Optical Products / Non-Medical

Radiation Type. Optical

Radiation Safety Report Type Required? None

Annual Reports Required? No

Applicable Performance Standard(s). No standard applicable. General Radiological Health requirements apply. [1000-1005]

Published at https://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfPCD_RH/classification.cfm?PCD=RHH, the page recording that it was last updated on September 28, 2026 and accessed on October 16, 2026.

Three things follow, and the Foundation separates them. The first is about the character of the emission, and it is the only one of the three that concerns this subsection directly. A light-emitting diode lamp emitting visible light for illumination is, on the Center's own classification, a product whose radiation type is optical and to which the general radiological health requirements apply. The character of an emission does not change with the housing around it. The visible light emitted by an indicator on a washing machine, by a video display, by a dynamic message sign and by a flashing warning beacon is the same optical radiation, emitted from the same class of emitter, and it is electronic product radiation for the same reason.

The second is a limit on what the entry proves, and the Foundation states it before the Department does. Product code RHH covers one product class: finished bulbs and lamps for illumination. That is one of the thirteen classes set out at Part VI, and it is not the class about which this comment says the most. Paragraph 360hh(1)(A) defines electronic product radiation by the physics and the source and not by a classification code, and a code assigned to one class is not a determination that any other class falls outside the definition. The Foundation relies on the entry for what the Center said about the emission, and not for the reach of the statute.

The third is the Foundation's own, and it runs the other way, though not in the direction the Foundation first supposed. The Center has not confined itself to the lamp in a room. It has assigned five product codes to light-emitting diode products and three more to displays, and it has recorded against every one of them that no performance standard applies. The census is set out at

Appendix F.1 and the consequence is drawn at Part II.B.6. What is missing from the classification is not the indicator or the display, which are there. It is the roadway: no code reaches a diode headlamp, a diode warning beacon, a diode roadway luminaire, a pedestrian crossing beacon or an outdoor message sign, while the laser equivalents of two of those carry a performance standard and an annual reporting obligation today. The Foundation does not say that the shape of the classification is a legal limit. It says that the shape is an instance of the under-administration this comment alleges throughout, and that the entry at RHH is evidence of that and not against it.

Second, the Center classified the emission. The radiation type is recorded as Optical, and the entry states that the general radiological health requirements at parts 1000 to 1005 apply. That is the agency's own characterization of the visible light emitted by a light-emitting diode lamp as radiation, recorded in the database the agency maintains for radiation-emitting electronic products, and it is the proposition this subsection asks to have stated.

Third, and the Foundation asks the Department to read this field twice: against a product class the Center has defined, and whose radiation type the Center has classified, the Center has recorded that no performance standard applies. That is the premise of Part IX.I, written by the agency. The Foundation is not asking the Department to assert an authority it has disclaimed. It is asking the Department to fill in a blank the Department has already printed.

2. What the agency says it regulates when these products are imported

The agency's guidance on importing radiation-emitting electronic products defines such a product as any electrically powered product that can emit any form of radiation on the electromagnetic spectrum, and lists among the non-medical products so regulated liquid crystal displays and light-emitting diodes. It identifies the governing provisions as sections 532 to 538 of the Federal Food, Drug, and Cosmetic Act, which are the provisions codified at 21 U.S.C. §§ 360hh to 360ss and relied on throughout this comment. Published at https://www.fda.gov/industry/importing-fda-regulated-products/importing-radiation-emitting-electronic-products, accessed October 16, 2026.

3. The instruction given to the trade in 2017

On June 6, 2017 United States Customs and Border Protection published a message to the trade, numbered CSMS 17-000330 and headed Light-Emitting Diode (LED) Reporting to FDA, relaying an update from the Food and Drug Administration. The sentence the Foundation relies on is this one: "LED products emit visible optical radiation, which qualifies them to be radiation-emitting electronic products." The message went on to state that entry data was expected for light-emitting diodes used for general or local area illumination, such as lamps and lightbulbs, under a stated tariff heading, and was not expected for finished products using light-emitting diodes only as indicator lights, such as toys, telephones, appliances and remote controls. Published at https://content.govdelivery.com/accounts/USDHSCBP/bulletins/1a00f8a, accessed October 16, 2026.

Two features of that instruction bear on this comment, and one misreading of it has to be closed off at once. The instruction was operative rather than advisory: it told importers what the agency expected to receive, and the expectation rested on the characterization of visible optical radiation as electronic product radiation. And it drew its line in 2017, which places the agency's position on the character of this emission seven years before the determination of May 24, 2024.

The misreading is this. The message excused importers from submitting entry data for products using light-emitting diodes only as indicator lights. That is an instruction about what data the agency wished to receive at the border. It is not a determination that an indicator lamp is outside 21 U.S.C. § 360hh(1)(A), and nothing in the message says that it is. The Foundation is particular about this because the distinction between illumination and indication is not a distinction this comment adopts. Part VI.G treats indicators on appliances, chargers, smoke alarms, routers and televisions at length and identifies the characteristic that governs them; Part V.C.2.k records that single indicator diodes are, on a testing laboratory's own account, typically not evaluated under

the present standards at all; and Part IX.J asks that an indicator lamp on a household appliance be capable of being dimmed or extinguished by the user. An administrative convenience adopted at the border should not be read back into the statute as a jurisdictional line, and the Foundation asks the Department not to read it that way.

4. The determination of May 24, 2024 reached the merits

An agency that lacks authority over a subject disposes of a petition about it on that ground, which is the cheapest disposition available and requires no evidence. The Final Response of May 24, 2024 did not do that. It engaged an organization to conduct a literature search and systematic review, weighed the evidence, and reached a conclusion about health effects. An agency that reaches the merits has necessarily decided that the subject is within its authority, because otherwise the merits were none of its business. Parts I.C.6 and II.F set out the response and what it rests on; what this subsection takes from it is narrower, and it is about conduct rather than reasoning.

5. The one public page on which the Department mentions these products, and what it tells a reader to do next

The four records above are internal or technical. A classification database entry, a guidance document for importers, a message to customs brokers, and the response to a petition are each addressed to somebody who already knows what to look for. This record is different. It is a page on this Department's public site, addressed to the general reader, and it is the only page on that site the Foundation has found which mentions light-emitting diodes at all.

The page is headed Laser Products and Instruments, is published by the Center for Devices and Radiological Health, and states that its content is current as of November 13, 2024. Under its description of what a laser is, it says this:

> LEDs (Light Emitting Diodes) are different from laser diodes and are not subject to the Federal laser product performance standard.

The sentence that follows it uses an ordinary light bulb as its example of a source of visible light, so the product class is in view in the next line as well.

a. Two things that sentence establishes, and the Foundation takes both

The first is that it is an affirmative act of distinguishing rather than an omission. Somebody at the Center thought it necessary to tell the reader that these products are not within the laser standard, and a distinction is only drawn where it might otherwise be missed. The sentence therefore presupposes a reader who might suppose the laser standard reached a light-emitting diode, and it answers that reader. That is this Department treating light-emitting diodes as a product class lying within the field its own program occupies, which is the proposition this Part asks it to state.

The second is that the exclusion the sentence states is an exclusion from one performance standard and not from the Act. The page establishes that itself, without saying it. Among the authorities the page sets out for the reader are the electronic product radiation control subchapter of the Federal Food, Drug, and Cosmetic Act, including 21 U.S.C. § 360ii, and parts 1000, 1002, 1003, 1004, 1005 and 1010 of title 21 of the Code of Federal Regulations together with §§ 1040.10, 1040.11 and 1010.4. The sentence excludes these products from § 1040.10. It does not exclude them from the general provisions of part 1000, from the records and reports of part 1002, from the notification of defects under part 1003, from the repurchase and repair obligations of part 1004, or from the importation provisions of part 1005.

And this Department has already said exactly that, in the record reproduced at subsection 1. The classification entry for these products records, in the field for applicable performance standards: "No standard applicable. General Radiological Health requirements apply. [1000-1005]". Two records of this Department, reached by different routes and addressed to different readers, state

the same position. There is no standard for these products. The general requirements apply to them. The Foundation asks the Department to notice that it has twice said so.

b. What the page does not do, which is why the Foundation sets it out

Having told the reader that these products are different from laser diodes and outside the laser standard, the page says nothing further about them. It does not state that they are electronic products within 21 U.S.C. § 360hh(1)(A). It does not state that the general provisions apply to them, although the same Department's classification entry does. It does not identify any standard, guidance document, classification record, program page or office to which a reader with a question about a light-emitting diode product should go. The Foundation has examined the references the page offers and every one of them concerns lasers, laser light shows, laser notices, laser product reports, laser compliance and laser variances, or else the general pages on importing, market entry and reporting which apply to electronic products as a class and say nothing about this one. The page mentions light-emitting diodes once, to say what does not apply to them, and stops.

The Foundation states the consequence as the reason for the request rather than as an accusation. A person injured by one of these products, or manufacturing one, or buying one for a workplace or a school, who goes to this Department's site to find out what the position is, finds one sentence about light-emitting diodes. The sentence tells them what does not apply. Nothing on the page tells them what does. The natural reading of a page which distinguishes a product from a regulated class and then falls silent is that the product is not regulated, and that reading is wrong: the same Department has classified the product, assigned it a code, characterized its emission as optical, told the importing trade that it qualifies as a radiation-emitting electronic product, and recorded that the general radiological health requirements apply to it. Subsections 1 through 3.

That is why the statement this Part asks for has to be made in terms. Part VII records the reports of harm transmitted to this Department by people who had concluded that somebody was responsible. This page is the clearest demonstration the Foundation has found of how hard that conclusion is to reach from the Department's own public material, because the Department has already published the half of the position which is a negative and has not published the other half anywhere a reader would look.

c. The limits of the point

A web page is not a regulation. The Foundation does not suggest that this page misstates the law, because it does not: the sentence is accurate, and light-emitting diodes are indeed not subject to § 1040.10. The Foundation does not suggest that the silence which follows the sentence was deliberate, and nothing in its argument turns on whether it was. It does not contend that this Department is obliged to maintain a web page about any particular product class; the provision which did compel a recurring public account of this program was § 360qq, and it was repealed in 1998, which Part II.I sets out. What the Foundation contends is narrower. Paragraph 360ii(a)(1) directs the Secretary not only to develop performance standards but to administer them, Part II.C treats that verb, and a program being administered can be expected, where it addresses a product class in public at all, to tell the reader where to look next.

6. What the Foundation asks, and four things it does not claim

The Foundation asks the Department to state, in terms: that visible light emitted by light-emitting diode products is electronic product radiation within 21 U.S.C. § 360hh(1)(A); that such products are electronic products within § 360hh(2); and which of the duties imposed by § 360ii(a) the Department understands to attach in consequence. The third limb is the operative one. A confirmation that stops at the definition concedes the premise and leaves the duties unaddressed, and the requests at subsections C, D and E of this Part are the duties in question.

Four things the Foundation does not claim, stated here so that the request is not read for more than it is. A product code is an administrative classification and not a rule; it binds nobody and is not a determination under any provision of the Act. The entry recording that no performance

standard applies is a statement about the standards that exist, not a concession that one is required; the case for requiring one is made at Part IX.I and does not rest on this entry. The Customs message is a Customs document relaying the agency's position, and the Foundation does not describe it as an agency letter. And a classification made for import and reporting purposes does not by itself determine which duties under § 360ii attach, which is precisely the question this subsection asks the Department to answer.

What remains after those qualifications is simple, and the Foundation states it in one sentence. The Department is asked to say what its own classification database, its own guidance to importers, its own instruction to the trade and its own disposition of two citizen petitions have each already assumed.

B. Publish the Evidentiary Basis for the May 24, 2024 Determination

1. Identify the independent third-party organization engaged to conduct the literature search and systematic review

The Foundation asks that the organization be identified by name. The determination of May 24, 2024 attributes a review of the literature to an independent third party, and the Foundation has not been able to establish who that was.

The request is for four facts and none of them concerns the science: the identity of the organization, the instrument under which it was engaged, the scope of what it was asked to do, and whether its report exists as a document. Part IV.I.6 records that the agency's records on this subject remain unavailable to the public, and Part IV.D sets out the requests by which Mr. Baker, individually, has sought agency records.

The reason the identity matters is stated plainly and is not an insinuation. A determination that rests on a review by an unnamed body cannot be assessed by anybody outside the agency, and a commenter asked to respond to it is asked to respond to a conclusion whose basis is withheld. The Foundation makes no allegation about the organization, whose competence it has no reason to doubt and no means of assessing.

2. Publish the literature search and systematic review

The Foundation asks that the search be published: the databases queried, the search terms, the date range, the inclusion and exclusion criteria, the number of records retrieved and the number retained. That is the ordinary minimum for a systematic review and it is what allows a review to be checked rather than accepted.

Part V.A.1 sets out the Foundation's own search strategy and Part V.A.2 the categories of evidence and how each is weighted, and the Foundation records that it published those so that the Department could test its appraisal rather than take it on trust. It asks for the same courtesy in return, and notes that the comparison is not a rhetorical one: Appendix C sets out the Foundation's appraisal of each study it relies on, entry by entry, with what each establishes and what it does not.

If no systematic search was conducted, the Foundation asks that this be stated. A determination founded on a narrative review rather than a systematic one is not thereby wrong, and the Foundation does not suggest it is. But a reader cannot tell which was done, and the difference bears on how much weight the conclusion carries.

3. Publish the criteria by which the evidence then before the agency was judged insufficient

The Foundation asks that the criteria be published: how the evidence then before the agency was weighted, what counted as sufficient to establish an effect, what counted as sufficient to exclude one, and how the two thresholds related to each other.

The last of those is the one the Foundation asks the Department to address directly. A finding that an effect has not been established and a finding that an effect does not occur are different findings

resting on different evidentiary thresholds, and Part V.A.3 sets out how this comment distinguishes what is established, what is emerging and what is unresolved. Part IX.B.4 concerns the particular finding of a long history of safety, and Part VII.J.1 sets out why an absence of recorded injury, where no surveillance exists, is not evidence of an absence of harm.

The Foundation asks for the criteria rather than for a different conclusion. If the criteria are published and the conclusion follows from them, the Foundation will have learned something it does not now know, and so will every other commenter.

4. State the basis for the finding of a long history of safety with respect to the visible wavelengths emitted

The Foundation asks the Department to state the basis of that finding, and identifies the three particulars that would make the statement responsive.

First, the emission characteristics against which safety was assessed, and the levels. The finding is expressed with respect to the visible wavelengths being emitted. The Foundation asks which measured quantity was compared against which limit: radiance, irradiance, luminance, spectral distribution, or some combination, and in each case the numerical value below which the agency regards a product of this class as presenting no risk of the effects described in Part V. If no such value has been established for any of those quantities, the Foundation asks the Department to say so, because that answer is as responsive as a number and is the answer the Foundation expects.

Second, the products the history covers. Part I.C.7 asks what the history is a history of. The Foundation asks the Department to identify the period and the product types the finding draws on, and to state whether it extends to the high-radiance, narrow-peak, modulated and multi-emitter products described at Part V.B, which postdate most of any period the phrase could denote.

Third, the spectral question specifically, because the finding is framed in spectral terms. The Foundation asks the Department to state whether it regards the spectral power distribution of a visible-light emitter as bearing on the safety of that emitter; if so, what spectral criterion it applies; and if it applies none, how a finding expressed with respect to the wavelengths emitted was reached without one. Part V.B.3 and Appendix C.70 set out the evidence that the biological response depends on this quantity at matched photometric output and at matched correlated color temperature.

The Foundation repeats here what it states at Part I.C.7. It does not ask the Department to find these products unsafe. It asks the Department to identify the level, and if no level has been identified, to undertake the study by which one could be.

5. Reconsider the determination against the record assembled in Parts V and VII

The Foundation asks that the determination of May 24, 2024 be reconsidered against the record assembled in this comment, and frames the request as reconsideration in light of new material rather than as a challenge to the earlier decision.

The framing is deliberate and the reason for it is practical. The 593 accounts at Appendix A postdate the determination, as does much of the literature appraised at Part V and Appendix C. An agency may revisit a determination on a changed record without conceding that the original was wrong, and the Foundation wishes to leave that route open rather than to close it by insisting on error. Part I.C.10 sets out what the Foundation asks this Department to accept and what it does not.

C. Undertake the Research Required by § 360ii(a)(2), (4), and (5) [RFI Q5.o, Q16]

1. Express emission and exposure radiometrically

This is the specific methodological request on which the rest of Part IX.C depends. Any study the Department undertakes, and any measurement protocol it adopts, should report spectral power distribution, radiance, irradiance and power density, with photometric quantities given in addition rather than instead.

Three reasons, each established elsewhere in this comment. Photometric units are weighted by a brightness function that discounts the short-wavelength region at issue, which Part I.G and Part V.J.4 set out. The responses under study do not follow that function, which Part V.L.3 sets out. And radiometric reporting makes optical exposure data directly comparable with the radiofrequency exposure data this Department is gathering under this notice, which Part V.J.5 sets out and which is the one request in this Part that costs the Department nothing but a choice of units.

2. Characterize source geometry and apparent source size

The Foundation asks that the characterization record the geometry of the source and not only the quantity it emits. Part V.B.2 sets out why: these products concentrate their output into emitting areas far smaller than those of the sources they replaced, so a product of identical luminous flux presents a different stimulus to the eye.

The quantities asked for are the luminance of the emitting surface, the apparent source size at the distances at which people actually meet the product, and the uniformity of the emission across the surface. The third matters because a luminaire presenting an array of discrete points behaves differently from one presenting a diffused surface of the same average luminance, and Part III.G.1 treats shielding and diffusion as techniques of minimization for that reason.

Apparent source size is the quantity that connects this request to the exposure limits already in use. Part V.C.2 sets out the blue light hazard assessment, in which the angular subtense of the source determines which limit applies and therefore whether a product is treated as a small source or an extended one. A characterization that omitted the geometry would not permit the existing framework to be applied to these products at all.

3. Resolve temporal modulation rather than integrating it away

The Foundation asks that the characterization resolve the time course of the emission rather than report its average. The distinction is not a refinement. An instrument that integrates over a period long compared with the modulation returns the mean illuminance and discards the entire characteristic, and Part V.D establishes that the characteristic discarded is the one associated with the responses at Part V.D.2 and Part V.E.1.

Four quantities are asked for: the modulation depth, the fundamental frequency, the duty cycle, and the rise and decay times of each transition. Part III.E.2 treats the last of these as a characteristic requiring a boundary and records that the Foundation has located no federal specification of it anywhere, and Part IX.I.2 sets out why temporal light modulation is different from every other characteristic in the way it would have to be regulated.

One further resolution is asked for and it is not presently measured by anyone. Part VI.H sets out that a display can hold total luminance constant while modulating strongly in color, because its color channels modulate against one another, and that none of the temporal quantities in ordinary use is computed per wavelength channel. The Foundation asks that the characterization of products in that class resolve modulation per channel. It asserts no effect of channel modulation and relies on no study of it; it asks that the quantity be measured, because a quantity nobody measures cannot be the subject of a finding either way.

4. Adopt the weighting functions appropriate to each response studied

Photochemical retinal injury, melanopsin-mediated circadian effect and visual discomfort each have their own wavelength dependence. A study should state which weighting it applies and why.

And it should preserve the unweighted spectral data, which is the part of this request the Foundation asks the Department to notice particularly. A weighting discards information irreversibly. Data reported as a weighted quantity cannot be reweighted when a better action spectrum becomes available, and Part V.L.3 establishes that for most of the responses this comment concerns no agreed weighting exists yet. Preserving the spectrum costs nothing at the time of measurement and is the difference between data that remains useful and data that does not.

5. Study the product classes identified in Part VI

Part VI identifies the product classes in the exposure environment. The Foundation asks that the study and evaluation directed by paragraph 360ii(a)(4) reach them, and offers a priority order, because a request to study twenty classes at once is a request that will not be acted on.

The order the Foundation proposes follows the principle Part VI.A states, which is the conditions of the encounter rather than the number of units deployed. First, the classes a person meets involuntarily in the public way and cannot decline: motor vehicle lighting at Part VI.B, the emergency and warning lamps at Part VI.C, and roadway and area lighting at Part VI.D. Second, the classes where presence is compulsory and the exposed person is among those Part IX.L asks be addressed expressly: school, workplace and healthcare interiors at Part VI.E, and the school bus lamp at Part VI.C.3. Third, the remainder.

The Foundation states the basis of that ordering and its limits. It rests on voluntariness and duration rather than on evidence of harm, because Part VIII.D establishes that no measure of harm by class exists to order them by. It is therefore a proposal about where to begin and not a ranking of risk, and the Foundation would not defend it as the latter. Part VI.B is first on it for an additional reason that does not depend on the ordering at all: Part VI.B records that it is the only class for which a federal standard already sets numerical limits on emission, so it is the class in which a characterization would have an existing instrument to inform.

6. Study the populations identified in Part V, and in particular the one for which no adequate study exists

The requests at subsections 1 through 5 concern how a study should be conducted and which products it should cover. This one concerns who should be in it, and the Foundation makes it separately because a study can satisfy every methodological request above and still not answer the question for the people most affected.

Part V.E.3 sets out the position for autistic people and the Foundation does not repeat it here. In summary: atypical reactivity to sensory input is part of the diagnostic construct; the two most relevant studies the Foundation could identify are set out at Appendix C.82 and Appendix C.83; the first measures the response to light but included no autistic participants; the second has eighty-seven diagnosed autistic children but measures nothing and reports no photometric or radiometric quantity whatever; and the Foundation is aware of no study that holds a diagnosed population, a measurement, and a characterized exposure at the same time.

The Foundation asks the Department, under paragraph (a)(4), to undertake or commission a study with the following three features held together, since the deficiency in the existing literature is that no study holds all three:

Participants identified by clinical diagnosis rather than by trait questionnaire administered to a population without the condition.

An outcome that is measured rather than reported, whether physiological, such as the pupillary light reflex with its latency and amplitude in absolute units and with redilation included, or behavioral and observed.

An exposure characterized in the terms subsection 1 requires, namely spectral power distribution, radiance, irradiance and power density, with the temporal structure resolved as subsection 3 requires rather than integrated away, and with the conditions of darkness and of repeated flashing included among those tested, because Part V.E.3 establishes that the repeated-exposure condition has been excluded by the design of the studies that exist.

The Foundation states the limits of this request. It does not ask the Department to presume an effect, and Part V.E.3 declines to assert one. It does not ask for a study of autism, which is not this Department's subject under this chapter and is the subject of other components of it. What it asks is that where a population is defined in part by its reactivity to sensory input, and where the products described in Part VI emit the sensory input in question, the study that paragraph (a)(4) directs should include that population and should characterize what it is exposed to. Neither has occurred.

The same request applies, with the same reasoning and without separate elaboration, to the populations identified at Part V.E.1, Part V.E.2 and Part V.C.2.g, namely persons with photosensitive epilepsy, persons with migraine and photophobia, and children, whose ocular transmittance at the short wavelengths is higher than that of the adults from whom the exposure limits were derived.

D. Establish Adverse Event Reporting and Surveillance for Optical Radiation [RFI Q10]

Part VII.J establishes that no federal system directed at optical radiation collects reports of adverse reaction to it, and states the Center's own position that a channel for consumer reports already exists. This subsection asks for what a channel is not. The Foundation renews the request it made to a component of this Department on March 3, 2023 and sets out what it does and does not ask for.

The distinction the request turns on

A channel receives whatever arrives. A surveillance system is built to answer a question, and Part VII.J.1 sets out the four things it needs that a channel does not have. A case definition, so that it is known what is being counted. A denominator, so that a count becomes a rate. A capacity to follow up, standardize and verify. And a published output, so that what was received can be seen. The Foundation used the channel: Part IV.B records the transmittal of the reports now at Appendix A to the Center's radiological health route between 2022 and 2026. What followed is the subject of Part IV.I.

What such a system would have to record

More than a symptom. A system that records only what a person experienced can establish nothing about the emission that produced it, and the Foundation's own database has exactly that defect, which Part VII.A.5 concedes. The additional fields are not elaborate: the location, the installation or product complained of, the product class in the terms of Part VI, and whichever of the characteristics at Part III the reporter or an inspector can supply. With location and installation recorded, the geographic question at Part VII.J.2 becomes askable. Without them it does not.

Four routes that already exist, requiring no new authority

The Foundation identifies them because the objection to this request is likely to be that it requires something new, and it does not.

Manufacturer reporting of accidental radiation occurrences. The Foundation asks the Department to determine whether the reports described at Part VII are accidental radiation occurrences within 21 C.F.R. § 1000.3(a), and therefore reportable by manufacturers under § 1002.20. That

determination requires no rulemaking. If the answer is yes, a reporting obligation already attaches and has not been observed. If the answer is no, the Foundation asks that the reason be stated, because the reason will be informative either way.

The Center's consumer route. Part VII.J.1 sets out the Center's statement of May 23, 2019 that it already has a means for consumers to submit reports. The Foundation asks that this route be published in terms that name optical radiation from light-emitting diode products, so that a person who has such a report can find it, and that what it has received be stated.

The Centers for Disease Control and Prevention. Part VII.J.1 sets out the request of March 3, 2023 and its disposition. Part IX.E.3 asks for the internal liaison that would carry it.

Occupational reporting. Part VII.J.3 sets out the occupational position and the health hazard evaluation capability that sits within this Department.

The impracticability objection, answered by an existing federal system

If it is said that incident surveillance of this kind cannot practically be built for a hazard distributed across millions of installations and reported by members of the public, the answer is that the federal government operates such a system for fire. Part II.H.21 sets out the comparison. The Foundation does not suggest the two subjects are alike in their science. It observes that the architecture exists, that it was built for voluntary reporting of incidents by many thousands of local bodies, and that its existence disposes of the argument from impracticability.

And the States, which the Department can simply ask

Part II.H.13 asks the Department to ask rather than to assume, and the Foundation repeats the suggestion here as part of this request. Begin with the States operating approved occupational safety and health plans, and with the consumer protection offices of the most populous States. Each holds complaint records. A survey of what they hold is not a surveillance system, but it is obtainable now, by correspondence, and it would establish whether the subject appears in records the federal government has never looked at.

What the Foundation does not ask

It does not ask the Department to adopt the Foundation's form, its condition categories, or its data. It does not ask that its reports be treated as verified. Part VII.A.5 and Part VII.J.1 set out why its database has the defects it has, and every one of them follows from who is doing the collecting rather than from the subject matter.

One consequence of granting this request deserves stating, because it cuts against the Foundation and the Foundation would rather state it than have it pointed out. If the Department establishes a system and the system receives very little, that is a finding, and it is a finding adverse to this comment. The Foundation accepts that risk and asks for the system anyway, because a Department that has established no surveillance cannot read its own empty files as a safety record, and Part IX.B addresses the use that has been made of silence.

E. Exercise the Interagency Liaison Duty of § 360ii(a)(3) and (a)(6) [RFI Q17]

1. Food and Drug Administration [RFI Q17.a]

The notice asks about coordination with the Food and Drug Administration. For this subject matter that question is not a question about coordination between two bodies, and the Foundation sets out why in three steps the Department can verify from the statute.

First, the duty is the Secretary's. Section 360ii(a) directs that the Secretary shall establish and carry out an electronic product radiation control program, and each of the six paragraphs beneath it directs what the Secretary shall do. Part II.A sets out the framework. The statute does not name the

Food and Drug Administration and does not name the Center for Devices and Radiological Health. The authority sits with the Secretary and reaches those components by delegation within the Department.

Second, this notice was issued by an office of the Secretary. The question put to the public in it, so far as it concerns coordination with the Food and Drug Administration, is therefore a question the Department is asking about the exercise of the Department's own duty by the Department's own component.

Third, that makes the office issuing this notice able to do something the Foundation cannot do and the Center is unlikely to do unprompted. It can put the question internally. It is not a petitioner, it is not bound by the position taken in the Final Response of May 24, 2024, and a question asked from within the Department requires the Center to concede nothing in order to answer it.

What the Foundation asks

Four things, none of which requires the agreement of anybody outside this Department. That this comment and the record at Part VII be transmitted to the Center for Devices and Radiological Health. That the Center be asked to state whether it carries out a program directed at the light-emitting diode products that account for most human exposure to artificial optical radiation, and if so to identify it. That the Center be asked the questions at Part IX.B concerning the evidentiary basis of the determination of May 24, 2024. And that whatever the Center answers be recorded on the docket of this proceeding, so that the answer exists in a public document whichever way it goes.

The Foundation asks for none of the following and says so expressly. It does not ask this office to overrule the Center, to direct a scientific conclusion, to reassign the delegation, or to find that any duty has been breached. Part I.C.9 explains why the Foundation's attention is on the duties rather than on the conclusions. The request here is that the question be put and the answer written down.

2. National Institutes of Health [RFI Q17.b]

The notice asks about coordination with the National Institutes of Health. The Foundation's answer begins with a concession, because the obvious version of this answer is wrong.

It would be convenient to say that this Department funds no research on the subject. That is not true and the Foundation does not say it. Part V.E.1 records work by investigators funded by the National Institute of Neurological Disorders and Stroke on light sensitivity and its mechanisms, and Part V cites published research in areas within the remit of more than one institute. The Foundation has not surveyed the research portfolio of this Department and makes no claim about its extent.

The gap is of a different kind and it is the gap this comment is about throughout. Research into a mechanism is not the same thing as the study and evaluation that paragraph 360ii(a)(4) directs, which is a study of the emission of a product and of the conditions of exposure to it, conducted for the purpose of determining what may be minimized. Part II.F sets out that paragraph and the absence of any such study. Funded investigators establishing how light reaches the trigeminal system in migraine are answering a question about physiology. Nobody is answering the question of what the luminaire outside the window emits and at what level it affects the person inside, and no quantity of the first kind of research produces an answer to the second unless someone asks for it in those terms.

The institutes whose remit the questions fall within

Part IX.C sets out the research the Foundation asks for. Its questions divide, by subject matter, across institutes of this Department: retinal and ocular effects, which is the remit of the National Eye Institute; photosensitive epilepsy, migraine and photophobia, which fall within the National Institute of Neurological Disorders and Stroke; and environmental exposure and its health effects, which fall within the National Institute of Environmental Health Sciences. The Foundation names those three because the correspondence is evident, not because it has established that any of them regards the subject as within its priorities.

What the Foundation asks

Three things. That the Department state what research into optical radiation emitted by light-emitting diode products it has funded, through which institutes and over what period, which is a question the Department can answer from its own records. That the research questions set out at Part IX.C be put to the institutes named above in the terms paragraph 360ii(a)(4) uses, which are the emission and the conditions of exposure, rather than in the terms in which mechanism research is ordinarily framed. And that the Center for Devices and Radiological Health and those institutes be connected, which is liaison within a single Department and is the easiest instance of the duty at Part IX.E.5 to perform, because it requires an invitation from nobody outside this building.

The Foundation asks for no particular finding and takes no position on how any such research would come out. Part IX.C.6 sets out what it asks be studied and Part IX.L sets out the populations it asks be addressed expressly.

3. Centers for Disease Control and Prevention [RFI Q17.c]

The request made to this component on March 3, 2023, and its disposition, are set out at Part VII.J.1. The Foundation renews it here and asks that the surveillance described at Part IX.D be established.

The liaison asked for in this subsection is internal to the Department, which distinguishes it from the requests at subsection 4 and makes it the least burdensome of them. It requires an invitation from nobody outside this Department and the agreement of no other agency.

4. Agencies outside the Department

The Foundation asks the Department to exercise the liaison duty of § 360ii(a)(3) and (a)(6) with the agencies identified at Part II.E and Part II.H, and to state on the record, as to each, whether consultation concerning visible light emitted by LED products has occurred and with what result.

a. A first time-limited request, and the proceeding that is open now

One of those requests is time-limited and the Foundation sets it out separately for that reason. The Department of Transportation announced on October 6, 2026 a negotiated rulemaking to modernize Federal Motor Vehicle Safety Standard No. 108, docketed as NHTSA-2026-1981, with applications and comments due November 9, 2026 and headlamp glare among the announced subjects. Part II.H.5. The Foundation asks the Department to communicate with the Department of Transportation concerning that proceeding, to offer whatever it holds bearing on the health effects of the emissions at issue, and to state whether it has done so. The request is made now because the proceeding is open now, and because the pattern described at Part IV.G — a federal rulemaking determining the optical characteristics of a product class without the participation of the agency holding the radiation-health authority — is in this instance still capable of being avoided rather than merely described.

Specifically, the Foundation asks the Department to do four things, the first three of which require the agreement of no one:

consult and maintain liaison with the National Highway Traffic Safety Administration concerning the proceeding, under § 360ii(a)(3) and (a)(6)(A), the latter of which names techniques, equipment and programs for testing and evaluating electronic product radiation as a subject of consultation and the proceeding having announced test procedures as a subject of negotiation;

file in Docket No. NHTSA-2026-1981 by November 9, 2026 whatever the Department holds bearing on the health effects of the emissions at issue, including the reports described at Part VII;

state on the record of this proceeding whether any communication between the two Departments concerning vehicle lighting has occurred, and when;

and seek whatever participation in the negotiating committee the Department of Transportation and the committee's charter permit, the Foundation asserting no entitlement to it.

b. A second time-limited request, and this window closes first

On September 17, 2026 the Office of Engineering and Technology of the Federal Communications Commission released Public Notice DA 26-997 in ET Docket No. 13-84, summarized at 91 Fed. Reg. 60,128 (Sept. 22, 2026), seeking comment on the radiofrequency exposure issues remanded to that Commission in Environmental Health Trust v. Federal Communications Commission, 9 F.4th 893 (D.C. Cir. 2021). Comments are due October 22, 2026, which is the day after the comment period in this proceeding closes. Part II.H.8.

Two features distinguish this request from the one above and the Foundation states both, because they cut in different directions. The first is that the subject of that docket is radiofrequency energy and not visible light. The Foundation accordingly does not suggest that optical material belongs in it, does not ask this Department to take any position there on the optical question raised in this comment, and does not ask it to take any position on the radiofrequency science. The second is that the Commission has invited participation in terms that name this category of participant: it invites, among others, "local, state, federal, and international health and safety agencies". So the occasion was created by the other agency rather than by this one, it is addressed to agencies of exactly this kind, and it is open as this comment is filed.

The Foundation asks the Department to do three things, none of which requires the agreement of anyone:

state on the record of this proceeding whether any communication between this Department and that Commission concerning the matters remanded in Environmental Health Trust has occurred since the correspondence of April 24, 2019, and if so to produce it;

determine, before October 22, 2026, whether to participate in ET Docket No. 13-84, and state what it decides and on what ground, a stated reason being useful to this record whichever way the decision goes;

and state whether the assessment conveyed to that Commission on April 24, 2019 remains the position of this Department, which Part IX.B asks in another form and which Part II.H.20 sets out at length.

One observation is added and confined. The notice states that probative value will be accorded to submissions able to overcome "the failings that the court identified when the Commission last attempted to rely on the expertise of expert agencies", and Part II.H.8 sets out why that sentence describes the correspondence of April 24, 2019. The Foundation does not ask this Department to accept that characterization, which is the Commission's and not the Foundation's. It asks the Department to notice that the agency which received the one documented consultation in this program's history has described the episode in those terms, in a document published a month before this comment, and has reopened the record in the same document.

c. A third agency outside the Department, which has already written a standard for the same products

The Foundation asks for one further consultation, and sets out the reason at the length it deserves because the Department can verify every element of it without leaving the Federal Register.

The Consumer Product Safety Commission enforces a mandatory safety standard for toys. Section 106 of the Consumer Product Safety Improvement Act, 15 U.S.C. § 2056b, made the ASTM toy safety standard a consumer product safety standard, and the current edition is incorporated by reference at 16 C.F.R. § 1250.2(a). That standard limits the sound a toy may emit, by a numerical criterion measured at a prescribed distance by a prescribed method, for the stated purpose of reducing the risk of hearing loss. It contains no limit on what a toy may emit as light. Part VI.M.

This Department has classified the same product. Product code RIO is assigned to light-emitting diode toys, the radiation type recorded against it is optical, and no performance standard applies. Appendix F.1.14.

So two federal agencies have looked at the same object. One has limited the energy it may deliver to a child's ear. The other has recorded that it emits radiation, assigned it a code, and limited nothing. The Foundation does not suggest that the Commission has failed in any duty; sound is within its authority and electronic product radiation is within this Department's. It asks the Department to do what § 360ii(a)(3) directs, which is to consult and maintain liaison with other agencies having related functions, and to state on the record of this proceeding whether any consultation with the Commission concerning optical emission from toys or from other products intended for children has ever occurred.

The Foundation asks three things specifically. That the Department state whether such consultation has occurred and when. That it consult the Commission as to whether an optical emission requirement for products intended for children should be addressed under 15 U.S.C. § 2056b, under § 360kk, or under both. And that it place before the Commission the market surveillance results at Appendix C.59 and the opinion at Appendix D.1.18, which bear on a product class the Commission regulates and which the Foundation has no reason to believe the Commission has seen.

5. Send an express written invitation to consult to each agency, and state which were sent

a. Why the invitation is the operative act, and why only this Department can make it

Paragraph 360ii(a)(6) directs this Department to consult and maintain liaison. The duty is this Department's, and Part II.H.10 establishes the direction in which it runs: neither the Occupational Safety and Health Administration nor the National Institute for Occupational Safety and Health bears any duty under this chapter, because the obligations of this part of title 21 fall on the Secretary of Health and Human Services.

The consequence is the one Part II.H.10 draws, and it is the premise of this request: of the two departments the provision connects, only one can invoke it. An agency correctly advised that the provision imposes nothing on it is in no position to initiate the consultation the provision contemplates. If consultation is to begin at all, it begins with an approach from this Department. The Foundation asks that the approach be made in writing, to each agency, and that the Department say on the record which approaches it made.

b. The statutory warrant, which is express in one of the two provisions

Paragraph 360ii(a)(6) directs consultation and liaison without naming an instrument. Section 360jj supplies one for the studies it directs: in carrying out those studies the Secretary is to invite the participation of other Federal departments and agencies. Part II.I.4.f sets the provision out and establishes two things about it, that it is a second interagency requirement independent of § 360ii, and that it attaches to the studies rather than to the program generally. Part IX.K asks for those studies and for that invitation as part of them.

The Foundation records that the text of § 360jj(b) and (c) is paraphrased rather than quoted in this comment, from a secondary codification source, and that Part II.I.4.f says so. The request in this subsection does not depend on the paraphrase: paragraph (a)(6) directs consultation whatever instrument is used, and an agency cannot be consulted without being approached.

c. One agency has already offered, and the offer is conditioned on a request

Part II.H.20 records the nine agencies that answered the Foundation and what each said. One answer differs from the rest in a way that bears directly on this request. The other agencies said the subject was not theirs. The United States Access Board said the subject was not within its authority

and added that it would provide technical assistance to the Food and Drug Administration on request. It is the only one of the nine that offered to be consulted. Part II.H.11 treats the Board.

The Foundation asks the Department to notice the form of that offer. Assistance on request is contingent on a request being made, and the Foundation can locate no record that one was made. An offer that has stood open and untaken is not a failure by the agency that made it; it is an invitation already accepted in advance, waiting only for the letter that would trigger it. Of all the requests in this Part, this is the one with the least standing in its way.

d. What the Department of Labor correspondence establishes, stated accurately rather than favorably

It would be convenient for the Foundation to report that the Department of Labor has said it is waiting to be invited. It has not said that, and the Foundation states what the correspondence does establish because the weaker account is the accurate one and the stronger would be refuted from the documents themselves.

Part II.H.10 sets out the exchange. On August 15, 2024 the Director of the Directorate of Standards and Guidance replied to a Foundation petition and to a further letter, stating that the agency cannot violate the provision relied upon because that provision does not apply to it, and declining the requested consultation with the Food and Drug Administration on that basis. The comment records that the agency was correct, and that the Foundation had asked the wrong department.

So the Department of Labor did not decline an invitation and did not say it awaited one. It declined a request that it perform a duty that is not its to perform. The Foundation submits that this is the firmer ground of the two, because it rests on the statute rather than on an agency's willingness: an invitation issued by this Department is a different act from the request that agency properly refused, and nothing in its answer bears on how it would respond to one.

Two further matters in that correspondence bear on what an invitation should ask for. Part II.H.10 records that in 2022 the agency stated that its Directorate of Standards and Guidance would examine the relevant scientific literature and monitor developments. Whether it did, and what it found, is precisely the kind of information paragraph 360ii(a)(6)(A) contemplates passing between the two departments, and this Department can ask for it. And that agency has been on notice of this subject since 2022, so a consultation initiated by this Department would not be arriving unannounced.

e. What the Foundation asks

That the Department send a written invitation to consult and maintain liaison, concerning the visible light emitted by light-emitting diode products, to each department named expressly in § 360ii(a)(6), being the Secretary of Commerce, the Secretary of Defense and the Secretary of Labor, and to each agency identified at Part II.H as falling within the residual category of other appropriate Federal departments and agencies.

That the invitation identify the subject with enough particularity to be answerable, rather than in terms that permit a reply that the subject is not the recipient's. The Foundation suggests three elements: the emissions at issue, expressed in the quantities at Part I.G; the product classes at Part VI that the recipient's own program places in the public way; and the characteristics at Part III in which a boundary would have to be drawn.

That where the study at Part IX.K is conducted, the invitation to participate attaching to it be sent to the same agencies, so that the two provisions are performed together rather than separately.

And that the Department state on the record of this proceeding which invitations were sent, on what dates, and what replies were received. Where no invitation was sent to a department named expressly in the statute, the Foundation asks that the Department say so. Part II.H.22 collects what the record presently shows, which as to most of these agencies is nothing either way.

The Foundation states the cost of what it asks, because it is the smallest of any request in this Part. An invitation is a letter. It commits the Department to no conclusion, concedes nothing about what these products emit or whether anyone is harmed by them, requires no rulemaking, and can be sent before any of the research at Part IX.C is begun.

f. The statute directs the Secretary to maintain liaison, and a thing cannot be maintained before it exists

The Foundation rests this request on the verbs, and states first what they are not, because the point is sometimes put in a form the text will not bear. Neither of the liaison paragraphs uses the word establish. Paragraph (a)(3) directs the Secretary to "maintain liaison with and receive information from" other Federal and State departments and agencies with related interests. Paragraph (a)(6) directs him to "consult and maintain liaison with" the Secretary of Commerce, the Secretary of Defense, the Secretary of Labor, the Atomic Energy Commission, and other appropriate Federal departments and agencies, on the two subjects it then names.

The word establish appears in the clause that governs both of them. Section 360ii(a) directs that the Secretary "shall establish and carry out an electronic product radiation control program designed to protect the public health and safety from electronic product radiation," and provides that "as a part of such program, he shall" do the six things the paragraphs enumerate. Part II.D.1 sets out the structure and establishes that each of the six is introduced by shall as a component of a mandatory program.

Two consequences follow, and the Foundation separates them because they are independent and either would do.

The first is structural. The duty to establish attaches to the program, and the liaison paragraphs are components of the program the Secretary is directed to establish. A program of which the liaison component has never been brought into being has not been established as to that component, whatever has been done about the others.

That consequence does not rest on the Foundation's reading alone. The Department has already asserted the premise it depends on. Part II.D.1 records that, asked in litigation whether it had complied with § 360ii, the United States answered that the Food and Drug Administration "has complied with the statute and established such a program," citing 21 C.F.R. §§ 1000.1 to 1040.30.

The Foundation takes that representation at its word and asks what follows from it. The program the United States says was established is the program of which paragraphs (a)(3) and (a)(6) are components, because the opening clause of § 360ii(a) makes them so. A representation that the program has been established is therefore a representation that extends to its liaison component. The Department can accordingly be asked, without any contest about the other five paragraphs and without reopening the litigation in which the answer was given, what the liaison component of the established program consists of: with which agencies it subsists, through which officials it is conducted, and in what record it is recorded. Part II.D.1 makes a separate observation about the regulations cited in that answer, which this subsection does not repeat.

A federal agency outside this Department has read the provision the same way, and the Foundation records it because the agency in question is the one at item c. Part II.H.11 sets out the Access Board's answer declining a petition, in which the Board construed § 360ii as directing the Food and Drug Administration to establish and carry out an electronic product radiation control program, and quoted paragraph (a)(6) in full in support of that reading. The only agency of the nine that offered to be consulted is also the agency that identified, in writing, the provision under which the consultation would occur.

The second is a matter of ordinary language and does not depend on the first. Maintain is a verb that presupposes its object. A relationship cannot be maintained before it exists, any more than a register can be kept before it is opened. A direction to maintain liaison therefore entails that a liaison relationship be brought into existence, and the entailment is in the meaning of the word rather than

in any gloss the Foundation puts upon it. Congress could have written consult from time to time and stopped there, which would have described a series of discrete events and nothing continuing. In paragraph (a)(6) it wrote both.

That conjunction is the sharper form of the argument and the Foundation puts it separately, because the two verbs paragraph (a)(6) joins are of different character. Consult describes an act that is performed and completed, and that can be performed again. Maintain liaison describes a condition that persists between the acts. A provision that directs both is not satisfied by either alone. A Department that consulted on one occasion and maintained nothing afterward would have performed half of what the paragraph directs. A Department holding a standing channel on which it never consulted about the two subjects the paragraph names, being techniques, equipment and programs for testing and evaluating electronic product radiation and the development of performance standards under § 360kk, would have performed the other half.

The contrast with the neighboring paragraph is available, and the Foundation relies on it for no more than it shows. Paragraph (a)(3) directs the Secretary to maintain liaison with and receive information from a broad class of bodies, and it does not contain the word consult. Paragraph (a)(6) contains it, and contains it as to the departments it names expressly and as to the two subjects it specifies. The word appears in the one paragraph and not in the other, and the Foundation reads the difference as doing work rather than as inadvertent. Part II.E and Part II.H treat the two paragraphs separately for that reason.

The practical consequence is that the sequence subsection g sets out is not an overlay the Foundation has placed on the statute. The invitation and the instrument are acts of consultation. The standing relationship they would bring into being is the thing that is afterward maintained. The two verbs of paragraph (a)(6) correspond to the two stages, and the Foundation has organized its request in those stages because the paragraph names them.

The Foundation states the limit of the argument. It does not contend that the statute prescribes the form the establishment must take, and subsection g is offered as content rather than as a reading of the text. What it contends is that something must exist before it can be maintained, and that the Department has not identified anything that does. Part II.H.22 collects what the record shows as to each agency.

g. What establishment consists of, and what maintenance would then implement

The Foundation offers three elements. It does not present them as required by the text, and the Department may discharge the duty in any form it chooses. They are offered because the duty has so far been treated as though it had no determinate content, and these three have determinate content and determinate answers.

First, a named point of contact. Consultation between departments is conducted by people. A duty framed as a relationship between two Secretaries is performed, in practice, by identified officials with the subject in their portfolio, and the Foundation asks the Department to identify, for each agency, the official within the Center for Devices and Radiological Health who holds this subject and the official at the other agency with whom he or she deals. Part II.H.15 records an instance in which an agency outside this Department identified its own officer by name and title in correspondence with the Foundation, which shows the question is an answerable one.

Second, an instrument recording what the two agencies will address. Four things would give it content: which product classes at Part VI are within it; which emission characteristics at Part III are within it; which agency holds which authority over them, so that the question of allocation Part IX.M raises is answered rather than left open; and what information is to pass between them and how often, which is the subject paragraph (a)(6)(A) names. The Foundation understands memoranda of understanding to be the instrument this Department customarily uses to record relationships of this kind, and asks the Department to state whether any memorandum of understanding presently in force covers the visible light emitted by light-emitting diode products with any of the agencies at

Part II.H. That is a question the Department can answer from its own records and the Foundation cannot answer at all.

Third, maintenance, which is the performance of what the instrument records. Part II.I.6 develops the proposition that a duty performed once is not a duty discharged, and it applies with particular force to this verb: a liaison established and then left dormant is a liaison not maintained. The Foundation does not ask for a stated interval and would not know what interval to ask for.

What this adds to the request, and the Foundation states it because it is the reason for making it in this form: it converts an obligation that has been treated as unanswerable into questions with determinate answers. Asked whether consultation has occurred, a Department may reasonably reply that consultation is a matter of degree and that contacts of various kinds occur. Asked who the point of contact is, and whether an instrument exists, and what it covers, the answer is yes with particulars or no. Part II.H.21 describes what the present record shows about the program as a whole, and the Foundation submits that the difficulty there is in part a difficulty about the form in which the question has been put.

One concession, stated because it bears on how much weight the second element can carry. An instrument that recorded nothing would establish nothing, and the Foundation would not be assisted by a memorandum executed for the sake of having one. The instrument matters only as evidence that the subject has been identified and the responsibility allocated. If the Department can show that both have happened without an instrument, the Foundation's point is met.

h. The limit of the request

An invitation is not consultation, and the Foundation does not present the sending of letters as the discharge of the duty. The provision directs the Department to consult and to maintain liaison, and maintain is a continuing verb; Part II.I.6 develops the point that a duty performed once is not a duty discharged. A letter to each agency would begin what paragraph (a)(6) contemplates. It would not complete it.

Nor does the Foundation ask that any other agency be directed to do anything. Part II.H.10 is explicit on that and this subsection does not depart from it. The request is that this Department discharge its own duty, and the Foundation asks nothing of the recipients of the invitations beyond that they receive them.

F. Require Disclosure of Emission Characteristics [RFI Q9]

This is the least expensive request in this Part and the Foundation puts it in those terms deliberately. Disclosure requires no exposure criterion, no threshold, no finding about health, and no determination that any product is harmful. It requires only that what a product does be stated in quantities that mean something. Every other request in this Part asks the Department to decide something. This one asks that a fact be published.

What should be disclosed is set out at Part III, which identifies sixteen characteristics requiring boundaries, and Part IX.C, which asks that the emission be characterized. The quantities the Foundation asks be disclosed for a product offered for sale are the spectral power distribution rather than the correlated color temperature, for the reason Part V.J.4 gives; the luminance of the emitting surface rather than only the luminous flux of the product; the luminous intensity and its distribution; the depth and frequency of temporal modulation, and the rise and decay times; and the geometry under which each was measured, because Part V.J.2 establishes that the measurement conditions determine the result.

The instrument is at Part IX.J.5, which sets out the labeling authority and the precedent this Department has already set in using it, and Part IX.J.1 establishes that the recommendation authority at § 360ii(b)(1) is not the standard-setting authority and is not conditioned on a determination that a standard is necessary. The three subsections below set out who needs the

disclosure and for what, because the answer differs and the form of the disclosure should follow the use.

1. To purchasers and specifiers

A purchaser cannot specify what is not published. Part VIII.G.2 sets out the consequence at the point of procurement and Part VIII.F.2 sets out the asymmetry it produces between an entity that holds the product literature and a person who holds only an account of their own symptoms.

What a specifier needs is a figure that can be written into a solicitation and tested on delivery. At present a specifier can require a correlated color temperature, a luminous flux, an efficacy in lumens per watt and a warranty term, because those are the quantities manufacturers publish. None of them describes what the product does to a person who looks at it. A specifier who wished to require a maximum source luminance, a limit on short-wavelength content expressed spectrally, or a modulation depth below a stated figure cannot, because the information does not exist in published form. Part VI.E.1 and Part VI.D record the same difficulty for school districts and municipalities.

The Foundation asks that disclosure be required in a form a purchaser can use, which means a published figure for a identified model rather than a statement of typical performance for a product family, and that the measurement geometry accompany each figure.

2. To state and local public entities conducting accessibility self-evaluations

This is the subsection on which Part VIII depends, and the Foundation states the connection exactly. Part VIII.C sets out the four steps a self-evaluation of an emitting product would require under 28 C.F.R. § 35.105. The second step is characterizing what each product emits, and Part VIII.C.2 establishes that it cannot be completed. The third and fourth steps depend on the second.

Disclosure would not supply the criterion. Part VIII.D.3 is careful about that: the entity would still have no federal figure against which to evaluate what it learned, and that is the subject of Part IX.I. What disclosure would supply is the other half of the problem, which is that at present the entity cannot even establish what it operates. An entity that could obtain, for each luminaire in its inventory, the quantities listed in the preamble to this subsection would be able to complete step one and most of step two of its own duty, and to compare the alternatives at step four, which Part VIII.C.4 describes.

The Foundation asks that the disclosure be framed with this use in mind, which has one practical consequence worth naming. A public entity does not purchase a lamp; it purchases an installation, frequently through a contractor and frequently as part of an energy program. Disclosure that reaches only the retail carton does not reach the entity. Part IV.G sets out the federal framework through which much of this equipment was procured.

3. To workers, schools, and healthcare providers

Three settings in which the exposed person neither selects the lighting nor can leave it, and in which somebody other than the manufacturer has a duty toward them.

Workers. Part V.H treats occupational exposure, Part VIII.B.6 sets out the employment provision and records that thirty-two of the 593 accounts at Appendix A describe work or employment, and Part VII.J.3 establishes that nothing is monitored. An employer asked to accommodate an employee who reports that the lighting is disabling has, at present, no description of what the lighting emits. Disclosure would give the employer something to work with, and Part VIII.B.4 establishes that the inquiry the employer owes is individualized and fact-specific.

Schools. Part VI.E treats interior lighting in schools and Part VI.E.2 sets out the position of children under it. A district procuring lighting for a classroom is procuring an exposure for the population Part IX.L identifies as both differently sensitive and differently exposed, and Part VI.E.1 records that it cannot specify by source luminance or short-wavelength content because the information is not published.

Healthcare providers. Part VI.E also treats healthcare settings and Part VIII.F.4 sets out an account from this record of a request for accommodation of lighting in a hospital emergency department, refused on the ground of a recent remodel. A provider deciding whether it can offer a patient a setting free of a particular emission needs to know which of its own fixtures emit what, and no provider can presently obtain that. Part VIII.B.3 records that this Department is the agency designated under Title II for programs, services and regulatory activities relating to the provision of health care and social services, which makes this the setting in which the Department's two capacities meet most directly.

G. Develop a Classification System for Optical Radiation Exposure [RFI Q5.p]

1. Spectral characteristics

The quantities in this family are the spectral power distribution; the short-wavelength content; the peak wavelength and bandwidth; and the weighted quantities appropriate to each response under consideration.

Part III.C treats spectral distribution as a characteristic requiring a boundary and Part V.B.1 and Part V.B.3 set out the physical account, including why correlated color temperature does not determine short-wavelength content and therefore cannot serve as the descriptor in this family.

2. Spatial characteristics

The quantities in this family are source radiance; apparent source size and angular subtense; directionality and beam distribution; uniformity across the emitting surface; the number, separation and arrangement of emitters; and the distance and geometry of the exposure.

Part III.D treats each of these and Part V.B.2 and Part V.B.8 set out the physical account. Part IX.C.2 asks that geometry and apparent source size be characterized, and Part V.J.2 establishes that the geometry of a measurement determines its result, so a criterion in this family is uninterpretable without a stated measurement geometry.

3. Temporal characteristics

The quantities in this family are modulation depth and waveform; drive frequency and flash rate; duty cycle; rise and fall times; single-exposure duration; and cumulative exposure.

Part III.E treats each of these and Part V.D sets out the physical and biological account. Part IX.C.3 asks that modulation be resolved rather than integrated away, and Part IX.I.2 sets out why this family would have to be regulated differently from the other two.

4. The effect families each class of characteristic bears upon

A classification is useful only if it says what each class is a classification for. The Foundation asks that each class of characteristic be stated together with the effects it bears upon, and sets out the correspondence it would propose.

The spectral characteristics at subsection 1 bear upon photochemical retinal response, which Part V.C.1 and Part V.C.2 treat; upon circadian and neuroendocrine response, which Part V.F treats; and upon the trigeminal and melanopsin-mediated pathways at Part V.E.4. They bear upon these through different action spectra, which is why Part IX.C.4 asks that the weighting appropriate to each response be adopted rather than one function applied to all.

The spatial characteristics at subsection 2 bear upon disability glare and veiling luminance at Part V.C.3, upon discomfort glare at Part V.C.4, and upon the photochemical response insofar as the angular subtense of the source determines which exposure limit applies, as Part V.C.2 sets out.

The temporal characteristics at subsection 3 bear upon photosensitive response at Part V.E.1, upon the stroboscopic and phantom-array effects at Part V.D.2, upon migraine and headache at Part V.E.2, and upon interference with clinical measurement at Part V.D.5.

The Foundation states the limitation of the whole table. These are the effects to which each family of characteristics is relevant, on the literature appraised at Part V and Appendix C. They are not dose-response relationships, no threshold is asserted for any of them, and Part V.K.4 records the 2018 Opinion's statement that reliable dose-response information is not available for the healthy general public across the wavelengths these products emit.

5. Why a criterion addressing one family alone is insufficient

A criterion that bounded one family alone would be satisfied by products that are unaltered in the respect that matters, and the Foundation gives three demonstrations drawn from the record rather than arguing the point abstractly.

Spectral alone. A product can be brought within any spectral criterion by lowering its correlated color temperature, and Part V.B.3 establishes that correlated color temperature does not determine blue content, so the adjustment need not change the emission in the respect intended. Appendix C records effects obtained with sources from which the short-wavelength content had already been reduced.

Spatial alone. A product can satisfy a limit on luminous intensity or illuminance while concentrating its output into a smaller emitting area, which raises the luminance and the apparent brightness without exceeding the limit. Part V.B.2 sets out the geometry and Part III.D.2 and Part III.D.3 treat radiance and luminance as characteristics requiring their own boundaries for this reason.

Temporal alone. A product can satisfy a modulation criterion expressed as an average while presenting abrupt transitions, because Part III.E.2 establishes that rise and decay times are not captured by modulation depth and frequency alone. And Part VIII.D.4 supplies the converse: a device whose flash rate is capped and whose intensity is not can comply with the rate and still present an intensity the framework never bounded.

The conclusion is the one Part III.B states in the form of four boundary shapes. A criterion addressing a single family is not merely incomplete. It is avoidable, and a criterion that can be satisfied without changing the exposure is worse than none, because compliance with it becomes an answer to the person affected. Part VIII.E.4 records the one documented instance in this record of an entity giving conformity with a federal guideline as its answer to a request for accommodation, and what the determination said about it.

6. Correspondence with the characteristics listed in Question 5

Question 5 of the notice lists characteristics of an exposure. The Foundation sets out the correspondence between that list and the classification proposed in this subsection, because the correspondence is the answer to the question and because a reader should be able to check it rather than take it.

Part III is the subsection that performs the mapping in full. It identifies sixteen characteristics of an optical emission that require boundaries, groups them into the three families used here, and states for each whether a boundary presently exists and in what form. Part III.H sets it out as a table of seventeen rows and the Foundation does not reproduce the table here.

What this subsection adds is the direction of the correspondence, which matters because it is the Foundation's position that the notice's list and the statutory language already fit together. The characteristics the notice names are properties of an emission and of an exposure to it. Paragraph 360ii(a)(2) names the emissions of, and the exposure of people to, unnecessary electronic product radiation. The notice is therefore asking, in the vocabulary of exposure assessment, about the quantities the statute directs the Secretary to minimize, and the Foundation asks the Department to

notice that it does not need a new framework to answer its own question. Part II.D sets out the paragraph and Part III.A the two questions a boundary has to answer.

7. Assign product codes to the light-emitting diode product classes that have none, and amend Table 1 to 21 C.F.R. § 1002.1 accordingly

The preceding six subsections propose a classification of exposure. This one proposes something narrower, cheaper and immediately available: a classification of products, in the system the Center already operates.

The Center maintains a classification of radiation-emitting electronic products in which each class carries a product code, a definition, a radiation type, the reports required of it and the performance standard applicable to it. The Foundation has searched that classification and sets out the result at Appendix F. In summary: three hundred and ten product codes are classified as optical; one hundred and forty-nine of them carry a performance standard, and one hundred and forty-one of those one hundred and forty-nine are laser products. The only other optical standards in the system are four codes for sunlamp products and four for high-intensity mercury vapor lamps. Within the category the Center calls General Optical Products, Non-Medical, there are twenty-one codes and twenty of the twenty-one record that no standard applies.

Five of those codes are for light-emitting diode products and three more are for displays. The Center has therefore classified the lamp, the indicator, the decorative string, the bare diode sold as a component, the toy, the liquid crystal display, the digital display monitor and the flat-panel television. What it has not classified is the roadway. There is no code for a diode headlamp, a diode signal or marker lamp, a diode emergency or warning beacon, a pedestrian crossing beacon, a diode roadway luminaire or an outdoor message sign. There are codes for the laser versions of two of those, and each carries a performance standard under 21 C.F.R. part 1040 and an annual reporting obligation.

The Foundation therefore asks the Department to do three things, in the order given, none of which requires a performance standard to exist first.

First, assign product codes to the classes identified at Appendix F.2. That subsection proposes thirteen, with a product name, a definition, a category, a radiation type and a cross-reference to the Part of this comment that describes the exposure, in the form the Center's own entries use. The Foundation does not ask that its drafting be adopted. It asks that the classes be recognized, and it has done the drafting so that the request is a specific action rather than a direction to think about one.

Second, amend Table 1 to 21 C.F.R. § 1002.1 so that the classes so assigned are subject to a product report under § 1002.10 and an annual report under § 1002.13. The Foundation frames that as parity rather than as a new burden. A laser traffic signal and laser automotive lighting and signals are each required to report annually today. The diode products that perform the same function on the same roadway are required to report nothing. The Department is asked to close that difference in the direction of the instrument it already uses.

Third, and this is the step that makes the first two worth taking, use what the reports produce. A product report under § 1002.10 requires a manufacturer to describe the radiation emitted. Part V.J.4 of this comment is a census of a literature that could not say what its own light sources emitted; Part IX.F asks that emission characteristics be disclosed. The reporting obligation is the existing mechanism by which the Department would come to possess that information, and it is available now, under regulations already written, without waiting for the standard asked for at Part IX.I.

H. Reconstitute the Technical Electronic Product Radiation Safety Standards Committee

This request comes before the request to prescribe a standard because the statute puts it there. Section 360kk(f) directs that the Secretary consult the Committee before prescribing any performance standard under that section, and Part II.K establishes the consequence: a program whose standard-setting body cannot convene cannot set a standard, whatever the record before it. Part II.K sets out the statute, the implementing regulations at 21 C.F.R. part 14, subpart G, and the Committee's present condition, and this subsection does not restate any of it.

It is also the most readily achievable thing the Department can do in response to this record, and the Foundation puts that first because it bears on how the request should be read. It requires no rulemaking, no new science, no new authority and no agreement from anybody outside the Department. It requires appointments.

The four requests below ascend in what they ask. The first two ask something of the Department alone. The third asks the Department to put a question to the Committee. The fourth asks the Department to invite the Committee to use a power the Committee already has, and the Foundation has no means of predicting what the Committee would do with it.

1. Fill the statutory membership and confirm the charter

The Foundation asks that the fifteen seats be filled in the proportions the statute fixes, that the charter be confirmed as current, and that a Chairperson be appointed. Part II.K.1 sets out the composition: fifteen members, five from government, five from affected industries, five from the general public, with at least one representing organized labor, each technically qualified by training and experience in a field applicable to electronic product radiation safety.

Two provisions make this a precondition rather than a formality, and both are in the Code of Federal Regulations rather than in a charter the agency may revise. Part II.K.2.c sets out 21 C.F.R. § 14.125(c), which fixes the quorum at ten members, of which at least three shall be from each of the government, industry and general public categories. And the same subsection sets out § 14.125(d), under which the Chairperson ordinarily submits a report to the Commissioner within sixty days. If the office of Chairperson is vacant, the consultation the regulation contemplates cannot be completed as written, because the officer who is to report does not exist.

What the record shows about the seats is set out at Part II.K and the Foundation states only the arithmetic here. Nominations were sought in January 2025 for ten of the fifteen seats. A body with ten vacancies cannot meet the quorum that § 14.125(c) requires, and cannot meet the category minimums within it. The Foundation draws no inference about why the seats were vacant and asks only that they be filled.

The Foundation does not ask for any particular appointee, for any balance of view among the appointees, or for its own representation on the Committee. It has not sought a seat and does not seek one here. What it asks is that the body Congress required to exist be in a condition to act.

2. Publish the Committee's proceedings as § 360kk(f) and 21 C.F.R. § 14.130 require

Section 360kk(f) directs that all proceedings of the Committee be recorded and the record available for public inspection, and Part II.K.1 sets out that requirement. The Foundation asks that the Department publish the record of the Committee's proceedings, state when it last met, and state what it considered.

One meeting matters more than the rest and the Foundation identifies it for that reason. Part II.K records that the Committee is reported to have met in 2016 and to have discussed hazards of light-emitting diode products, including the blue light hazard, at a meeting at which the Center presented its own concerns about these products. If that is so, the subject of this comment was before the

statutory advisory committee, raised by the Center itself, in the decade before the determination of May 24, 2024.

The request that follows is narrow and is addressed to the record rather than to the merits. The Foundation asks that the minutes, presentation materials and any report of that meeting be published, and that the Department state whether the Committee has met since. The reason is at Part IX.B: the determination of May 24, 2024 rests in part on an assessment of the state of knowledge, and what this Department's own advisory committee was told about these products, and when, is part of that state of knowledge. Part IV.I.6 records that the agency's records on the subject remain unavailable to the public.

The Foundation does not assert that the 2016 meeting produced any recommendation, or that anything was concealed. It asks for a record the statute already says shall be available.

3. Refer visible light emitted by LED products to the Committee

The Foundation asks the Department to refer the subject of this comment to the Committee: visible light emitted by light-emitting diode products, as an instance of electronic product radiation within the meaning of the Act.

The referral does not require a proposed standard to exist, and that is the point of making it separately from Part IX.I. Part II.K.2.b sets out 21 C.F.R. § 14.122 in full. Paragraph (a)(2) is the consultation that attaches to standards proposed for consideration, and it is the only one of the Committee's three functions triggered by anything the Commissioner does. Paragraph (a)(3) provides that the Committee may make recommendations to the Commissioner on any other matters it deems necessary or appropriate in fulfilling the purposes of the Act, and it is not confined to standards at all. A referral under that paragraph asks the Committee for its view of a subject, which is a thing it may consider whether or not a standard is before it.

What a referral would accomplish that nothing else in this Part would. It would put the question to the body Congress designated as technically qualified to answer it, rather than to the Foundation, to a court, or to a sister agency that has said the subject is not its own. Part II.H establishes that every federal body the Foundation asked has declined the question. The Committee is the one body within the program whose function is to consider exactly this kind of question, and nobody has asked it.

The Foundation asks the Department to notice what the referral costs it, which is nothing. Referring a subject commits the Department to no position on the science, to no finding about any product, and to no standard. It is a precondition to performing the duty rather than a concession to a petitioner. If the Committee considers the subject and concludes that no standard is warranted, that conclusion would be a far stronger basis for the position taken in the Final Response of May 24, 2024 than the Final Response presently has, and the Foundation says so in the knowledge that the conclusion may go against it.

The Foundation asks that the referral transmit this comment, the record at Part VII, and the appraisal of the literature at Appendix C, and that the Committee be asked specifically whether the characteristics identified at Part III are the characteristics that require boundaries and whether any of them can presently be bounded on the available evidence.

4. Invite the Committee to exercise its authority to propose a standard

The Committee may propose a standard on its own motion. Part II.K.2.b sets out 21 C.F.R. § 14.122(a)(1), under which the Committee may propose electronic product radiation safety standards to the Commissioner for consideration, and Part II.K.1 sets out the statutory counterpart. The Foundation asks the Department to invite it to do so for the products this comment concerns.

The significance of the power is structural. Every other route to a standard in this Part begins with the Department deciding something: that the products are within the Act, that a characterization is needed, that a standard is necessary. This one does not. A proposal under paragraph (a)(1) originates with the Committee, which means there exists a route to a standard for these products

that does not depend on the agency acting first, and that route has been available throughout the period Part IV describes.

The Foundation states the limits of the request squarely, because the provision is less powerful than it first appears and a reader who checks will find that out. Paragraph (b) of the same section provides that responsibility for action on performance standards under 21 U.S.C. § 360kk rests with the Commissioner, after receiving the advice of the Committee. A proposal by the Committee is therefore not self-executing and binds nobody. It would be advice, and the Commissioner would remain free to decline it.

That is still worth asking for, and the Foundation gives the reason. A proposal from the Committee would be a technical document, produced by a body of fifteen technically qualified members drawn in equal parts from government, industry and the public, addressing what may be bounded and how. Nothing of that kind exists for these products anywhere, and Part VIII.D establishes that its absence is what leaves every public entity in the country without a referent. Whether the Commissioner adopted it or not, the document would exist.

The Foundation asserts no entitlement to any of this, does not predict what the Committee would propose, and does not ask that the Committee be directed to propose anything. The request is for an invitation.

I. Prescribe a Performance Standard Under § 360kk [RFI Q5.n]

This subsection asks for one performance standard and defers the rest, and the Foundation states the deferral as plainly as the request. A comment that asked the Secretary to prescribe limits on four emission characteristics, having spent Part V establishing that three of them cannot presently be expressed in any agreed quantity, would be asking for something that cannot be drafted and would deserve to be discounted on all four. The Foundation asks for the one that can be drafted now and says why the others cannot.

1. The order of operations, which the Foundation does not ask the Secretary to disturb

Two steps come before a standard and both are the subject of other subsections. Section 360kk(f) requires that the Technical Electronic Product Radiation Safety Standards Committee be consulted before a standard is prescribed, and subsection H asks that the Committee be reconstituted for that reason. Section 360kk(a)(1) conditions the prescribing of a standard on the Secretary's determination that one is necessary for the protection of the public health and safety. The Foundation does not ask the Secretary to skip either step and does not assert that the determination has been made.

What the Foundation does ask is what Part II.D establishes about the relationship between that discretion and the duties that precede it. The condition in section 360kk(a)(1) governs whether a standard issues. It does not govern whether the Secretary studies and evaluates the emission, which paragraph 360ii(a)(4) directs without qualification, or whether the Secretary develops and evaluates procedures for minimizing exposure, which paragraph 360ii(a)(5) directs without qualification. A necessity determination that has never been attempted because the underlying evaluation has never been performed is not an exercise of discretion. It is the absence of one.

2. Why temporal light modulation is different from every other characteristic in this comment

Everywhere else this comment has had to concede that the number cannot yet be written. Part I.G establishes that no agreed spectral descriptor exists and that correlated color temperature is not one. Part V.J.4 establishes that the instruments in general use cannot see the wavelengths at issue, that the satellite record is unitless, and that a national government surveying eight measurement techniques found one that measures the relevant quantity and that one unavailable. Appendix D.1 records a national guideline stating that prescriptive limits on lighting are not possible. Those are real obstacles and the Foundation has not argued around them.

None of them applies to flicker, and the Foundation sets out four reasons.

First, the quantities are settled. Modulation depth, modulation frequency, duty cycle, waveform, and rise and fall times are defined, are measured by instruments that cost very little, and are not the subject of any dispute about units. There is no analogue here of the lux problem at Part V.J or the correlated-color-temperature problem at Part I.G. A photodiode and an oscilloscope resolve the question.

Second, a consensus standards body has already written the numerical criteria, in mandatory language, and nobody is bound by them. IEEE Std 1789-2015 is described at Appendix D.2 and treated at Part V.D. Its Recommended Practice 3 is set out below.

Third, the effects are documented in human beings, at frequencies human beings cannot perceive. Part V.D sets out the evidence and Appendix C.94 tabulates it: unperceived neurological effects from light-emitting diodes at frequencies up to 200 hertz, unperceived retinal effects between 76 and 162 hertz, and headache, visual disturbance and seizure at lower frequencies. The comment does not have to reason from a rodent or infer from an ecological endpoint to reach a human effect here.

Fourth, the Department has done this before for an optical emission characteristic. Section 1040.20 of title 21 prescribes emission limits for sunlamp products in terms of the ratio of irradiance in defined wavelength bands, as Part II.D and Part I.G describe. A performance standard expressed in a measured optical quantity, for a consumer product class, administered by this Center, already exists in the Code of Federal Regulations. The Foundation is not asking for a novel instrument.

3. What the Foundation asks the Secretary to consider prescribing

That the Secretary consider prescribing, for electronic products offered for sale in the United States whose function is general illumination or visual display, a limit on temporal light modulation of the emitted optical radiation. For the content of that limit the Foundation does not offer a number of its own. It asks the Secretary to begin from the one a consensus body has already written:

> "Recommended Practice 3: (seizure prevention) For any lighting source, under all operating scenarios, flicker Modulation (%) shall satisfy the following goal: Below 90 Hz, Modulation (%) is less than 5%."

Three features of that text are the reason the Foundation points to it rather than to the other two recommended practices in the same clause. Its terms are any lighting source, under all operating scenarios, and shall. The standard distinguishes it expressly from its neighbors, which begin with the words if it is desired, and its own commentary states that it is a strict rule for seizure prevention and should be adhered to at all times for all operating conditions. And the risk assessment behind it, at clause 7.4.1.3, identifies the susceptible subgroup as persons aged five to twenty-four and estimates the prevalence of seizure at between one in a hundred thousand and one in four thousand.

The Foundation asks the Secretary to notice what that combination amounts to. A standards body of the industry has concluded that a rule is strict, that it should be adhered to at all times, and that the population it protects includes children; and has expressed that conclusion in a document that binds nobody, that a purchaser cannot read without buying it, and that no federal instrument references. Whether that situation calls for a performance standard is the determination section 360kk(a)(1) commits to the Secretary. The Foundation submits that it is at least a determination worth making on the record rather than by default.

a. Four matters a standard would have to settle, which the recommended practice does not

The Foundation identifies these because a request that ignored them would not be serious. The measurement method, including the detector bandwidth and the averaging interval, since a modulation depth depends on how it is measured. The operating conditions at which compliance is assessed, which must include dimmed operation, because Part V.D records that modulation in these

products is commonly produced by the dimming method itself and a product compliant at full output may not be compliant at twenty percent. Whether compliance is assessed on a new product or over its service life, which no instrument in this comment presently addresses for any optical characteristic. And the treatment of products whose modulation is intended and perceived as a signal rather than as illumination, which Part VI.C discusses and which would require either exclusion or a separate limit.

b. A fifth matter, which the Foundation puts first in importance: the number of emitters a person meets at once

The four matters above concern how a single product is measured. This one concerns whether measuring a single product answers the question, and the Foundation states it at length because it bears on every performance standard this comment asks for and not only on the one asked for here.

A performance standard prescribed under 21 U.S.C. § 360kk bounds what a product emits. It does not bound what a person is exposed to. Those are different quantities whenever a person can meet more than one product at a time, and in every class at Part VI a person routinely meets many.

The statute itself distinguishes them. Paragraph 360ii(a)(2) directs the Secretary to support activities to minimize two things, not one: the emissions of, and the exposure of people to, unnecessary electronic product radiation. Part II.D.4 establishes that the two objects are coordinate. An emission is a property of a product. An exposure is a property of a place at a moment, and it is the sum of what everything emitting into that place contributes.

The established metrology says the same thing, and the comment has already set out the arithmetic. Part V.C.4.b gives the Unified Glare Rating of the International Commission on Illumination, which predicts discomfort glare from an installation as a logarithmic function of a summation over the glare sources in the field of view, each source entering the sum through its own luminance, solid angle and position. The quantity that term predicts is a property of the summation. A limit applied to one term in it is not a limit on the sum.

The accessibility framework has already conceded the point in the one place where it set an optical number. Part VIII.D.4 sets out that a visual alarm appliance is capped at a flash rate of 3 hertz, that the explanatory manual records that rates above 5 hertz may trigger seizures in people with certain forms of epilepsy, and that the manual's own worked example is two compliant appliances in one room presenting a composite rate of 6 hertz. Two products, each within the limit, producing an exposure outside it. The only instrument the framework offers against that outcome is a recommendation to synchronize.

The Department has already asked this question in this proceeding, about the other kind of radiation. Question 15 of the Request for Information asks for evidence on antenna density, cumulative neighborhood exposure, and simultaneous exposure to multiple sources. Part II.K. The Foundation asks that the same question be asked of the optical case, and observes that the optical case is the easier of the two to pose, because the sources are visible and countable and their geometry is known.

The scientific committee of the European Commission has identified the same gap. It records that there is insufficient knowledge about the actual exposure of people to optical radiation from light-emitting diode sources and about the total exposure from all optical radiation sources. Part V.K.4. The second clause is this matter.

c. A sixth matter: the shape of the transition, which the recommended practice does not reach either

Subsection 2 of this Part lists the quantities it describes as settled, and rise and fall times are among them: defined, measured by a photodiode and an oscilloscope, and attended by no dispute about

units. The Foundation therefore has to account for the fact that the criterion it points to does not mention them, and it does so here rather than leaving the omission to be noticed.

Recommended Practice 3 is written in modulation depth as a function of frequency. Modulation depth is computed from the maximum and the minimum output over a cycle and is indifferent to how the output travels between them. Flicker index is sensitive to waveform and is the nearest available quantity, and it is not a measure of transition time either. Part III.E.2 sets out the distinction and the reason it matters.

The consequence is that a standard written in modulation depth and frequency alone would be satisfied identically by two products that differ entirely in this characteristic: one whose output moves smoothly between its states, and one that switches in microseconds. The Foundation submits that those are not the same stimulus, and that nothing in the quantity chosen would distinguish them.

Part III.E.2 establishes the position in federal law, and it is a complete absence. Every federal instrument the Foundation has examined that addresses the temporal behavior of an optical emission specifies a schedule, meaning how often and for how long, and not one specifies a shape. The single apparent exception is a state specification that states transition time as a ceiling, which forbids slowness and is the opposite of what would be needed.

The boundary required in this dimension is accordingly a floor rather than a ceiling: a minimum transition duration, or equivalently a maximum rate of change of output. The Foundation cannot state the value and does not propose one. What it asks is that the matter be among those a standard settles rather than among those it omits by not naming them. A characteristic absent from a criterion is neither permitted nor forbidden by it; it is unaddressed, and Part VI.R.4 sets out what followed the last time a property of a converted lighting class went unaddressed because nothing had ever required it to be specified.

d. One consequence the Foundation reports against its own proposal

The Foundation recommends a radiance limit in several places in this comment, and Part V.B.2.2 sets out how such a limit is met: by enlarging the emitting aperture at unchanged luminous output, through a diffusing optic, a larger lens, or a greater number of emitters operated at lower drive current. The third of those techniques reduces the radiance of the product by increasing the number of emitters in it. The Foundation reports the consequence rather than leaving it to be found. A limit expressed on one product, met by multiplying emitters within that product, improves the quantity the standard measures. Whether it improves what a person meets depends on the geometry, and the standard as described would not ask.

e. What the Foundation asks, and the limit of what it can ask

It does not ask the Department to regulate how many luminaires a city installs, or how many vehicles are on a road. Section 360kk reaches products, not places, and the Foundation has been careful throughout this comment not to ask for authority the chapter does not confer. The request is narrower and is in three parts.

First, that the standard state the condition it assumes. That any performance standard prescribed for an optical emission specify, on its face, the number of emitting products and the geometry of their arrangement for which the limit was derived, as the reference distance and the aperture are specified. A limit derived for one product viewed alone should say so, so that a public entity performing the evaluation at Part VIII.C, or a purchaser reading a disclosure under Part IX.F, is not left to assume that compliance describes an installation.

Second, that the research include the aggregate. That the research directed by § 360ii(a)(2) and the studies and evaluations directed by § 360ii(a)(4), which Part IX.C addresses, include the exposure produced by multiple simultaneous sources in the arrangements set out at Part VI, and not only the emission of single products. The statutory warrant for this is

the second object of paragraph (a)(2), and the Foundation asks for nothing beyond what that paragraph names.

Third, that the recommendation instrument carry what the standard cannot. That a recommendation under § 360ii(b)(1), which Part IX.J addresses, state what a product standard does not reach, so that the entities which do control the arrangement of products in a place, and which Part IX.E identifies, have the Department's statement of the limit rather than an inference from its silence.

The Foundation states the obvious objection to all three and does not answer it. None of these is a number. Each is a requirement that a number, when it comes, be accompanied by a statement of what it assumes and what it leaves out. That is less than the Foundation would ask for if the research at Part IX.C had been done, and it is as much as the record presently supports.

4. Technical achievability and practicability under section 360kk(a)(2)

Section 360kk(a)(2) directs that a performance standard be technically achievable and that the Secretary take into account the reasonableness and practicability of its application. The Foundation offers three things and withholds a fourth.

That the criterion originates with the industry's own standards body rather than with this commenter, which is evidence that engineers familiar with the technology considered it attainable. That the measurement is inexpensive and routine, as set out above. And that products meeting it exist, since the criterion has been published for more than a decade and drivers producing low modulation are sold. What the Foundation withholds is any estimate of cost. It has no data on the incremental cost of compliance across the product class and will not supply a figure it cannot support. That is precisely the kind of question the Committee at subsection H exists to answer and the Foundation asks that it be put there.

5. What this subsection does not ask for, and why not

No limit on spectral content. No limit on luminance, illuminance or radiant intensity. No limit on the angular distribution of the emission. The Foundation believes each of those characteristics matters and Part IX.C asks that each be studied. It does not ask for a standard on any of them now, for the reason given at the head of this subsection: the comment has established that the quantity in which such a limit would be expressed is not settled, and a limit cannot be prescribed in a quantity nobody has agreed. Part I.G sets out the candidates for a spectral descriptor and the demonstrated defects of each, including a published warning that a limit written in the leading candidate could be satisfied by moving a diode's pump wavelength into the violet. The Foundation will not ask the Secretary to prescribe a limit it has itself shown to be evadable.

When the research at subsection C supplies the quantities, the same request should be made for the other three characteristics, and the Foundation says so now so that the narrowness of this subsection is not read as a concession that the others do not warrant standards. They do. They are not yet draftable. Flicker is.

No limit on products whose function is to flash, and the question that exclusion leaves unasked

The standard asked for at subsection 3 is confined to products whose function is general illumination or visual display. A notification appliance is neither. Its purpose is to be noticed, and in such a device modulation is the signal rather than an artifact of the driver circuit. Warning beacons and emergency lamps at Part VI.C are in the same position.

The exclusion is deliberate, and the reason is one the Foundation states against its own criterion. Recommended Practice 3 applies to any lighting source, under all operating scenarios, and requires modulation below 90 hertz to be less than 5 percent. A visible alarm flashing between full output and darkness at 3 hertz has a modulation of 100 percent at 3 hertz. It exceeds that criterion by a factor of twenty, and so does every warning beacon in the country. A request to apply the criterion to all

products would therefore be a request to prohibit the notification appliance that deaf and hard-of-hearing people depend on, and the Foundation asks for nothing of the kind.

But the exclusion leaves a question unasked, and the Foundation puts it here rather than leaving it. The accessibility specification set out at Part VIII.D.4 bounds the flash rate of a visible alarm in both directions, at a minimum of 1 hertz and a maximum of 3 hertz. It bounds the pulse duration at a maximum of two tenths of a second. It bounds the duty cycle at a maximum of 40 percent. It specifies a xenon strobe type or equivalent. It does not bound the transition. Nothing in it requires the output to switch abruptly, and nothing in it forbids an appliance whose output rises and falls over a measurable interval.

Two things follow and the Foundation separates them. The first is that the minimization this chapter directs is available in this class without amending the accessibility specification at all. A manufacturer who built a visible alarm whose output ramped rather than switched, at a rate within the permitted band, would be building a compliant appliance. The Foundation is not aware that anyone has built one, and is not aware of any evaluation of whether such an appliance would notify as effectively.

The second is that whether the abruptness, and the rate, are necessary to the notification function is an empirical question, and it is the question paragraph 360ii(a)(5) directs the Secretary to answer: to develop, test and evaluate the effectiveness of procedures and techniques for minimizing exposure to electronic product radiation. Part II.G sets out the paragraph and Part III.G the techniques. The questions are specific and answerable. Does an appliance flashing at 1 hertz notify as reliably as one flashing at 3? Does an appliance whose output ramps notify as reliably as one that switches instantaneously? Does a steady indication, dark before and illuminated now, notify as reliably as either? The Foundation does not know the answer to any of them and asserts none.

What it asks is that the Department answer them, and state the answer whichever way it falls. If the abrupt high-rate flash is necessary to notify a person who cannot hear the audible alarm, that is a finding this Department is equipped to make and the Foundation will accept it. The finding would also establish that the emission is necessary within the meaning of paragraph (a)(2), which is the test at Part II.D.2, and the question would be closed. If it is not necessary, then a characteristic that Part V.E.1 associates with seizure, and that the explanatory manual of the accessibility framework itself records as capable of triggering seizures above 5 hertz, is being emitted into schools, hospitals and workplaces without serving a purpose for the person who receives it. Part VI.E describes those settings. Either answer is useful to the Department and to the public. The absence of either is the condition this comment describes.

The Foundation states the limit of this request in terms, because the subject admits of no ambiguity. It does not ask that visible alarms be made dimmer, slower or less noticeable. It does not ask for any reduction in the effectiveness with which a deaf or hard-of-hearing person is warned of a fire. Part VIII of this comment is addressed to disability access, and a request that degraded the warning a disabled person receives would be inconsistent with the whole of it. The request is whether the same notification performance can be obtained with temporal characteristics less aggressive than those now in use, and if it cannot, that the Department say so.

J. Make Recommendations Under § 360ii(b)(1), Without Waiting for a Standard

The requests at subsections C and I are for research and for a performance standard. Both take years. This subsection asks for something the Department may begin now, and the Foundation puts it forward because of what Part VIII describes. A city choosing a streetlight, a school district specifying classroom lighting, a manufacturer designing an appliance and a person buying a lamp all operate today with no federal criterion of any kind. Not a weak criterion. None.

1. The authority is express, and it is not the standard-setting authority

The Foundation does not rest this request on § 360kk. A performance standard is binding, requires rulemaking, and is conditioned by § 360kk(a)(1) on the Secretary's determination that one is necessary. The authority for this request is elsewhere in the same subchapter and is addressed to recommendations rather than to standards. Section 360ii(b)(1)(B) authorizes the Secretary to make such recommendations relating to such hazards and control as he considers appropriate, the hazards and control in question being those of electronic product radiation. Part II.B.

The Foundation accepts the discretionary character of that provision and does not argue around it. The question it raises is not whether the Secretary must make recommendations. It is whether the Secretary has considered whether to, and on what basis he concluded that none was appropriate for a product class that accounts for most human exposure to artificial optical radiation. The Foundation has found no record of that consideration.

Two further provisions support the request. Section 360ii(b)(1)(A) authorizes the Secretary to collect and make available, through publications and other appropriate means, the results of research and studies relating to the nature and extent of the hazards and control of electronic product radiation. And § 360ii(a)(5), which is a duty rather than a power, directs the Secretary to develop, test, and evaluate the effectiveness of procedures and techniques for minimizing exposure. A technique for minimizing exposure that is developed and never communicated to anyone positioned to apply it has not been given its effect.

The instrument also exists and this Center already uses it for the other light-emitting product class in this program. Part II.E.4 describes Laser Notice No. 56, guidance issued by the Center for Devices and Radiological Health in 2019, succeeding Laser Notice No. 50. Recommendations under the electronic product radiation control program are not a novel instrument requiring new authority. They are an instrument the Center has in hand, has used, and has not used here.

2. What can be issued now, without new research

The Foundation is careful here, because a comment that faults the Department for stating a conclusion ahead of the record cannot coherently ask the Department to publish numbers the record does not support. Each of the following either transmits what is already published or recommends a capability rather than a threshold.

- Transmit the quantitative recommendations that consensus bodies have already published. Recommendations expressed in melanopic equivalent daylight illuminance exist and are described at Part V.J.4. The Department need not originate them. Collecting and making available the results of research and studies is what § 360ii(b)(1)(A) describes.
- State what the existing photobiological hazard framework covers and where it stops. Part V.C.2. A purchaser told that a product conforms to a photobiological safety standard is entitled to know what that conformity was assessed against and what it was not.
- State that lumens, watts and correlated color temperature do not describe the spectral content of a source, and identify the quantities that do. Parts V.B.3 and V.J.1. This is a statement of physics rather than of risk, and it is not in dispute.
- Recommend capability rather than level, wherever the level is not yet known. That an indicator lamp on a household appliance be capable of being dimmed or extinguished by the user. That an outdoor luminaire be capable of dimming and scheduling, and be shielded against emission above the horizontal. That a product intended for a bedroom default to its lowest output. And that an indicator whose function is to confirm that a product is working normally indicate instead only the departure from normal, so that the lamp is dark while nothing is wrong. None of these requires a dose-response relationship.

Identify the emission information a purchaser or specifier should request from a manufacturer, which subsection F addresses as a disclosure obligation and which can be recommended in the meantime.

The Foundation draws attention to the fourth of those in particular. A recommendation that a user be able to switch off an indicator lamp asserts nothing about whether the lamp is harmful. It requires no finding about anyone's health, it is available on the present state of knowledge, it costs the manufacturer a switch, and it restores to the person exposed a choice that the design of the product removed. The Foundation suggests that the indicator lamps now fitted to household appliances are the clearest illustration in this comment of a gap that cannot be explained by difficulty. They are electronic products. What they emit is electronic product radiation. They are installed in bedrooms and kitchens and operate through the night. There is no federal criterion of any kind addressed to them, and no one has suggested that there is any obstacle to recommending that they be capable of being turned off.

The Foundation draws attention to the last of those as well, because it is the only recommendation in this comment that disposes of a measurement problem instead of solving it. Every other proposal about indicator lamps runs into the difficulty that the right emission depends on the ambient condition: a lamp set to be visible in a lit room is punishing in a dark one, and a lamp set for the dark room cannot be seen in daylight. An indicator that is dark unless something is wrong has no such difficulty, because for almost the whole of its service life it emits nothing at all, and when it does emit, the condition it reports is one the occupant wants brought to their attention. The question of how bright a confirmation of normality should be does not arise, because there is no reason to confirm normality continuously to a person who has not asked.

Two limits on that, stated by the Foundation. It does not apply to a product whose indication is itself a safety function required by another authority, and the Foundation has not established which household products are subject to such a requirement. It also does not apply to an indication a user has asked for. The recommendation is about the default, which is the only thing a recommendation under § 360ii(b)(1) can reach.

One contrast is worth recording because it shows that the federal government already specifies quantities of this kind when it chooses to. Under the Department of Housing and Urban Development's construction standards for manufactured homes, a visible notification appliance installed in a room designed for sleeping must have a minimum rating of 177 candelas, with a lower figure permitted in stated mounting conditions. 24 C.F.R. § 3280.209(f). That is a federal regulation fixing, in candelas, how much light a device in a bedroom must produce. It is a floor and not a ceiling, and it governs an alarm rather than a status lamp, so the Foundation does not offer it as a precedent for a limit. It offers it for the narrow point that the unit, the setting and the exercise are all familiar to the federal government, and that what is missing for the products this comment concerns is not the technique.

3. What must wait for the research, and should be acknowledged now

The Foundation does not ask the Department to publish today a maximum illuminance for a sleeping environment, a maximum luminance for an appliance indicator, or a permitted short-wavelength content for a street luminaire. Those are the numbers that matter most and they are the numbers the record does not yet support. To ask for them now would be to ask the Department to do what Part I.C.7 faults it for having done, in the opposite direction.

What the Foundation asks instead is that any recommendations issued state which questions the Department regards as unresolved, what evidence would resolve them, and when it expects to address them. A document saying plainly that no federal recommendation exists for the illuminance of a sleeping environment, that the question is under study, and that a recommendation will follow when the study supports one, is worth more than the present silence. It tells a purchaser the truth about the state of the record.

The Foundation adds one observation about what such a record would have to contain, because an instance of it now exists. Obayashi and others measured bedroom light directly, with light meters, in 2,947 adults in Japan. They report a median bedroom intensity of 1.0 lux with an interquartile range of 0.2 to 4.0 lux, and associations at thresholds of 3 and 10 lux with measures of obesity, blood lipids, systemic inflammation, sleep disturbance and depressive symptoms. Appendix C.32.

That is the shape of the evidence on which a recommendation could eventually rest: direct instrumental measurement of the exposure in the place where it occurs, at a scale sufficient to describe its distribution across a population. The Foundation does not propose those thresholds as federal recommendations and could not. It is one cross-sectional study, in one country, in a cohort whose mean age was 69, reported in photopic lux and therefore carrying no information about spectral composition. What the Foundation offers it for is narrower: the measurement is feasible, it has been performed at population scale, and nothing of the kind has been performed in the United States. Paragraph 360ii(a)(4) directs the Secretary to study and evaluate conditions of exposure, and § 360ii(b)(4) authorizes the Secretary to procure electronic products for research and testing purposes. Part II.B. Neither the authority nor the method is missing.

4. The limits of the instrument, stated by the Foundation

First, a recommendation is not a substitute for a performance standard and the Foundation does not offer it as one. The request at subsection I stands. Issuing recommendations would not discharge § 360ii(a)(1), would not satisfy § 360kk, and should not be treated as closing the question whether a standard is necessary. The Foundation asks that any document issued say so expressly, so that it cannot later be read as a determination that no standard is required.

Second, a recommendation binds no one. A manufacturer may disregard it and a city may ignore it. The Foundation regards it as valuable nonetheless, for the reason Part VIII gives: a public entity conducting the self-evaluation that 28 C.F.R. § 35.105 requires needs a criterion to evaluate against, and a published federal recommendation is a criterion even when it is not a rule.

Third, this Department regulates products and not their operation by others. The Foundation does not ask it to direct any city when to switch off a streetlight, which is not within this authority. It asks that the luminaire be recommended to have the capability, and that the Department publish the exposure information on which a city would decide. The distinction is observed throughout this subsection.

5. The labeling instrument, and the precedent the Department has already set

One instrument deserves separate mention, because the Foundation has found no reference to it anywhere in the agency's treatment of light-emitting diode products and because the Department has used it before, on a light-emitting product, under this subchapter.

Section 1040.20 of title 21 prescribes a performance standard for sunlamp products and ultraviolet lamps. Paragraph (d) of that section is headed Label requirements, and it provides that in addition to the labeling requirements of part 801 and the certification and identification requirements of §§ 1010.2 and 1010.3, each such product shall bear a label containing a warning statement. The regulation then sets out the words. They begin:

> "DANGER—Ultraviolet radiation. Follow instructions. Avoid overexposure. As with natural sunlight, overexposure can cause eye and skin injury and allergic reactions. Repeated exposure may cause premature aging of the skin and skin cancer–"

The regulation goes on to require a recommended exposure position, directions for achieving it, a recommended exposure schedule including duration and spacing, and a statement of the time before results appear; and it specifies that the label be permanently affixed to an exterior surface, legible and readily accessible to the person being exposed immediately before use. 21 C.F.R. § 1040.20(d).

The Foundation asks the Department to hold that beside the products described in Part VI. The Department has already determined, for one class of light-emitting product, that the user is entitled to be told in prescribed words what the product emits, what overexposure may cause, how far away to stand, and for how long. Whatever may be said about whether a comparable determination is warranted for any other lamp, it cannot be said that the instrument is unavailable or that the Department lacks experience of it.

Two consequences follow, and the Foundation separates them because they travel by different routes.

A mandatory label is part of a performance standard. The requirement at § 1040.20(d) exists because a standard was prescribed under § 360kk, and a label requirement for any other product would travel the same way, through rulemaking. That request belongs with subsection I and the Foundation does not make it here.

A recommended label does not. Section 360ii(b)(1)(B) authorizes the Secretary to make such recommendations relating to the hazards and control of electronic product radiation as he considers appropriate, and a recommended form of consumer information is a recommendation. The Foundation asks that the Department consider whether any such recommendation is appropriate for products emitting visible light, and that if it concludes none is, it say why.

The Foundation records that the proposition has been put to researchers in this field, and records with equal care what kind of evidence that is. A survey described at Appendix C.25 asked circadian researchers whether light-emitting diode lamps with high content between 460 and 495 nanometers should carry the warning label maybe harmful if used at night, and 79.1 percent of those responding agreed. That item appeared in the survey's expert-opinion section rather than among its statements of evidence; the response rate was low; and the survey was funded by a lighting company whose commercial position is described in that entry. The Foundation therefore offers it for one proposition only, which does not depend on any of that: the question of whether such products should be labeled is one that people who study this subject are actively asking. Whether the answer is yes is for the Department, on a record it has not yet assembled.

6. Why this is the least that could be asked

Of everything requested in this Part, this request costs least. It requires no finding of harm, no rulemaking, no appropriation of consequence, and no authority the Center does not already hold and use. If the Department concludes that the evidence does not yet support a performance standard, that conclusion is entirely consistent with making the recommendations described at subsection 2. If the Department concludes that the evidence supports not even those, the Foundation asks it to identify which of the five items it regards as unsupported, and why.

K. Conduct the § 360jj Studies and Report to Congress [RFI Q18]

This is the only request in this Part addressed to a provision outside § 360ii, and the only one whose product is a document delivered to another branch of government rather than held or published by the Department. Part II.I sets out the provision, what it directs, and the single occasion on which the study it directs was performed.

1. What the Foundation asks, and the three things it does not ask

The Foundation asks four things. That the Secretary conduct the study directed by 21 U.S.C. § 360jj(a)(2) as it bears on electronic products that emit visible light. That he make a report of the result to the Congress under § 360jj(a). That in carrying out the study he invite the participation of other Federal departments and agencies, as subsections (b) and (c) of the same section direct and as Part IX.E.5 asks separately. And that the report carry such recommendations for legislation as he may deem appropriate.

The first thing the Foundation does not ask for is the repealed annual report, and it identifies the distinction because the two provisions are easily conflated and a request that confused them would deserve to be refused. Part C of this subchapter originally carried two reporting obligations. One was a standing requirement that the Secretary report annually to Congress on the administration of the program, codified at 21 U.S.C. § 360qq, under which annual reports were transmitted for approximately three decades. Congress repealed it by Public Law 105-362, title VI, § 601(a)(2)(A), on November 10, 1998. Part II.I.8 sets out the repeal. The Foundation does not ask the Department to resume a reporting obligation Congress eliminated. The studies-and-reports provision at § 360jj was not repealed and is the provision this subsection concerns.

The second thing it does not ask is that the study reach any particular conclusion. The study § 360jj(a)(2) directs is a study to determine the necessity for the development of standards. A determination that standards are unnecessary would be a performance of the duty. The Foundation asks for the study and the report, not for the answer, and Part IX.I states separately and on its own grounds the one standard it asks the Secretary to consider prescribing.

The third is that it does not ask the Department to decide the pending petition in this proceeding. Subsection 5 sets out why.

2. The provision is differently conditioned in its two halves, and the request tracks the difference

Section 360jj(a) provides:

> "The Secretary shall conduct the following studies, and shall make a report or reports of the results of such studies to the Congress on or before January 1, 1970, and from time to time thereafter as he may find necessary, together with such recommendations for legislation as he may deem appropriate"

Part II.I.2 draws the distinction this request depends on, and the Foundation restates it here only to show that the request is shaped to it. The direction to conduct the studies carries no qualifier: the Secretary shall conduct them. The first report carried a date certain, January 1, 1970, and it was made; Part II.I.4 sets out the document. Two things in the provision are committed to judgment. Whether further reports are made from time to time thereafter turns on what the Secretary finds necessary. What legislative recommendations accompany a report turns on what he deems appropriate.

The Foundation therefore asks for the unconditioned thing without qualification and for the conditioned thing in the only form the condition permits. It asks that the study be conducted. It asks that the Secretary determine whether a further report is necessary, and that he state the determination and the basis for it.

The Foundation is careful about what it says of that determination, and says it in the terms this comment uses throughout. It does not contend that the Secretary must find a report necessary; the statute gives him that finding and the Foundation does not ask the Department to treat the word necessary as though it were absent. What it contends is that the finding is one the statute assigns to him, that the Foundation can locate no instance of its having been reached as to any product emitting visible light, and that a judgment a statute assigns is not exercised by never being taken up. The complaint is of discretion unexercised, not of discretion abused, and the remedy correspondingly is that the Secretary exercise it either way and say which.

3. Why the study has never been performed for these products, which is a point about scope and not about staleness

Part II.I.4 establishes the position from the agency's own document rather than from silence, and the Foundation summarizes it here because it is the factual premise of the request. The duty was performed once. The study was carried out during 1969 and reported to Congress in April 1970. The staff document performing the second study is BRH/DEP 70-30, issued by the Division of

Electronic Products of the Bureau of Radiological Health, and its preface and its introduction each state the scope: the study was confined to three classes of products, being industrial radiographic and fluoroscopic x-ray units, particle accelerators, and analytical x-ray equipment.

All three emit ionizing radiation. Not one is a source of visible light. The statutory definition at § 360hh(1)(A) reaches ionizing and non-ionizing electromagnetic radiation alike, and Part II.B establishes that it reaches the emissions this comment concerns; the study as performed addressed the first branch of that definition and not the second.

The Foundation states the argument in the form Part II.I.4 states it, because the distinction is the whole of its force. This is not a contention that a 1970 study has grown old and should be refreshed. A report that is old is still a report. It is a contention that the study never addressed this subject matter at all, so that as to products emitting visible light the duty has not been performed once rather than performed long ago. The products did not exist in 1969: Part II.I.4 records that high-brightness white light-emitting diodes suitable for general illumination were not commercially available until the late 1990s.

One feature of the 1970 study tells against any assumption that a study of this kind is a formality that concludes against regulation. As to particle accelerators it concluded that standards were needed. Part II.I.4 quotes the sentence. Where the second study was performed, it found a need for standards.

4. What a report under this provision would do that no other request in this Part does

Every other request in Part IX produces something the Department holds, publishes, or prescribes. This one produces a document addressed to Congress, and the Foundation identifies two consequences of that difference.

The first is that the report would arrive to a body that has already acted on the adjacent subject. Part IV.F sets out what Congress has done. A report under § 360jj(a)(2) would place before that body a federal account of what these products emit and of the conditions under which people are exposed to them, which is at present not available to it from any federal source.

The second concerns the legislative-recommendation clause, and it answers something this record contains repeatedly. A recurring federal response to this subject is that it lies outside the responding agency's authority. Part VIII.E.6 records an instance and Part II.H collects the agencies. If the Secretary concludes, after conducting the study, that the authority or the resources to address this radiation are wanting, § 360jj(a) is the vehicle Congress supplied for telling Congress so. The Foundation draws attention to that because it makes the request available to the Department on any view of the merits: a Secretary who thinks the subject beyond his present powers can perform this duty by saying that to the body that can supply them, and saying it concedes nothing about whether these products injure anyone.

5. The pending petition, and the limit of what this comment asks about it

On December 30, 2025 the Soft Lights Foundation and Mark Baker petitioned the Commissioner of Food and Drugs under 21 C.F.R. §§ 10.25 and 10.30 to conduct the study § 360jj(a)(2) directs and to submit a report to Congress. Part II.I.5 sets out the petition, what it asks, and its procedural history: a response of the kind permitted by 21 C.F.R. § 10.30(e)(2) issued on June 18, 2026, stating that the petition raises issues requiring further review and analysis by agency officials, and the matter remains pending. The Foundation does not contend that the regulation was contravened. Part II.I.5 says so and this subsection does not revisit it.

The Foundation does not ask the Department to decide the petition in this proceeding, and does not suggest that a response to a request for information is the place to decide it. The two proceedings are separate and should remain so. It identifies the overlap for one reason only: the subject of the petition is a subject of this request for information, and a Department asking the public what it should do about human exposure to electromagnetic radiation has before it, at the same time, a

pending petition asking it to do this particular thing about one part of that radiation. The Foundation thought it better to say so than to leave the Department to discover it.

One matter of capacity, which this comment keeps separate throughout. The petition was submitted jointly by the Soft Lights Foundation and by Mr. Baker in his individual capacity, which Part IV.A.2 records. This comment is the Foundation's alone. Nothing in this subsection is advanced on behalf of Mr. Baker individually, and nothing in it is intended to enlarge or alter the petition.

L. Address Sensitive Populations Expressly [RFI Q11]

The Foundation asks one thing under this head and states it in a sentence. Whatever the Department characterizes, recommends, publishes or prescribes about an optical emission, it should state expressly which population the figure is written to protect. That is the whole of the request. It is not a request for a particular number.

Two categories, which are commonly confused

The populations this comment concerns divide in two, and a criterion that addresses one does not address the other.

Differently sensitive. The same exposure produces a different response. Part V.G and Part V.E treat the literature; the conditions reported include photosensitive epilepsy, migraine and photophobia, traumatic brain injury, and autism and other sensory processing differences. Part VII.A.4 records the self-identified condition categories of the 593 reporters at Appendix A, and Part VII.K treats the group as a whole. Part III.F treats the exposed person as one of the sixteen characteristics that require a boundary.

Differently exposed. The same emission delivers a different dose. This category is less often noticed and is the stronger of the two, because it does not depend on any claim about individual susceptibility. Part V.C.2.g sets out the measured age-dependence of ocular transmission in the short-wavelength band: a young eye transmits far more of it to the retina than an older one. Part VI.E.2 sets out the position of children in school lighting, which combines the longest compulsory exposure, the least filtering, and no capacity to consent or to avoid. A criterion written to a standard observer of unstated age does not protect that population, and it does not fail because the population is unusual. It fails because the criterion did not say who it was about.

Why the request is for an express statement rather than for a number

Because a criterion silent as to population does not thereby apply to everybody. It applies to whoever the measurement model assumed, and the models in general use assume an unimpaired adult observer. Part III.F draws the consequence and Part VIII.B.2 draws it for this Department specifically: a criterion written to the comfort of an unimpaired observer, adopted by a Department that carries a duty under section 504 of the Rehabilitation Act, would exclude by construction the people the duty exists to reach. The exclusion in such a case is not a decision anyone made. It is a consequence of a question nobody asked.

The Foundation is not the first to ask for this. Part V.C.2 quotes a recommendation to the same effect published in a reference work in 2015, and the Foundation relies on it rather than on its own formulation.

Four things that would satisfy the request

That every figure the Department publishes about an optical emission name the population it is written to protect, and the response it is written to prevent.

That where the data for a population is absent, the absence be recorded rather than the population omitted. Part VIII.D.3 makes the equivalent point about a public entity's self-evaluation: a record that states what is not known is more useful than a record that does not reach the subject.

That a percentile of the general population not be used as a proxy for a sensitive one. The two are different quantities. A value exceeded by five percent of a general population says nothing about a person whose response differs in kind rather than in degree.

And that these populations be included in the research requested at Part IX.C.6 and in whatever surveillance is established under Part IX.D, which is where the data to answer the question would come from.

What the Foundation does not ask

It does not ask that the most sensitive individual set the limit, and it says so because that is the request it would be assumed to be making. A criterion set to the most reactive person who can be identified would be refused, would deserve to be refused on the grounds Part IX.I.4 sets out as to practicability, and is not necessary to anything this comment asks for. What the Foundation asks is that the choice be visible. If the Department sets a figure that protects some populations and not others, that is a decision it is entitled to make, and the Foundation asks only that a reader be able to tell which it did.

M. Additional Matters for the Department's Consideration [RFI Q18]

Three matters do not belong under any of the heads above and the Foundation sets them out here rather than leaving them unstated.

First, the allocation of responsibility, which no document presently states

Part II.H records what nine federal agencies said when the Foundation wrote to them between March 2022 and August 2023. Most answered that the subject was not within their authority. One is barred by statute from acting on it. One stated that it holds no statutory authority over visible light or non-ionizing radiation from electrical devices and has no experts in the subject. One said it would defer to this Department. And one, the United States Access Board, offered technical assistance to this Department on request, which Part II.H.11 and Part IX.E.5.c set out.

The Foundation asks the Department to state the allocation rather than to leave it to be inferred from that correspondence. Specifically: which of the product classes at Part VI are within this Department's program; which of the characteristics at Part III are within it; which agency holds which authority over the remainder; and what information is to pass between them and how often, which is the subject of Part IX.E. Part VI.U is the table this comment reserves for the first two of those, and the Foundation records that it is not written.

The reason this matters more than an ordinary question of jurisdiction is that the subject has been declined by every federal body asked except the one that has not answered the question. Part IX.A asks for the answer in its narrowest form, which is confirmation that visible light emitted by these products is electronic product radiation within the Act.

Second, the defect route, which requires no rulemaking and no standard

Part II.J.1 sets out § 360ll and the provision at § 360ll(e) under which the Secretary, upon determining that an electronic product has a defect relating to the safety of its use by reason of the emission of electronic product radiation, may direct the manufacturer to furnish notification. The Foundation invoked the provision on December 1, 2025 and sets out at Part II.J.1.c what that letter did and did not accomplish. It asks the Department to notice that the first trigger of § 360ll(a)(1) does not depend on a performance standard existing, and therefore does not depend on the ground taken in the Final Response of May 24, 2024. The Foundation does not ask for a defect determination on this comment and says why at Part II.J.1.c.

Third, what becomes of this comment

The Foundation asks that the Department state what it does with the material filed here: whether the reports at Appendix A are entered into any Departmental record, whether this comment is

transmitted to the Center for Devices and Radiological Health, and whether any of the questions in Part IX receives an answer. The request is modest and the reason for it is at Part IV.I: the Foundation's experience of transmitting material to this Department is that transmittal is acknowledged and disposition is not stated, and a comment whose fate is unrecorded cannot be distinguished later from one that was never filed.

X. CONCLUSION

A. The Question the Department Asked, and the Answer This Comment Gives

The Department asked, in Docket No. HHS-OASH-2026-0397, what is known and what should be done about human exposure to electromagnetic radiation. The request is addressed principally to radiofrequency emissions and electromagnetic fields. The Foundation's answer concerns a different region of the same spectrum: the visible light emitted by light-emitting diode products.

That is responsive rather than adjacent, and Part II.B establishes why. The definition at 21 U.S.C. § 360hh(1)(A) reaches "any ionizing or non-ionizing electromagnetic or particulate radiation", and the Department has already classified these products under it: Appendix F reproduces the twenty-three radiation-emitting product codes the Center has assigned to light-emitting diode products, and proposes thirteen more for the classes to which no code presently corresponds.

The continuity is not an analogy, and Part III.D.6 states the reason in one line. Irradiance and power density are the same quantity, in the same unit, differing only in the part of the spectrum measured. Radiofrequency exposure in the United States is limited in watts per square meter. Optical exposure can be expressed in watts per square meter. A program that measures one part of a single quantity and leaves the other unmeasured is not drawing a line between two different kinds of thing.

The answer this comment gives to the Department's question is therefore short, and the remainder of the document is its support. The exposure the Department is asking about has an optical component. That component is among the most widely encountered forms of electronic product radiation in the country, placed there in substantial part by federal policy, as Part IV.G sets out. This Department holds the authority over it. And the program Congress directed it to establish and carry out has not been applied to it.

B. The Program Exists, and It Has Never Been Applied to This Radiation

The Foundation states the defect precisely, because the imprecise version of it is refutable from the Department's own records and the precise version is not.

The electronic product radiation control program directed by § 360ii(a) exists, and the Foundation does not contend otherwise. The agency established it and has carried it out. Part II.C.2 collects the performance standards prescribed under § 360kk for the product classes the agency selected: diagnostic x-ray systems, microwave ovens, laser products, sunlamp products, and high-intensity mercury vapor discharge lamps, among the others gathered in parts 1020 through 1040. One of those standards, at 21 C.F.R. § 1040.30, is a lighting standard written around a radiometric quantity that luminous output does not describe. The program is not a fiction and this comment nowhere treats it as one.

What the Foundation contends is narrower and, on the record assembled here, unanswered. As to the visible light emitted by light-emitting diode products, the program has never been applied at all. Part II.M sets out which duties have been discharged and which have not, and the summary is this. No performance standard under § 360kk governs this radiation. The Foundation has located no study or evaluation by the agency of these emissions or of the conditions of exposure to them. No consultation or liaison with the federal agencies whose own rules determine what these products emit appears in the public record. No procedure or technique for minimizing exposure has been

developed, tested or evaluated. And no research, development, training or operational activity directed to this radiation has been identified.

That is the defect, and it is a defect of application rather than of design. The program's mechanisms are adequate to the task: standards under § 360kk, research under § 360ii(a)(2), study and evaluation under (a)(4), minimization techniques under (a)(5), liaison under (a)(3) and (a)(6), an advisory committee under § 360kk(f), studies and reports to Congress under § 360jj, and recommendations under § 360ii(b)(1). Every one of them has been directed at other classes of electronic product radiation. Not one has been directed at this one.

One of those mechanisms is not presently capable of operating at all, and the Foundation records it here because it bears on what the Department can do and in what order. Part II.K.6 establishes that the statutory advisory committee § 360kk(f) requires is not presently constituted in a form that permits a performance standard to be proposed through it. A program whose standard-setting mechanism cannot be used is not, as to any subject, in a position to produce a standard.

C. Unnecessary Radiation, Including What Is Commonly Called Light Pollution

Paragraph 360ii(a)(2) directs the Secretary to plan, conduct, coordinate and support research, development, training and operational activities "to minimize the emissions of and the exposure of people to, unnecessary electronic product radiation". It is the provision on which this comment principally rests, for the reason Part II.D gives: it contains no finding, no determination and no threshold that must be reached before the duty attaches, and its only limiting word is the adjective describing the radiation.

That word is unnecessary, and Part II.D.2 establishes what it does here. It does not ask whether a component of the emission serves the purpose of the lamp, which is the question energy policy asks and answers in lumens delivered for each watt consumed. It asks whether the radiation serves any purpose for the person exposed to it. The two senses can point in opposite directions, and Part II.D.2.a describes a spectral region in which they appear to have done so.

Light pollution is unnecessary electronic product radiation within that paragraph. Part II.D.3 establishes it on the statutory text rather than by analogy: the radiation does not leave, it reaches people, and emission directed away from the surface an installation exists to serve performs no function for anyone. Part III.D.1 states the same thing as a characteristic requiring a boundary and identifies it as the clearest instance in this comment of radiation that is unnecessary without any demonstration of hazard: light emitted above the horizontal from a roadway luminaire illuminates no roadway, and light entering a bedroom window from a parking area illuminates no parking area.

The Foundation states the consequence it draws and the one it does not. It draws this: the duty to minimize unnecessary radiation attaches to radiation that is unnecessary, whether or not it has been shown to injure anyone, because the statute uses two different words and Congress chose the one it chose. The Senate report describes the subject of the 1968 Act as unknown, unnecessary and potentially hazardous radiation, and the three adjectives are disjunctive. It does not draw this: that light pollution is an environmental question this Department should take up as such. Part II.D.3 meets that objection and the Foundation does not enlarge on it here.

Part III sets out the sixteen characteristics of emission and exposure in which a boundary would have to be drawn if minimization is to mean anything, and says of each whether a number can presently be stated. For most of them it cannot. That is the premise of the request rather than a concession extracted from it. The research paragraph (a)(2) directs and the evaluation paragraph (a)(4) directs are what produce such numbers, and neither has been conducted as to this radiation.

D. The Only Agency With the Authority, and What the Foundation Asks

The Food and Drug Administration is the only federal agency Congress has authorized to control the radiation emitted by electronic products. That authority is conferred by part C of subchapter V of the Federal Food, Drug, and Cosmetic Act, 21 U.S.C. §§ 360hh to 360ss, and Part I sets it out.

That is not advanced as a rhetorical claim. It is the answer to the question this record raises most often. Part II.H collects the federal agencies whose own rules determine the optical output of these products, among them the agencies responsible for motor vehicles, highways, aviation, rail, energy, labor, consumer products and federal buildings. Part VIII.E.6 records the answer those agencies give when the question is put to them, which is that the subject is not theirs. In most instances they are right, and this comment says so. Part II.H.10 shows it for the Department of Labor: the liaison provision imposes no duty on that department, the agency said so, and the agency was correct.

The consequence is that the question has no other home. A person seeking to have this exposure evaluated is told by one agency that the provision does not apply to it, which is accurate, and by this Department that a performance standard is not necessary, which is the subject of Part I.C. The provision that connects the two is addressed to this Department, and of the two only this Department can invoke it.

What the Foundation asks is set out at Part IX and summarized at Part I.H. The shape of it is worth stating once in full, because a document of this length can be mistaken for a broader demand than it makes. The Foundation does not ask the Department to find that these products injure anyone. It does not ask for a ban on any product. It does not ask for performance standards across the sixteen characteristics; it asks for one, in the single dimension where the quantities are settled and a consensus body has already written a numerical criterion in mandatory language, and Part IX.I states the request and its limits. For the rest it asks for the things a program does before it regulates: research and evaluation, disclosure of what these products emit, consultation with the agencies that place them in the public way, an advisory committee in working order, the studies and the report to Congress that § 360jj directs, and the recommendations the Department may issue now under § 360ii(b)(1) without waiting for any of it.

The record on which it asks is in the appendices. Appendix A contains the complete LED Incident Report database, 593 reports. Appendix B contains the complete record of public comments submitted to the headlamp petition, 4,991 of them. Appendix C appraises 153 peer-reviewed articles. Appendix D lists the assessments, standards and other documents cited. Appendix E is a chronology of the petitions, litigation and congressional action described at Part IV. Appendix F sets out the thirty-six radiation-emitting product codes, twenty-three assigned and thirteen proposed.

One statement about capacity, which this comment maintains throughout and repeats here because the record contains matters of both kinds. This is the comment of the Soft Lights Foundation. Where the Foundation has described proceedings in which Mark Baker has acted in his individual capacity, Part IV.A.2 identifies them as his, and nothing in this comment is advanced on his behalf or seeks any relief for him.

The Department asked what should be done about human exposure to electromagnetic radiation. The Foundation's answer is that a part of that radiation is emitted by products in nearly every street and nearly every room in the country; that the people exposed to it did not choose the exposure and in most cases cannot avoid it; that this Department holds the sole federal authority to control it; and that the program Congress directed the Secretary to establish and carry out has not yet been applied to it. The Foundation asks that it be applied, and asks nothing in this comment that requires the Department to conclude anything about these products that the research it is directed to conduct has not yet established.

APPENDICES

Appendix A — LED Incident Reports (Complete Record)

This appendix reproduces the Foundation's LED Incident Report database in full: 593 reports, the earliest dated April 21, 2024 and the latest October 14, 2026. The database begins in April 2024 and there are no earlier reports. Each report was written by the person who experienced what it describes, submitted to the Foundation through the form described at Part VII.A.1, and then transmitted to the Food and Drug Administration as Part IV.B sets out. Every report here was therefore in the Department's possession before this Request for Information issued.

They are reproduced as received. Spelling, punctuation, capitalization and grammar are the reporter's own and have not been corrected. No report has been shortened, paraphrased, excerpted or omitted. Part I states the Foundation's reason: a count of reports is not the same evidence as the accounts themselves, and the particulars are what a reader needs in order to judge them.

Order and numbering. The reports are in date order, earliest first, which reverses the order of the Foundation's own file. The order was reversed so that a report received after this comment is filed can be added at the end without renumbering any report the comment cites. Where two reports share a date they are ordered by place.

The two fields the Foundation supplies. Each report is headed with the date it was received, the place the reporter entered on the form, and a condition category the reporter selected from the choices the form offers. The date format has been made uniform; the Foundation's file records some dates in numerals and some in words, and nothing else in the header has been altered. Four categories appear in more than one spelling and are reproduced as the file records them. Eight reports carry no category.

What the reports do not carry. No name, no street address, no telephone number, no electronic mail address, no clinical record. The Foundation has checked the whole set for each of those and found none. The condition categories are self-identified and are not diagnoses. Part VII.A.6 sets out the screening practice and its limits.

The Foundation reproduces each account without adopting its contents. Many reports attribute a condition to light-emitting diode exposure and some assert a causal relationship. Those are the reporters' statements of their own experience and belief. They are not findings, the Foundation does not advance them as findings, and Part VII.A.5 states what the database does and does not establish. A small number of reports also contain assertions on subjects outside this proceeding, which the Foundation neither endorses nor has removed, for the reason given above.

The reports

Reports received in 2024

April 2024

A.1 April 21, 2024 — Beaverton, OR — Autism

LED flashing lights cause me to suffer severe anxiety, panic attacks, and fear.

A.2 April 21, 2024 — Davis, CA — Migraine

I used to go for long walks at night in my neighborhood for exercise and as therapy for my chronic eye migraine issue. Since 2016 when the City replaced all the sodium vapor street lights with LEDs, I have not been able to walk at night due to the harsh glare and brightness of the lights. They are nothing like the old lights. Add to that all the LED house lights that have been installed since then. My neighborhood has become a no go zone. I paid mello roos taxes for years to pay for all the green spaces I can no longer use because of these lights. Some are even on all day and hurt my eyes even in

the day time. My health has suffered from not being able to get my walks - weight gain, high blood pressure. And this is just a fraction of the story. I can no longer drive at night because of the intense LED car headlights in my face. I cannot go into town at night to a restaurant or store for the same reason - LED lights everywhere. I cannot travel on a train or bus for the same reason. Airports also have these lights taking the joy out of plane travel. I have to shop for my groceries online in stores like Safeway that have installed these lights nationwide. If I get exposed to these lights, I will get a ripping eye ache that lasts for weeks, a feeling that the surface of my eyeballs has been lased.

A.3 April 22, 2024 — Wakefield, MI — None

Sitting in the left-turn lane waiting for the light to turn green, the pickup truck in the opposing left-turn lane had a new pinpoint LED turn signal that was so bright and so focused, was like a laser pointer shooting right into my right eye. Even in broad daylight the LED was so bright and so focused like a laser pointer I had to sheild my eyes with my hand until the traffic light turned green and I completed my turn. Hours later I am still seeing spots with my right eye. Praying there is no permanent damage.

A.4 April 23, 2024 — Dallas, TX — None

Makes me blind and hard to see road. Especially oncoming traffic when the lights are elevated higher than me.

A.5 April 23, 2024 — Sammamish, WA — Autism

I'm a lifelong resident of the Seattle area, and I was diagnosed with Asperger syndrome in early childhood. Additionally, I have been diagnosed with depression, adjustment disorder, anxiety, attention deficit disorder (ADD), and I suspect that I might also have undiagnosed post-traumatic stress disorder (PTSD).

My biggest concern, especially in the last couple of years, is the dangerously bright light-emitting diode (LED) headlights that have been proliferating on our roadways at a disturbing rate since the early 2020s. They have had deleterious impacts on my quality of life since I can no longer exercise outdoors or drive at night without fear of being exposed to excessively bright LED headlights, experiencing sensory overload, and having meltdowns as a result. Even during sunny days, if drivers leave those LED headlights on, they are still too bright and extremely unpleasant to look at; it's particularly worse when it's cloudy or raining. LED headlights, especially those on Teslas, are some of the worst offenders, to the extent that I can recognize a Tesla from a distance solely by its headlights.

I am an avid lifelong cyclist and ride my bike all over King County. I have visited places such as Skagit County, Whatcom County, Snohomish County, Pierce County, Vancouver Island, Point Roberts, Snoqualmie Pass, Cle Elum, Vashon Island, Whidbey Island, the Kitsap Peninsula, and San Juan Island—all by bicycle. I have also ridden on nearly every regional trail in the Seattle area as well. However, my enjoyment of this activity has been greatly diminished by the excessive glare from these LED headlights, starting in the early 2020s. I have effectively lost one of the best stress relief methods I use to cope with my mental health issues, compounding my problems even more.

I also enjoy going on walks, and they have also been impacted by these LED headlights, making it unpleasant for me. I can no longer enjoy walking outside at night, robbing me of the ability to walk during times when it's cooling off during what are supposed to be pleasant summer evenings. Again, even during the day, I constantly encounter excessive LED radiation and glare from these LED headlights.

Earlier this winter, my neighbor was driving a rental car equipped with LED headlights, which shone into my bedroom when they returned from work in the evening. They have since returned to their regular car, which still has halogen bulbs; however, one of their halogen lights has burned out, and I'm afraid the owner might install LED headlights to replace it. Despite this, I still have LED headlights shining towards my bedroom from passing drivers since I live near a "T" intersection. This situation makes me feel unsafe in my own home, particularly during winter when daylight is limited.

The distress caused by these lights has led to hospitalization, and I feel as though I'm under house arrest because of them, causing serious mobility issues for me. I have written to ALL, and I mean

ALL, of my elected officials at the state and federal level, and the lack of any adequate response has only added to my frustration and anguish.

My ultimate goal is to urge the government and policymakers to acknowledge the problems of these excessively bright LED headlights and the dangers they pose to the general public. I advocate for regulations on their brightness and for using a warmer color temperature instead of the bluish light, which disrupts circadian rhythms and makes it difficult to spot road hazards at night.

Personally, I wish to see LED headlights banned completely from our roadways in favor of tungsten filament halogen bulbs, which are less harsh and easier on the eyes. The so-called benefits of LED headlights are outweighed by the risks they pose to the general public, and for many of the reasons I have cited, they need to be completely banned from our public roadways.

I'm extremely appalled and deeply troubled by the fact that I cannot safely use public rights of way that I have paid my tax dollars for because these LED headlights have formed a discriminatory barrier and infringe on my constitutional rights to freedom of movement. I strongly urge the Food and Drug Administration to take action. I believe that these lights are a threat to national security and public health, and swift action must be taken. The current situation is completely unacceptable!

A.6 April 24, 2024 — Mantua, NJ — None

Multiple incidents. I had to cancel 2 gym memberships because of bright LED lighting they installed, and theres no gym within a workable distance that doesn't have this insane lighting. Ive cobbled together used gym equipment at home for more money than I could afford. I cant work without special tinted glasses, or I get migraine symptoms within minutes. Even with this protection there are places I cant stand and directions I cant look because some of the LED fixtures are simply too intense and instantly painful.

I can no longer go to the local grocery store under any circumstances, its too bright, and the list of places I cant go is growing as businesses install this harsh intense LED lighting. Shop Rite, Five Below, Giant Fitness, Planet Fitness, Pantry One, T Mobile- these are some of the places I simply cant enter with any level of protection short of a complete blackout blindfold.

A.7 April 25, 2024 — Horseheads, NY — Astigmatism

I have astigmatism, which is 30% of the population of ALL ages. LED headlights and all bright white LED lights give me a wicked headache all day that pain meds don't touch. I rented a car recently with LED headlights & I had a huge headache from the headlights reflecting off of other surfaces. So I can't even drive a car with LED headlights. Just in the past couple of weeks, I almost was in 3 accidents while being blinded by LED headlights. I have no problem with halogen headlights. My work commute is on a 2-lane road for an hour & I need to work to live. I can't just stay home. What kind of life is that? So I have to put my hand up to block the headlights of the line of cars going the opposite way and look at the white line. One morning when it was raining thus more reflections, I was on a slight bend and looked up just in time to see an older SUV unsafely trying to pass a huge line of cars coming right at me in my lane. They were hurrying to get back over maybe 20 feet from the nose of my car. They had aftermarket LED headlights, so it was like two big floodlights that blinded me. The 2nd time was I was approaching a roundabout and pickup truck from the opposite side had blinding LED headlights. I checked to make sure no one was coming from the left before I got there, but *poof* a car appeared out of no where and honked at me. They almost hit me. I was so distracted by being blinded by the LED headlights, I didn't see them. And another time I was at a crosswalk and had been stopped for other pedestrians. But a car going the opposite direction had blinding LED headlights. I didn't see the additional pedestrians until I was passing over the crosswalk. I had looked too. The pedestrian had thankfully stopped. They were partially blocked by my windshield frame too. Again, I never had these problems with halogens. LED headlights are dangerous! Explain to me how lights that are 800x brighter than halogens are not blinding other people. LED headlights are marginalizing almost 50% of the population...specifically people with disabilities that include astigmatism (30%), migraines (17% women & 6%), and seizures (4%). And we can't forget age discrimination against seniors with cataracts. It also affects the circadian rhythm and eye health of both people and wildlife...all of them. That is why there are blue light filters on devices. Please do the right thing and ban bright white LED headlights and LED lights in general.

A.8 April 27, 2024 — Coudersport, PA — None

I am beyond infuriated with the use of bright white LED lights, I'm beyond frustrated with the searing eye pain that LED lights procure, I am beyond infuriated with the intense migraines that I suffer from when dealing with bright white LED lights. I am beyond frustrated with the amount of pain that is brought upon me due to these LED lights. They are an unnecessary monstrosity that never should have been brought into public view! They are NOT beneficial in any way, shape, or form. In fact they are detrimental to society and the environment.

A.9 April 27, 2024 — Elk Grove, CA — Autism

The Ziosk portable kiosk payment system has a bright LED screen. During dinner at a Chilis restaurant, we placed the kiosk face down on the table to avoid exposure to the LED Visible Light radiation from the LED screen. At payment time, my partner inserted the credit card for processing. At the completion of the processing, a large white LED light on the side of the kiosk suddenly irradiated me with white LED Visible Light radiation. Due to the intensity of the white light, everything around me became black, except for the overwhelming feeling of bright white light. I felt disconnected from reality and as if I had entered a nightmare dream. I believe that I was partially unconscious. As I began to recover consciousness, I thought that perhaps I was staring at the LED flash on a cell phone, but that this was much more powerful. Then, as I became more aware of my surroundings, I realized that that the white light was from a large, white LED from the side of the Ziosk device. I felt nauseous, so I fell to my stomach and tried to vomit, but I only ended up coughing. I then felt overwhelming anxiety and panic and went to the kitchen, demanding accommodation. A staff person then began yelling at me. I ran outside screaming. I continued to try to vomit, but only spit came out. At some point, both of my hands went numb and tingly. The police were called. I dialed 911 to tell them not to turn on their LED flashing lights, but they had the red and blue flashing lights on, which further debilitated me.

A.10 April 27, 2024 — Izhevsk, Russia — Other

I cannot stand the LED headlights. It all started about 4 years ago when the amount of cars with LED headlights started to become noticeable. I understood at that time that I couldn't look at these lights because my mind goes sick, mye eyes begin immediately to get irritated to a very considerable degree that it really hurts, my muscles are becoming stiff and I get nervous tics, that is involuntary rapid head movements. Moreover, I begin to feel some sort of panic attack. Back then the amount of cars with LED headlights in my area was around 12-16 percent and it was possible to get along. Since then, the situation only got worse. The amount of cars with very blinding and extremely piercing LED headlights nears probably already 40 percent in may area and I gave up at all staring in the oncoming traffic direction because I just cannot do it any more.

Because of a neurological condition, I was not allowed to drive a car and now it seems that it's even for the better. I cannot even imagine how people drive nowadays with this killer light. In my country we have day running headlights as a must so the headlights are on 24/7. While there is a sunny and clear weather I can somewhat go along the road facing the opposite direction, but with a gloomy weather, rainy weather, dusk, let alone nighttime I cannot physically do this. I have to avoid major roads going either along residential areas with much less traffic or going along a pavement that runs parallel to the incoming traffic, thus I somehow can move away my head and eyes and to see what is going on on the upcoming a lane (a lane that is further away from the pavement). When using public transport I have to sit in that part of a bus/tram that has windows on the left right from the driver seat. so that I am spared to see the upcoming lanes with the upcoming traffic.

Thanks to all this, to a huge light pollution caused by LEDs and other numerous LED lights sources sprung up recently, I am almost confined at home during nighttime because I cannot stand this light. Only warm shielded LED in moderate quantities are more or less OK for me, but unshielded LEDs over 3000 K, bright LED shop signage, LED digital billboards and LED decorative building lighting makes me have fits of very severe panic attacks. I don't feel these attacks at all with outdoor halogen headlights and sodium/incandescent/CFL lamps or warm (2700 K and less LEDs in moderate quantities). The indoor LED lighting has less negative impact on me, though too much white indoor LED light is also uncomfortable while the indoor white fluorescent light is quite OK for me.

I am asking the US regulatory agencies to give the answer why LED light can trigger severe panic attacks while other light sources are quite alright and even uncomfortable. I am sure that I am not alone.

A.11 April 27, 2024 — Rodeo, CA — None

I drive a fairly small car. On the highway at night, I find the excessively bright LED headlamps are both disrupting and an impediment to driver safety. As cars approach from the rear on either side, their headlamps reflected in my side-view mirrors are often so dazzling that I have to hold my hand in front of the mirror to be able to safely see the road. Even with my rear-view mirror in the "night" position, the brilliance of these headlamps when behind me can be distracting and blinding.

When approaching from the opposite direction, especially on narrow roads, they present even greater threat to driver comfort and safety, often causing momentary blindness. The worst cases are often Tesla headlamps, but many newer SUVs and pickup truck headlamps exhibit similar characteristics and are very nearly as bad.

These headlamps are unnecessarily bright, producing an spectrum of light that is especially blinding. They often illuminate not only the road, but the overhead road signs and the interior of the cars ahead of them. These headlamps are both a nuisance and a hazard to other drivers. And, in recent years, it seems to be getting worse. The headlamp arms-race is rapidly getting out of control at the expense of driver safety. Car makers must be made to comply with existing headlamp regulations, and, in fact, those regulations must be amended to consider ever increasing lux levels, higher color temperatures, and broader and taller light-pattern spread.

A.12 April 27, 2024 — Tuscon, AZ — None

LED headlights are having a negative impact on my driving continuously. I have good night vision, excellent reflexes, am generally quite alert at night. But I rarely drive at night because of the hazard of LED headlights. They blind me to the point where I cannot see the road AT ALL. I have very mild cataracts, and LED headlights totally make me see nothing but white. The only way I can navigate safely is to MEMORIZE the road ahead while I can still see it, and DRIVE TO THE RIGHT of the oncoming car. If it is a road I am not familiar with, I might not be willing to drive it at all. It is too easy to be surprised by an unexpected curve when I cannot see the road. I drive prudently. I am not willing to put up with this hazard. So I do not drive at night if I can possibly help it, and this has an impact on my life, and my ability to get home safely if I end up having to stay someplace away from home longer than anticipated. People are going to do what they have to do to stay safe. The mere fact there are not more accidents is not proof that LED headlights are safe. It is only proof that people try to avoid hazards, and may not be driving at all during nighttime hours. And what kind of harm does a laser directly into the face do to the eyes any time of day? Unanswered question.

A.13 April 28, 2024 — Algonguin, IL — Photophobia

I can't go out at night anymore due to the plague that is LED light pollution. It brought me solace. I can't walk my dog or enjoy it at all anymore. I don't see wildlife at night anymore. I love nature and it's harder to appreciate now. I used to love driving but I can't without immediate extreme dizziness and migraine. I can't look outside at all when the sun starts to set. The building I work at has hideously bright LEDs that make me ill on a daily basis. I'm always squinting and adverting my eyes. ALWAYS. It took many aspects and simple pleasures of my life away and I miss them dearly. Please do something about this! I want my life back!

A.14 April 28, 2024 — Amesbury, MA — None

I am blinded by these headlights, streetlights, floodlights morning and night every day. These lights are a hazard on the road and unnecessarily bright and incorrectly dispersed. This is a danger to everyone and regulations need to occur swiftly

A.15 April 28, 2024 — Baltimore, MD — None

I can't for the life of me understand how this is even something I have to report. Do none of these people drive at night or in inclement weather? Do none of them pass billboards? I used to love driving at night, even prefer it in some cases, but the new street lights are terrible, especially the defective ones that turn purple and create such harsh lighting I literally can't look at it. And the LOW beams on

the new cars are more blinding than some of the old high beams!!!! I've flashed my lights at other drivers to alert them they're driving with high beams on and they flash back that it's their low beams. Not only does it "daze" my eyes so that I see spots and can't see the road properly for a few seconds, but it also creates harsh lighting conditions that makes it hard to discern what's hiding in the shadows behind objects like trees and street signs. And the blue hue of these LEDs that's being used is also not only harmful and exhausting on the eyes but colors things weirdly so it's harder to tell what's what. The car I drive still has "older" (aka not blue or insanely bright) headlights, and I used to love renting cars for longer trips but now every car I rent has those headlights which makes it an unsafe environment to drive in, and in those vehicles I have other cars flashing their lights at me to alert me I'm driving with high beams when I'm not!!!! Which again, causes a "daze" and I see spots and my sight is not clear while I'm maneuvering roads at night. This is clearly unsafe!!! I'm in my 30s! I don't have other eye problems and I shouldn't sound like a crotchety old person when talking about driving at night! It's absurd! In addition to all that, I've recently experienced billboards that switched from canvas to LED and LED signs outside of businesses that are so insanely bright you can probably see them from space. It might be necessary during the day when the ambient light is brighter, but these things need light censors and to adjust to a dimmer display during the night time. Because when I drive by it's like someone shining a flashlight in my eyes for a minute. It's absolutely not safe!!!! I have a similar issue with the road crews that do construction on the highway at night. A bunch of those crews have these flood lights that are supposed to illuminate the area for them but they aim them in such a way that they blind the drivers too! Who's "genius" idea was that!? Either the people making these things are blind as bats anyway or they just don't care.

A.16 April 28, 2024 — Chicago, IL — None

Every single day day or night I am blinded over and over again even driving short distances, I get spots and yesterday my eye was in actual physical pain as 1 car was so dam bright like the eclipse!!!! I'm collecting evidence to sue. We all should sue every driver who damages our vision and the government for allowing this!!! you CANNOT drive anymore EVER. Our Country is lost.

A.17 April 28, 2024 — Fareham, United Kingdom — None

Comment on statement "DOE researched studies and other publications to ascertain any known impacts of LED lamps on human health and has not found any evidence concluding that LED lighting used for general lighting applications directly results in adverse health effects.": 'General lighting applications ' is not the same as directed beam applications & the FDA should recognise this situation in the case of headlights.

A.18 April 28, 2024 — Hamilton, Canada — Migraine

LED headlights on numerous occasions have given such intense sharp pain in my eyes that induced migraines, forcing me to pull to the side of the road and vomit. Glare from LED headlights has blinded me on thousands of occasions. In some of those instances it has taken more than 5 seconds to regain my sight. LED headlights and taillights physically hurt my eyes when I'm in close proximity to them (I.e. stoplight) forcing me to physically block them with my hand. The glare, blindness, eye pain and migraines caused by LED headlights have been confirmed by my optometrist, Dr. Otto Lee. Among eye care professionals, LEDs are a known and documented problem in every age group. Driving at night for longer than 30 minutes has almost always resulted in me getting a migraine, which was never the case before LED headlights existed. As a result, I have to limit my nighttime driving to less than 15 minutes. This limits how much work I can do, or how much I can visit my family, especially in the winter months. I've had to restructure my life around LED lights.

A.19 April 28, 2024 — Lancaster, PA — Migraine

I am a migraine suffer, and my trigger is photosensitivity, especially from intense bright lights. For the last several years auto makers have installed LED headlights and the color temperature they have chosen to use is blinding for oncoming drivers. There truly is no need for the adaptive or “moving part” of the headlight if ya warmer color temperature is programmed into the LED headlight. The extremely intense and blinding colder “blue” white light emitted from LED headlights just feet away is MORE dangerous than looking up at the sun. If focused intense cold bright white light is not dangerous why do welders use masks? It is literally the same reason and effect these OEM LED headlights have on oncoming drivers. How many people need to die before LED headlights are given

a warmer light temperature? It is really not that hard. The technology already exists. Just look at the average teenager and how they use LED lights in their bedrooms. They have a small remote and they can change the color and or color temperature of the lights at their will. Thank you for your time.

A.20 April 28, 2024 — Los Gatos, CA — Astigmatism

With the increase in use of LEDs in car headlights in addition to cars raised too high (or their headlights tilted too high), driving on the roads at night is an incredible hazard. I commonly find myself unable to ascertain details of what's going on behind me with traffic and the position of other objects/cars when faced with these blinding lights. I have to get creative to even be able to see, and still face blind spots due to these stupidly bright lights. It makes driving dangerous and I can't believe LED lights in headlights didn't get banned years ago.

Every day the government allows this is increasing the likelihood of accidents, health issues from staring at these lights and just a generally worse quality of life.

A.21 April 28, 2024 — Marshfield, WI — Astigmatism

LED headlights are blinding to the point where I have almost hit deer and other vehicles because I cannot see when the LED lights are coming at me

A.22 April 28, 2024 — Milwaukee, WI — None

I am blinded by the brightness of the LED lights not only at night, but during the daytime. Even from a car behind me glaring in mirrors during daylight. Making it dangerous for me to drive. My eyes cannot adjust due to the brightness. I've swerved off the side of the road. Had to pull over. Which is not always possible when there's traffic behind you and traffic coming at you. This is a problem. There should be a limit on the brightness of the LED. This is such an easy thing to fix, but for some reason nothing gets done.

A.23 April 28, 2024 — Onsted, MI — Astigmatism

I get eye pain and headaches by being exposed to 4500K or higher led lights Whether I am driving at night or during a sunny day I am constantly shielding my eyes from led low beam headlights, running lights and brake lights. I have to adjust my side and rear view mirrors so I cannot use them to see properly to avoid being dazzled by led lights. If streetlights are on during the day and night I put my sun visors down because the leds are too bright. I drive over 1000 miles a week for my job. I dread cloudy, rainy days, dusk and night driving because of led lights. It's like torture to my senses. I am constantly blinded at night and have been during the day as well because of led headlights. If I am walking in a parking lot on a cloudy day I have to shield my eyes because led running lights are too bright. I have asked my neighbors to shield their outdoor lights or use softer 2700K led and it has caused me civil lawsuits and many legal problems do to this simple request. I have to wear dark sunglasses inside of places that have led lighting. I never had eye pain or headaches prior to led lights. LED headlights are the most dangerous aspect of driving by far. These lights have ruined normal day and nighttime activity for me were they are present.

A.24 April 28, 2024 — Ottawa, Canada — Migraine

I am very sensitive to many things, including light and sound. I loved to walk a lot at night when the lights used Halide orange/pink lights. Now that the city has been switching out the Halide lights with super bright LED white street lights my walks are much less enjoyable. It feels like I'm walking around in the day time. I don't understand this obsession people have with lighting the world up like a giant football stadium. It's not necessary, it's not pleasant, it messes with your circadian rhythm. In my case, it can cause headaches and light fatigue. It also hurts our environment. Birds, animals and insects cannot follow their natural rhythms because their environment is so bright at night now. Also, while driving, I'm blinded by headlights that use these horrendous white LEDs. I hope there is an invention of filters for the lights that are currently on vehicles and that it is enforced to add the filters to the headlights. A return to a golden soft colour would be preferable. As well as adding golden/orange filters to street lights and/or a different design that mimics old styles and colours of street lights. I really hope the government begins to regulate this. It's dangerous for the environment, people's health and eyes as well as creating an ugly world to look upon.

A.25 April 28, 2024 — Webster, MA — Other

Large pick up trucks as well as SUVs and other cars especially in MA., were it seems that tailgating is legal, get behind you and blind you from behind making it very difficult to see ahead of you. Same situation with vehicles approaching from the opposite direction.

A.26 April 29, 2024 — Irvine, CA — Photophobia

I have photophobia and photosensitivity due to multiple autoimmune conditions, and my life has changed significantly for the worse with the introduction of intense blue-white LED car headlights and the (ongoing) replacement of a large (about 16000) number of HPS lamps with LED fixtures (at correlated color temperatures of 3000 K and 4000 K) in my city (Irvine, CA).

Street lights: Bright exposed LED street lights of any color, but particularly those above 2700 K, pose a health risk and serious disability barrier for me. Being sharp and pointed sources of high glare and discomfort, they can exacerbate my dry eye symptoms (I have Sjögren′s syndrome) and the likelihood of an autoimmune flare-up. As a SLE (lupus) sufferer, I need to keep my daytime exposure to sunlight limited. It used to be that nights were my go-to option for long strolls, a drive to the grocery or restaurant, or a chance to bask in moonlight or stars at night—something that the gentler glow of shielded HPS lamps afforded. Over the past decade or so, and particularly in 2024, most of these basic human comforts have been taken away from me. I have pleaded with city officials to undo the damage and the discriminatory barrier that street lights cause me, and despite their efforts to mitigate a small portion of the damage (I have met with a very modest degree of success) via glare shields in my immediate neighborhood, the city at night is becoming a cheap, vicious display of human sensibilities and human compassion gone awry.

Headlights: Vehicle headlights with blue-white LED lights piercing into one′s eyes from oncoming traffic are the stuff of nightmares—poorly-angled, egregious beam patterns pretending to be ″safety features.″ Even five minutes′ exposure to this type of rampant glare while I drive or sit in a passenger′s seat is sufficient to bring on severe eye pain and vision disturbances, headaches that last days, and emotional distress. It is appalling that those objecting to these ill-conceived and risky fixtures are not taken more seriously.

Light pollution is a menace not just to humans but also to wildlife and foliage that suffer without shutters. Researching, designing, and implementing options that are conducive to safety and easy on the eyes must be high on the agenda, an urgent societal cause.

“So benumbed are we nowadays by electric lights that we have become utterly insensitive to the evils of excessive illumination” — Jun′ichirō Tanizaki, In Praise of Shadows

This evil is eradicable; let’s do what it takes.

A.27 April 30, 2024 — Auckland, New Zealand — Migraine

LEDs cause me to suffer hemiplegic migraines of three day duration. This has resulted in partial confinement to my home, exclusion from municipal life, partial loss of employment and deterioration of health. The migraine results in blurred vision, dysaesthesia to the left side of my face and left arm with severe occipital pain. It has resulted in loss of consciousness on multiple occasions, one of which leading to a three part fracture to my right arm.

A.28 April 30, 2024 — Roseville, CA — Autism

I was standing in a room and another person’s cell phone buzzed with a message notification. The iPhone also pulsed its LED camera flash, which struck me in the eyes. I fell to my knees, breathing hard, and trying to fight off a panic attack.

A.29 April 30, 2024 — Swanage, England — Other

LEDs have been fitted as replacements for low pressure sodium street lights in the area where I live, which is within the Dorset Area of Outstanding Natural Beauty and immediately adjacent to a National Nature Reserve. The CCT rating of the LEDs that have been installed here is 4000K, which results in an eerie blue-white light which I find most unpleasant. The glare from the new lights is excessive, to the extent that when I walk beneath them I have to look down at the pavement rather than looking forwards along the road, to keep the lights out of my field of view. The light spill from these lights is excessive, resulting in the blue-white glare of the lights penetrating the windows of my

house, which makes the interior of my home feel unwelcoming. I find that the light penetrating my home negatively affects my sleep quality, even though I have blackout blinds on my windows (the light still penetrates around the sides). This light intrusion was never a problem when the lights were low pressure sodium, as the orange glow was quite restful and not at all disturbing. My view across the Nature Reserve at night is now compromised by the new LED street lights, which produce an incredible amount of sky glow. My home is just 400 metres from the coast, so there is often mist or fog in this area, and these LED street lights cause the whole area to light up as the light scatters in the mist. It is exceedingly unpleasant. One of the lights is 185 metres away from my house and is over ten metres below it, yet the street light casts a bright image of my window onto my bedroom wall. It is so bright it appears as if a car is parked on the hillside with its full-beam headlights directed straight at my house. I have been so disturbed by these lights over the past two years that I believe my current condition of ophthalmic shingles (herpes zoster ophthalmicus) was triggered by them. I have been suffering photophobia, nerve pain, a facial rash with blistering and acute inflammation of one eye because of this condition, which has resulted in the hopefully temporary loss of useful sight in that eye. Since I am otherwise fit and healthy and have had no other stress to cause this condition to appear, I firmly believe that it is a direct consequence of the installation of LED lighting outside my home.

May 2024

A.30 May 1, 2024 — San Leandro, CA — Astigmatism

I regularly walk home from work in the evenings, which in the colder months means walking down a dimly lit street. Having poor eyesight and balance, I'm always afraid that the blinding headlights of the cars zooming down the street will cause me to stumble off the sidewalk and into the path of an oncoming car. It certainly doesn't help that some cars have headlights bright enough to leave afterimages in my vision, the last thing I'd want to deal with when walking at night.

A.31 May 3, 2024 — Amherst, NY — Photophobia

Discomfort, people and sleeping patterns, also disruptive for me from exercising early mornings or evenings with street lights over 2700k

A.32 May 6, 2024 — Cleveland, OH — Autism

LED lights give off a poor quality light, pure and simple. With the cheapening of everything these days, proper fixtures are usually non-existent, i.e., there is rarely any diffusion in the form of a large shade or lens--just the raw diode. For those who have in-focus vision (as everyone strives for with corrective lenses and such), the intensity of viewing a high-powered and undiffused LED at any distance is always an unpleasant one. As it happens literally thousands of times a day, our retinas get "etched" and degraded. This is not to say that an incandescent bulb can't be painful, it's just that in the days of incandescent bulbs we made proper fixtures.

For me, when I'm presented with an unexpected bright source of light, my eye naturally moves and centers it in my vision. There is something physiologically that makes it hard to look away instantly. It literally takes like a complete second to pull your eye away from it. However, the damage is already done. You stared directly into something that was of an infinitely higher magnitude of brightness in relation to its surroundings. THE EYE IS NOT BUILT FOR THIS. These encounters cause a tense visceral reaction throughout the body. Considering that there are BRIGHT LED lights on just about every conceivable object these days, and it's common for someone to have these negative encounters thousands of times in one day, and considering that the center of your vision is by far the most important throughout our lives, the collective pain and suffering is unimaginable.

There's a certain obsession with safety that I believe our society has falsely bought into. For example, daytime running lights used to be a small halogen bulb, perhaps 10 watts. Now, there are cars with many layered stacks of raw LEDs with candela measurements far exceeding our proper range of vision. It is saying that that person's car is the most important thing you ought to see down the road. Animals, pedestrians, everything else, doesn't get to grab your attention. Your vision system is so overloaded with the fact that "there's that car," that other possible visuals are much harder to see. Overall, the eye does not need that much light to see as long as the relative values are thoughtfully presented (as they used to be).

Nighttime is all but a faint memory as it is almost always ruined by the presence of stinging, streaking, damaging, high candella artificial lighting. We, as a species (and all species living in our vicinity) have lost a cherished and peaceful time; the hours of darkness that we once called, and still hypocritically call nighttime.

I don't believe that our nation should have any real discussion about mental health until we face the reality that we're degrading each other's eyes, our most important sense, on a grand scale.

People are literally suffering and slowly dying from the continued assault on their eyes, and thus, their brains.

A.33 May 9, 2024 — Saint Paul, MN — Photophobia

My eyes have retinal injury and bright LED lights cause intense pain and discomfort. Overly bright LED's impact my life in numerous ways. There is widespread illegal use of intense LED floodlights in my neighborhood, but the local law for legal use of LED floodlights is not enforced. LED streetlights seem designed to blind drivers, rather than illuminate streets. Streets are dimly lit, but streetlights are shine right into drivers eyes. Vehicles keep their headlights on day and night, and shine into sideview and rearview mirrors. This causes eye pain and discomfort.

A.34 May 10, 2024 — Yonkers, NY — Migraine

Led lights blind me in the road and flare up migraine. Have to stay home at night. Interfere with my life. Very dangerous.

A.35 May 12, 2024 — Hancock, WI — (no category given)

I almost hit a pedestrian on the side of the street because the car in oncoming traffic had blinding LEDs. I did not see the pedestrian until the oncoming car had passed. If the timing was just a little different, there would have been a terrible ending. I reported it to the nhtsa. They said the lights just seem brighter. (This was a few years back.) I used to love driving at night. Now I can't handle the LEDs. This puts more traffic on the road during the day. Even when someone driving next to me has LEDs, I have to lift my hand to cover my side mirror from letting it blind me.

A.36 May 14, 2024 — Cambridge, NY — Epilepsy

My daughter and I walked out to run an errand one afternoon. As we came around a building, there was an LED streetlamp, still on though it was daytime. I'd been completely fine a moment before, but the light struck me and I was instantly incapacitated by severe neurological symptoms, stumbling and shaking. I couldn't walk, speak or see properly and my face and left arm went numb. We turned back immediately, and my daughter had to hold me upright so we could get away from the light as quickly as possible. We did not complete the errand. About a week later it happened again. This time i was alone, and my impression was that the street lamp snapped on as I got closer. This time there was no-one to catch me. I fell and couldn't get back up again. I was nauseous, dizzy and disoriented, unable to see, my limbs uncontrollably hitting the ground. Eventually I crawled/dragged myself back home and remained ill for many hours. I felt humiliated on top of everything else. I do not know if anybody witnessed what happened. Nobody came to help me and I could not call for help because I couldn't speak.

A.37 May 14, 2024 — Chicago, IL — Other

blinding me and seeing spots all day. extremely stressed when i have to drive!!!!! I hate these lights and cannot believe this is legal!!!!people don't give a crap!!!

A.38 May 14, 2024 — Sammamish, WA — Autism

I have largely avoided walking around my neighborhood at night for quite a while because of extremely bright LED headlights, except for viewing the aurora borealis on May 10, 2024, and I was horrified at the growing rate my neighbors are installing very bright LED light bulbs that far exceed 2700 Kelvin. I had to walk to darker parts of the neighborhood to avoid my view being ruined by the glare of LED lights. Even while walking around at 3 in the morning to view the aurora without seeing a single car with LED headlights, I was subjected to extremely intense blue-rich white light LED radiation from many homes along my usual route. I was honestly hoping the solar storm would knock our power out, which didn’t happen.

In addition, I witnessed many poorly shielded LED lights without any diffuser at many stations along the newly opened Line 2 Link Light Rail in the Seattle area and was horrified at how these LED lamps are a potential discriminatory barrier. We always talk about diversity and inclusion here in the Seattle area and making transit accessible and yet never consider the needs of those with autism or epilepsy. I've even noticed that many buses by King County Metro (and likely Sound Transit) are now being fitted with LED headlights.

Banning incandescent bulbs is a crime against humanity and an attack on nature itself. We need very strict national light pollution laws instead of doing this at the local level. Or better yet, unban incandescent bulbs and let the customer choose instead of the government doing it for us.

A.39 May 18, 2024 — Houston, TX — Photophobia

While visiting a friend I was exposed to LED from overhead light fixtures in the apartment, and the extreme LED of Samsung TV. Together, they suddenly triggered photophobia, migraine, & brain fog in me and I am not a TV watcher. Just walking into a room with LED TV and lightning or shopping in grocery and drugstores with All the LED now triggers my eyes with pain. Shopping mall is out of the question for me. I have to wear very dark sunglasses and a cap with a bill. I Must have phone and other devices Very dark, And have limited screen time. I have to cover lamp shades with scarves. I've tried blue block glasses which don't help at all. Obviously the LED has caused me to be much less social. It has also caused my eyes to twitch, and has made them have intermittent blurry vision.

A.40 May 18, 2024 — Los Angeles, CA — None

LED lights make it dangerous to drive at night because my vision gets blocked while I'm driving a vehicle.

A.41 May 25, 2024 — Portage, MI — Photophobia

Debilitating headaches, dizziness and seizure like response when exposed to LED lighting. Increased sensitivity to any lighting type after prolonged exposure in LEDs.

A.42 May 27, 2024 — Avondale, PA — None

Unable to see the road, cars, or surrounding areas while driving when high beam LEDs are in use. Lowering these LEDs to regular or low beam does no use. Even in low setting these LEDs are 10 times brighter than my vehicle's regular incandescent lights and my eyes cannot adjust to account for dark adaptation to drive at night. Ban LEDs in vehicles or reduce them 75% to match other older model vehicles. Also - point them downwards so they light the roads instead of tree tops and telephone poles.

A.43 May 28, 2024 — Bangor, Northern Ireland — None

I see that because the Prime Minister has declared there will be an election in the UK, the petition for the issue to be debated has been declared null & void..... Raging ! The reflector size of dipped headlights gets ever smaller, increasing the intensity of dipped headlights - a triumph of style over function !

A.44 May 28, 2024 — Kuala Lumpur, Malaysia — Photophobia

Instant trigger of chronic migraines. Can't even function at all.

A.45 May 28, 2024 — West Springfield, MA — Other

Driving home at night from visiting my daughter and grandkids, my partner and I who are in our late sixties were constantly bombarded by LED lights. He was behind the wheel while we both kept aware for the usual zig-zagging speeders and with warm weather, motorcycles (why aren't they required to have a red light or reflector on the back of their helmets?).

It's like running the gauntlet having white/ blue blasts of light dazzle you from opposing traffic. Even on highways with wide median strips you never know when you will be temporarily blinded! There is construction everywhere, lane shifts, narrow temporary lanes with rough pavement and confusing signs and then those lights, sometimes from packs of cars all with LEDs hitting your eyes. Trucks or SUVs behind you and your rear and sideview mirrors are useless! You have to fiddle around, while driving to tilt the side mirrors or literally drive with a hand up blocking your rear view. This affects all

ages but is particularly bad for seniors! Older eyes have slower dilation response to glare. In a way it's age discrimination as older people will have to think twice about whether they can go out at night!

We have laws prohibiting people from shining laser lights into the sky as it can blind pilots in airplanes. This is the same thing. We worry about folks distracted by their phones or impaired by alcohol, but no one thought about super bright lights glaring in your eyes!

This impacts my life. It's dangerous! They should be recalled immediately. Like other car malfunctions manufacturers should change out the lights or put a filter on them. Let's do this now, not in 10 years or so. Switch back to halogen for the safety of all drivers.

A.46 May 28, 2024 — Winsted, CT — Other

Dangerous driving conditions at night on my way home from work!! I have to literally close my eyes as ridiculously bright LED headlights blind me while passing in the other lane. This is so dangerous and damaging!!!!!!!!!!!!!! How can this not be being addressed. I have almost crashed multiple times. I feel my eye sight is being damaged from these lights and getting worse. Please help up.

A.47 May 30, 2024 — Brighton, England — Migraine

My life has been devastated by LED lights. I am severely triggered by LED lighting, especially car headlights. I experience extreme migraine for up to 2-3 days after looking at a car headlight or a LED strip light, depending on duration of exposure. LED panels in shops, buildings and street lights make me very ill also.

I can be vomiting for 6 hrs or more after exposure and have severe head pain, weakness and complete disability. Consequently I am now pretty much housebound and excluded from all social activities, travel and work. I have tried all the blue light blocking glasses but it is the FLICKER that is the trigger. In the same way strobe lighting affects people with epilepsy.

It is totally unacceptable that so many peoples lives have now been pretty much ruined by ubiquitous LED lighting.

A.48 May 30, 2024 — Jaffrey, NH — None

Being the director of a public library which offers evening hours, I regularly need to drive the 1/2 commute home in the dark. I also help care for my 93 year-old father, which again requires night driving. I am not elderly, do not wear glasses, and just passed the vision portion of my driver's license renewal. I have no health issues that would make night driving difficult.

The new LED headlights have made night driving extremely dangerous for me and by extension, anyone else I encounter on the road. I am literally blinded by the headlight intensity of both the oncoming traffic and the cars behind me if they have LED headlights. I studiously attempt to not look at the oncoming cars with LEDs, which means I don't have full visual scope, but as I live in a rural area, cars can come from around corners or over hills before I know where exactly to focus my eyes to avoid direct contact; thus I am constantly dazzled. If I accidentally have even a momentary direct eyeline contact with LED headlights, I have a blinding afterimage that lasts for several hundred yards. There are no shoulders on the rural highways I travel, so I cannot pull over until my blindness passes (and I would have difficulty seeing the shoulder after exposure anyway). If a car behind me has LED headlights, the glare in my rearview and side mirrors can interfere so badly with my ability to see that I sometimes have to turn all the mirrors away so that the glare is targeted elsewhere--very dangerous, if not illegal. The LED light from the car behind me is so intense, I could easily read a book if stationary. I have begun wearing special yellow glare-reducing glasses to drive at night, but as they reduce and darken my overall vision, this is risky.

I cannot cease driving at night if I wish to remain employed. I cannot cease driving at night if my father is to continue to receive my care. I don't wish to cease driving at night and limit my ability to freely live my life simply because all new cars have ridiculously blinding headlights. The invention of LED headlights has created a real problem in my life, and the danger of an accident is real. There doesn't even seem to be a justification for their widespread use, which is additionally maddening.

I have limited my comments to the issue of safety re LED headlights. In other areas, I also find LED light has reduced my quality of life (I can no longer see the night sky due to neighbor outdoor LEDs, etc.) and am outraged that I am given no choice in the matter of home lighting. For decades, I have

line dried all my laundry in an effort to energy-offset my continued use of incandescent lightbulbs. Now it is illegal to sell incandescent lightbulbs and I am consigned to having to spend every night hour of the rest of my life illuminated by light that feels like nails on a chalkboard to me. That rant can wait for another day.

Please take complaints regarding LED headlights seriously. They are TOO BRIGHT. How many accidents will need to happen before this is addressed? I know I feel like an accident waiting to happen unless I cease driving altogether, which is not an option and shouldn't have to be.

Thank you.

A.49 May 31, 2024 — Logan, UT — None

Our city has a 'suggested' policy of dark sky compliance where often they will cheap out violating EISs for various road projects. I successfully had a 'cobra' style HPS light typically used at interstate interchanges removed from near my home due to light pollution. Now on the street the rest are being phased out for Dark Sky Compliant (DSC) LED lights and it is a wonderful change. The light is diffuse, lights up the sidewalks, and has minimal spill onto homes or the street. A new hotel has been built across the street from us and the owner incorporated Dark Sky Compliant LED lights in the parking lot and surrounding and it is only slightly more bright at night than before, and it is safe for the hotel guests. I'd recommend making formal comments to Beaverton City to mandate future construction to be DSC and incentivize retrofits to meet DSC. Glaring lights are only slightly less annoying to me than sound pollution, but I've worked with our city to address both.

June 2024

A.50 June 1, 2024 — Fairfield, CA — Autism

During the day, I was driving a vehicle on a freeway when I struck by an LED flashing light from a bicycle on a parallel road. I reactively closed my eyes and then suffered a seizure reaction, which I would describe as like an electrical shock and loss of cognitive functioning and vision. I then had to emotionally fight off a panic attack.

A.51 June 3, 2024 — Oakland, CA — Other

blinded by oncoming headlights and totaled my car (1-17-2024)

A.52 June 4, 2024 — Cumberland, MD — Migraine

I have spent many hours trying to block the harsh alien light that floods our house since the LED streetlight has been installed in front of our house. It is summer now with leaves on trees. The light will be even more intense and be on for longer times in the winter. When I step onto my porch in the evening I am blinded by the LED streetlight and it is difficult to leave the porch without the risk of tripping on steps. I no longer take evening strolls because of the blinding glare on our streets. When I do walk at night, I get red spots in my vision and suffer headaches. I have had several panic attacks while trying to sleep. I feel that these have been triggered primarily by the oppressive feeling that my home and home life has been severely impacted and there is nothing I can do about it.

A.53 June 4, 2024 — Petrolia, CA — None

At night when an oncoming car or especially truck has LED bright lights, I stop right where I am. I can't see to move forward lest I drive into the oncoming vehicle or drive off the road, hit a tree or down a hillside. This happens frequently in the rural areas. In town, I cannot see pedestrians or even signal lights when the headlghts are aimed at me. It makes all the other features like crosswalks and parked vehicles disappear. Certain headlights are a danger and I'm glad I haven't had an accident from being blinded by them.

A.54 June 5, 2024 — Doylestown, PA — None

The LED lights are like Searing Laser High Intensity Lights that BLIND the drivers visibility and harm my eyes with pain and headaches. There is no avoiding them, I find I have to shield my eyes anytime one of the LED vehicles come toward me on the road. It is Impossible at night to drive and extremely difficult during the day I suggest going back to a softer headlight and putting an AMBER shield on vehicles that have LED lights to soften and stop the blinding that they cause or best go back

to the softer traditional lights. It is IMPOSSIBLE to drive at night and will eventually lead to burned out retinas and macular degeneration with this constant blazing brightness directly in the drivers eyes.

A.55 June 5, 2024 — Escondido, CA — None

As I walked into my local Costco, I was assaulted by an LED demonstration light. Immediately I got a headache and my vision turned blurry. Even after getting past the light, the effects lingered. As I walked down the first aisle, another demonstration light hit me, with the same result. I spent the rest of my time shopping under duress. I spoke with Jose H., the membership manager, and explained how dangerous those lights are, especially to people with neurological sensitivities, that they can cause seizures and worse, and requested that they be turned off. He said he couldn't do anything. He would have to confer with the corporate office.

A.56 June 8, 2024 — Brantford, ON, Canada — Photophobia

I am blinded by LED headlights while driving. This is extremely unsafe. LED headlights should be banned.

A.57 June 12, 2024 — San Tan Valley, AZ — Migraine

It literally feels like it is burning my retinas. I no longer feel safe driving at night. It's not safe for me or others. I don't know what to do. I feel like I'm going crazy.

A.58 June 12, 2024 — Tampa, FL — None

I recently visited a local establishment for lunch and every single one of their lights had 5000k (maybe even higher) bulbs in their fixtures. The color wasn't the only problem, but they clearly used some cheap bulbs with a very low CRI and a terrible flicker rate.

I'm normally not *that* sensitive to bad lighting, but this place in particular immediately triggered a full migraine and a feeling I can only describe as nauseating. I looked up pics on Google maps and years ago this place had nice warm lighting and used Edison style incandescents. Makes sense that I had no ill effects the last time I was there.

A.59 June 14, 2024 — Havre, MT — Other

The Bureau of Reclamation, a federal agency, is conducting a three-to four year construction project near our home. They are using high-intensity LED lights on the site. Our home is over one-half mile away from the site and 100 feet higher in elevation but the construction lights are projecting into our home, lighting it up from end to the other, and have been doing so since the summer of 2023. We have been asking them to modify their lights since August of 2023. When I started having daily migraines in December of 2023, we started blocking some of our windows with cardboard, but the damage turned out to be far worse. A few months ago, my husband was diagnosed with a sudden and drastic change of vision in one eye which alarmed his ophthalmologist, who was unable to find any physical reason for the loss of vision.

A.60 June 21, 2024 — USA — Autism

An individual contacted the Soft Lights Foundation to report thoughts of suicide due to repeated exposure to blue-rich LED lights such as vehicle headlights. The neighbors called the police who came out for a welfare check. The police stated that only the city council could do something about the LED lights.

A.61 June 29, 2024 — Hillsboro, OR — Other

My partner and I are blinded by LED headlights that drive behind us these days. It is getting worse. WE ABSOLUTLY HATE IT!!! It's unsafe and poses a safety hazard. LED Headlights are basically high beams. At least "high beams" have regulations on when they can be safely used.

July 2024

A.62 July 9, 2024 — Mangonui, New Zealand — Migraine

While traveling in the passenger seat along the state highway felt sudden thunderclap pain to the left occiput passing three flashing LED lights on three diggers repairing the road. My left eye began to

stream, my speech became slurred, then dysaesthesia to the left side of my face and arm occurred. I felt as though I had a concussion. The symptoms of this hemiplegic migraine event resolved gradually over a three day period.

A.63 July 9, 2024 — Woodland, California — Autism

A fire truck came down the street with LED strobe lights. The strobe lights caused me to suffer psychological trauma which lasts for hours after the incident.

A.64 July 15, 2024 — Albuquerque, NM — Autism

I am Autistic and have a sensitivity issue with BRIGHT LIGHTS. My city has changed their streetlights to LED 3000k and 4000k lights from streets to parking lots. Ever since these lights were installed, I have been getting constant migraines and large headaches multiple times a month. My city is REFUSING to do ANYTHING to bring back ANY form of AMBER streetlights. I've contacted the city AND state A LOT! And they won't do anything. I've even tried contacting the DOT of the state and he won't even be much help. My city continues to IGNORE my concern and also continues to install these WHITE LEDs. I've tried EVERTHING I could to help my city but they won't do ANYTHING. I hope I can FIND a way to FORCE my city to bring back these AMBER AND VAPOR streetlights back! My city had installed these lights back in 2019 and I've done EVERYTHING I could to try and make the city understand that these lights are TOO BRIGHT, and I CANNOT continue much longer going to bed every night and waking up every day with a LARGE MIGRAINE that causes me to even become DIZZY at times! I hope you can help me fight this issue in my city and FORCE my city to bring back AMBER AND VAPOR streetlights! Thank you for reading this!

A.65 July 16, 2024 — Albuquerque, NM — Migraine

When I am too close to these white LEDs, I tend to get a large, massive migraine and then I start to lose control of my senses. I become extremely quiet and my friend that I stay with has been noticing that I would act strange and also tend to get a little violent with him. Again, I have NO control of my senses when I am TOO CLOSE to these bright lights! I end up basically not remembering anything and my friend is telling me like, "why were you acting like that??" And I first did NOT know what was causing the problem, until I figured out that when I am REALLY CLOSE to these white LEDs, I tend to start getting that migraine and then lose complete control of my body! I currently am staying with my friend and where he lives, the city is refusing to take matters of these issues that SOME of the residents are experiencing SIMILAR symptoms. My friend who is Autistic will get really painful migraines! And he'll take WAY TOO many painkillers to try and stop his headaches. Before the city of Albuquerque changed their streetlights to white LEDs, my friend and I have had NONE of these issues. After a few months of these leds being installed in the city, Me and my friend had started to get these strange symptoms and they have only gotten worse! I've personally contacted the state and city's legislature and administration regarding this problem. BUT they don't want to do anything about the problem! My friend has contacted the whole state PLENTY of times explaining that this is extremely dangerous, but again, they do NOT want to do anything about it! I'm hoping that somehow, we can make Albuquerque replace their led white lights to a softer light like, 2200k HID LEDs and also MAYBE some LED VAPOR lights! I hope you can help force Albuquerque to do this!

A.66 July 17, 2024 — Sacramento, CA — Autism

I was driving on the freeway in the slow lane, when a tow truck in the fast lane ahead of me suddenly turned on LED strobe lights on the top of his struck. It felt like a lighting bolt when through my body. I instantly closed both eyes and felt like I should drive off the bridge.

A.67 July 24, 2024 — Blandon, PA — Other

I had an LED come downhill at me with high beams on while I was driving. Despite having light blocking glasses on, and being in my car behind my windshield, I still managed to suffer a temporary vision injury. For several minutes following the car passing me, I had a GIANT hallucination of an oval of light, with regular sight in the dead center, in both eyes. It was my first time experiencing this, and after the second minute I had begun to think it may be permanent. The experience was terrifying, I was over an hour from home, and so emotionally distraught on top of the vision impairment that it was difficult to maintain stable driving.

A.68 July 30, 2024 — Federal Way, WA — Other

LEDs cause me so many neurological symptoms brain fog, anxiety, depression, OCD, headaches, ghosting (ex. When looking at led tail lights and looking away I see them but it's a ghost appearance that's green) , lose my place when talking, visual accomdation spasm trigger, disconnect feeling, nausea. It's been a nightmare with LED lights. Some are worse than others.. especially ones using PWM as their brightness control which induces flickering. Car headlights are the WORST. I can see the flicker of most led headlights it's very uncomfortable.

August 2024

A.69 August 1, 2024 — London, United Kingdom — Other

Council lawnmower with flashing LED lights drove past me while I was walking along the road. I felt immediate severe head pain, nausea and discoordinated, and fell into the roadside ditch. I then vomited, climbed out with blurred vision and pounding head.

A.70 August 1, 2024 — Mangonui, New Zealand — Migraine

After accidentally (I have to avoid exposure to the direct beam of the LED) viewing a small but powerful security light for less than a second, I had to violently throw up for up to two minutes at which point I lost consciousness and fell to the concrete floor and hit my head. I woke in a pool of blood and further vomit. The security light has been turned off so I am safer in my home but unable to go anywhere with LEDs safely. I am now registered disabled and struggling to maintain my work which now has to take place at home. I have had several severe episodes where they have caused me to have seizures that can take months to recover from. I now experience up to 3 led induced migraines as opposed to once every three months prior to the roll out of LEDs. If I look briefly look directly at an LED it damages my vision and I am left with spots in my vision for hours to days. If spending time in spaces lit by LED I can find it hard to think clearly, I am unable to speak clearly and cant remember words. this also happens when I have a migraine with aura set off by a strong LED. My life has changed in every way imaginable since they where rolled out in my location around January 2021.

A.71 August 2, 2024 — Portland, OR — Photophobia

I am 40 years old, and I cannot see at night when faced with LED headlights (can see fine when they are not present). I have been told by 4 eye doctors that there is nothing wrong with my eyes and I have no condition to warrant a diagnosable handicap. Because I cannot see at night, ESPECIALLY in the rain (here in Oregon we get 9 months of rain per year), I am forced to get rides from others or not drive at all at night. This significantly impacts my job opportunities and my income potential. I am incredibly stressed out because of this and do not understand why no government agencies are taking action on this problem. I plan to pursue further lobbying activities or and/or legal action.

A.72 August 3, 2024 — Acton, MA — Sjogeren's

Having Sjogren's makes it extremely difficult to see with oncoming cars with unregulated LED headlights. They make it impossible to maintain any degree of driver safety. I must focus on the right edge of the road to be certain there are no pedestrians walking on the side of roads in the suburbs and country. Leaving the left side of my car exposed to the driving skills of the offending driver, which does not follow the defensive driving skills I was taught and use whenever I am in the driver's seat.

The other issue I encounter are the extremely bright blue LED lights on police cars when I approach the scene of an accident or when they pull are car over for a driving incident. Even when driving at 2-5 miles a hour to be cautious not to hit anyone I cannot see what's in front of me. Their blue lights put me at risk of hitting a pedestrian even when driving at 2-5 mph.

Why should my passengers and my safety be put at risk because of unregulated LED lights? If it has not already happened, this will lead to many lawsuits with the automotive manufacturers throwing the weight of their legal teams defending themselves when the regulation of LEDs would have prevented the injuries and loss of life.

A.73 August 3, 2024 — Austin, TX — Other

I have early cataracts. The LED headlights blind me, whereas halogen lights do not impair my vision at all. At a minimum adaptive driving beams should be required in the US like they have been used in Europe since 2012.

A.74 August 3, 2024 — Bellevue, WA — None

Interestingly, I believe this is also an issue for people with very good vision and not wearing glasses like me. The lights can focus very well onto my retina and make me uncomfortable looking forward at night, but how can people safely drive cars without looking at where the car is going? Due to the strong headlights in new cars, I simply avoid driving cars at night now.

I live in Greater Seattle Area where it's mostly cloudy over the year, and the sun sets very early in winter. Some of these LED headlights are so bright, it's even a pain for me driving around noon during day time. As a paradox, Daytime Running Lights should promote road safety, but they do act as a safety hazard on some cars now. This video should demonstrate my point well: (https://www.youtube.com/watch?v=s4Ws0__yiXg)

Thanks.

A.75 August 3, 2024 — Canaan, NY — Astigmatism

The LED headlights are a hazard.I'm still fairly young and have had to give up driving at night completely due to how unsafe it is getting blinded by them and not seeing the road for several seconds afterwards. I, like millions of others, have astigmatism in one eye, but I also have had migraines triggered by these lights, even during daytime driving from drivers with headlights on! My optometrist and doctor's office staff have stated that many other patients report similar issues. The internet is full of forums with people complaining about these lights, and their accounts are very similar - if not even worse - than mine. It's astonishing and reckless that these lights are being inflicted on the driving public!

A.76 August 3, 2024 — Chicago, IL — Photophobia

EVERY DAY BLINDED AND SEE SPOTS VISION IS DECLINING EVEN IN DAYTIME!!!!

A.77 August 3, 2024 — Chicago, IL — Astigmatism

Bright LEDs make it hard to drive at night. It's blinding and unsafe for me and the public. Sometimes sunglasses help but I shouldn't wear those at night

A.78 August 3, 2024 — Fort Collins, CO — Other

At 74 and having cataract replaced and it is nearly impossible to drive safely with the blinding blue white glaring LED lights. It is so distracting and frustrating I loose my concentration to drive properly. The lights seem to bounce up and down with a blinding flashing impact. Even police vehicles red and blue flashing on the side of the road are so blinding it is difficult and unsafe to go around them. I can't see what is in front of me. The contrast from dark to blinding flashing lights is too much to see what's in front of me.

A.79 August 3, 2024 — Fountain Hills, AZ — None

Apparently the plan to get drivers off the road is working with the BLINDING LED vehicle headlights. The police LED flashing lights are SUPER BLINDING.

A.80 August 3, 2024 — Fresno, CA — Astigmatism

Why do we have dimmer switches on our cars' headlights if intensity doesn't matter?

As a person with astigmatism I just had a conversation about these lights at my ophthalmologist's office as several of the office staff were nearby and joined in. All agreed these lights are so blinding, especially to those with astigmatism, and it creates a driving hazard. We all opined that they need to be regulated because they said they see problems with them across the board with their patients and in their own lives.

I'm also very photosensitive and have to look away from those oncoming lights to not be blinded by them. Should you really have to take your eyes off the road to drive? Does that make any sense?

Again, why do we have dimmer switches on our cars headlights if intensity doesn't matter?

A.81 August 3, 2024 — Glenville, GA — Migraine

They make me have stroke symptoms every time I am near an LED light of any kind

A.82 August 3, 2024 — Greenville, SC — None

Because of super bright LED lights, I can no longer drive at night. My eyes are very sensitive to that horrible brightness and I had to change my life around this problem. I had to look for a job where my schedule is not ending at night. How can this be allowed? All of you know that this is wrong. WHY?

A.83 August 3, 2024 — Hamilton, MA — Astigmatism

Like myself, millions of Americans have astigmatism that makes it difficult to drive at night. LED lights from oncoming cars, esp on 2 lane country roads, make it almost impossible to navigate safely when coming home from work in the winter. I have almost driven my car into a lake after being momentarily blinded by this kind of headlight. While good for the driver who has them, they are DANGEROUS for everyone else using the roads at night. Thank you.

A.84 August 3, 2024 — Hinsdale, NH — Photophobia

I absolutely can't look straight ahead and watch the road when an oncoming car with LED light comes toward me. I actually turn my head to the right a bit so as to not get blindness. If I do look at them, I see dark spot in my vision, just like a dark shadow that blocks the road. I also get migraines and have come home from driving at night very upset because I realize my migraine is most like due to the bright lights. I have to limit my driving at night unless it is necessary. It is a danger to me and others to be on the road at night. Please help with this scary situation.

A.85 August 3, 2024 — Onsted, MI — Astigmatism

Led headlights (low beams) , white led running lights, LED brake lights, emergency flashing Led lights and Led streetlights have adversely affected my ability to drive safely. I do not drive at dusk or Night anymore unless I have to (for work). I live in Michigan with snow covered roads and the most dangerous aspect of driving is being blasted by someone's Led headlights. I cannot use my read view or side mirrors anymore because of the vehicles behind me blinding my visions with their Led headlights. I have to constantly shield my eyes to be able to see the road due to oncoming Led headlights. I love nature and now my ability to enjoy the Night skies is ruined because of bright Led lights on at night. I never had any problems driving at night prior to Led headlights. Now driving has become a nightmare and a very dangerous task. Led headlights should be banned or at least some type of regulation regarding luminance and Kelvin temperature. Many Led low beams are much brighter than halogen highbeams. In addition to the dangers of led headlights being dangerous, they cause me headaches and eye pain. It's common knowledge that blue light is detrimental to the health of humans and don't understand why this type of lighting is being used in the public.

A.86 August 3, 2024 — Portland, OR — Other

A few years ago I was driving on Hwy. 211 in Oregon near Molalla at night when I encountered a pickup truck with LED (BLINDING!) lights headed toward me. The glare caused me to be blinded to my lane from the oncoming LED lights, and there was a deer I did not see until after the pick up truck passed. That was too late. Although I was not hurt, the deer could have crashed thru my windshield; I have seen this before. My car was "totaled".

A.87 August 3, 2024 — Riverside, CA — Other

Retinal retention where bright lights blind and the retina holds the image

A.88 August 3, 2024 — Rochester, NY — Astigmatism

LED lights have caused a multitude of problems for me since there general use. I'm blinded by LED headlights making it impossible to see after they have passed. LED lights in and on public buildings have resulted in headaches and migraines. LED streetlights makes driving difficult as it does not give diffuse light pole to pole. LED streetlights in a snowstorm create a dazzling reflection making orientation of the road impossible. LED strobes on emergency vehicles, construction vehicles and

personal vehicles have induced seizure type symptoms. Driving at night and being exposed to LEDs cause sleeplessness

A.89 August 3, 2024 — Yonkers, NY — Migraine

Headlight blind me. I cannot go out at night even for dinner with friends without being blinded and triggering migraines. I have better than 20/20 vision and these newer headlight blind like like the older ones never did. They really limit my quality of life. I went out for dinner with friends in the evening in July and was so blinded on the way home that I barely got home. I got a severe migraine lasting several days.

A.90 August 4, 2024 — Kittatas, WA — Astigmatism

I have had to stop my car entirely when driving at night because the lights were so blinding. I literally can not see and choose to stop my car in the middle of the road for everyone's safety. I don't have this issue with all the headlights. For some lights, I do use my hand to shield my eyes from the headlights. I had to do this over the weekend once again. I have noticed that when I use my hand to shield my eyes I feel heat on my hand. This weekend's incident stood out because I had the a/c on in my car and I could still feel heat on my hand from the on coming headlights. I have also noticed that my left eye, the eye that gets the most direct LED light, has been slowly getting worse.

A.91 August 4, 2024 — Spokane Valley, WA — Epilepsy

The use of LED lights in public spaces has and continues to become a more and more serious issue as more and more are being used and lights are being switched to this. In department stores like Walmart, I can only be in there for about 10 minutes max and it sets off my epilepsy. I get nauseous, and dizzy and begin to have auras. I have to immediately go outside to natural light. They are being used as street lamps and at night with it already dark outside, it makes them that much more awful for people like me. They are being used in headlights and I made a serious note of this when my son and I drove to Denver and back from WA. If there was oncoming traffic at night and older cars with older style headlights, there is no issues driving at night. Sure they are bright and you always have a little of that bright headlight thing going on, but those new LED headlights are just obnoxious beyond belief. Not only are they bright, but when you get a row of them and you have epilepsy - they flicker, and some flicker noticeably because when it is temperature change ie colder they seem to have an issue and cause flickering. As a person with epilepsy you only have the instinct to close your eyes and you can't because you are driving the car. Same with going down a street light with LED street lamps. And while I get that if you have epilepsy and they say don't drive. I CAN drive, and DO have my license and it is unfair to me to take away my license because of some light bulbs!!!! When I am otherwise allowed to drive. In my recent drive to Denver and the flickering head lights - some were almost to a point of flashing like an emergency vehicle. How on earth is that even safe for any driver encountering that in the dark at night? It is visually distracting like a strobe light. And then finally - I can not even have lighting in my own home or my office any more. You have completely gotten rid of any light bulb that a person with epilepsy or a person with strokes etc can use in their own home and using those ones that change the lighting tone from natural lighting to bright lighting really doesn't help sorry. So what do you expect all of us to do? Go back to only lighting our houses by candlelight? You, as the FDA need to LISTEN! I am in architecture and interior design, I am well aware of design and lighting. This is a very REAL issue that needs to be looked at. It is a health/ medical concern. My mom recently had a serious of mild strokes, and upon researching it since I have epilepsy - I discovered that strokes including decreasing blood flow to the brain CAN because by LED lighting! Before this is dismissed as a whim, you need to actually look at this. It is a real problem. If I go in to Lowe's or Home Depot in their lighting section I can last about 2 minutes and I have to go running out of there and want to throw up it is so bad. I used to love their lighting section - even just a couple years ago it was still ok because not all the lighting had been switched out yet - there was still a balance. Today I can make it about 2 minutes - you want to tell me that is not a serious health concern? I am just one person out of millions with epilepsy, strokes, migraines..... This effects a lot of people - not a handful. On my same adventure drive to Denver the other day - we stopped at hotel and stayed the night. When I came to the reception counter, the woman behind the counter had the lights above the counter area turned off. So I asked her about it and told her I had epilepsy and just wondered if she did and that's why she had the lights off. She told me that ever since the hotel had switched to the new lights, she can't keep them on any more. that she had a car accident and now had

a serious stigmatism that caused her migraines. The new lights make it so bad she gets sick and can not be around them at all so she had no choice but to turn off the lights just to be in that space. The FDA needs to listen - it is a REAL problem! Thank you

A.92 August 4, 2024 — Webster, MA — Migraine

When the migraine sets in after just ONE oncoming LED vehicle I have much trouble focusing my eyes back on the road. Especially on darker back roads which I travel to work on in the early morning and also have trouble focusing at work.

A.93 August 5, 2024 — Beaverton, OR — Migraine

Poorly designed LED lights impact my health severely. Flickering LED lights induce migraine headaches, and this affects my health nearly every day. Overly bright LED headlights and street lights impair my night vision and make driving more dangerous.

A.94 August 5, 2024 — Bradford, England — None

I walk my dog along part of a busy road, the car LED lights are so bright coming toward me that one night I did not see a bramble which hit my face leaving blood running down my face!

A.95 August 6, 2024 — Culver City, CA — Other

I have to hold one hand w/ a newspaper, and bring down my visor, the rear view & side mirrors to block all LED headlights. This makes it very difficult to see any traffic hazards. If the light does hit my eyes, i get a piercing pain back to my optic nerve worse than a migraine.

A.96 August 6, 2024 — San Diego, CA — Other

Honestly, this is an issue I must deal with EVERY time I have to drive at night! There are far too many outrageously and dangerously bright headlights that blind me and so many others I know. Whether it's headlights that haven't been positioned correctly, or large vehicles beams that shine directly into my review and side mirrors, either way it's awful! In order to drive without being blinded nonstop, I must flip my review mirror up, and use my left hand to block my drivers side mirror. This GREATLY reduces my safe usage of these needed tools, but I have no choice. I either do these things or be completely blinded by these eye scorching beams. I can recall when there were warnings against looking into these LED beans when flashlights started using them, and now, we are forced to be blinded by them WHILE DRIVING!!!

A.97 August 6, 2024 — Winters, CA — Autism

I was driving on a country road in the daytime. Over 1 mile ahead of me was a utility truck on the side of the road with amber LED flashing lights. For the entire mile, I was either glued to these LED flashing lights, or forcing myself to look away. As I approached the truck, the LED strobe lights were overwhelming and I could not see through the lights. I stopped my car in the road and started to panic. I put my hand in front of my right eye, and then tried to use my left eye to navigate around the truck. It is impossible for me to think or see with these LED flashing lights blasting me and I suffer extreme anxiety and panic.

A.98 August 7, 2024 — Knoxville, TN — None

Excessively bright, unshielded lights are being set up over the city, some residential, some commercial. Despite being against code, the City does not effectively address the issue. Lights close to my home leave me and my neighbors blinded to own properties, as well are problematic for drivers. I am literally unable to look across my lawn when they are on, as the glare is blinding and painful to my eyes (I have no eyesight issues), meaning I cannot see anything. They're also an ecological catastrophe. It is unbelievable these lights have gone unregulated this long.

A.99 August 7, 2024 — Valley Stream, NY — None

LED headlights are incredibly irritating and they've become far brighter than is necessary. Not only are they absolutely blinding in some cases but they're DISTRACTING, and I can't imagine what could be worse on the road. Headlights should be sufficient and shouldn't pose an issue for other drivers. The fact that they do risks lives every day!

A.100 August 9, 2024 — Jefferson, OH — Other

I have worked with injurious light emitting devices for 15 years. The act of being forced to look into high powered led arrays has been a continuous thing for me and at least a few other people at work. This has increased to a ridiculous glaring issue, and nobody seems concerned about. I became more interested in all of this recently when i noticed a sort of hole in my vision where if I look at something for a few seconds it just starts to go black. A common daily routine for me involves taking measurements thermal and electrical measurements of several very high powered lights in the space of a meter that output 72,000 lumens pointing up at my face, my face is less than 2 feet away. I was not given proper PPE and had to ask for it, then i received improper ppe, and by way of my own ended up using a shade 5 ppe for welding.(which is still not good enough because the stuff hurts my eyes also there appears to be zero science in choosing the right ppe for staring into injurious light) I am confused about what ppe to use for reading meters while viewing intense light. I went to the optometrist, and he claimed my eyes did not seem damaged, suggested i am experiencing some sort of photo bleaching and said that they will be damaged and he recomended that the company i work for should seek a safety hygienist. But like i said stuff disappears if i look at it for a few seconds a plus i seem to experience mental problems while being around these intense lights. I have read through all the regulations and shortcomings of various federal regulatory bodies and i just don't know where to start besides letting the safety coordinator person know my problems. I have not done that because i want to make a clear case and show everyone what is really wrong. That and i don't want to end up being ignored or dismissed.

A.101 August 12, 2024 — Queen Creek, AZ — Electromagnetic Sensitivity

My wife started to develop dizziness every time she would go inside of a newly opened Costco near our home. When she would arrive home, she would be nauseous and have to rest for a while. Now, she struggles to go there alone because of how being in the store makes her feel, and usually needs someone to go with her. The lighting in the store is the bright white LED type. Very agitating to the eyes. Not sure if there's other factors at play, by the lighting is definitely an assault on the eyes. When I go in there, I'm in and out pretty fast because the lighting is so stressful.

A.102 August 14, 2024 — Goodyear, AZ — Migraine

I have migraines that get triggered from bright lights from light bulbs and sun glare. I used to be safe from this affliction at night, but that hasn't been the case ever since LED headlights have become popular. I now feel that I have to wear sunglasses at night as well as during the day to avoid what feels like the unabated light of the sun from traffic from the opposite side of the street or from trucks who tailgate me for not going 80 mph on the freeway. I am essentially left blind and with a burgeoning migraine every time a passing car shines their lights at me, and I am certain I am not the only one who suffers from this.

A.103 August 15, 2024 — Round Lake Park, IL — Photophobia

I have had glasses since I was 10 years old and am now 31. After reaching my 20s my eyes leveled out and my prescription did not change for over 6 years. In the past year and a half I have worked from home on a computer. Between computer screen and the blue LED headlights my prescription went from -3.5/-3.75 to -4.25/-4.25. Even more recently for 2 days my left eye experienced a 'halo' effect when looking at lights that worsened at night. Thankfully it went away after a few days, but 2 opthalmologists couldn't determine the cause. Driving at night is an increasing hazard due the brightness headlights, especially the LED ones. There does not seem to be any regulation on how bright headlights can be and all the LEDs make it difficult to see the road when there are oncoming and they leave a lingering effect on my eyes after they've gone. I have order my new prescription with blue light filter lenses to lessen the effect of headlights and screens. Those special lenses seem to range anywhere from an additional $30 to upwards of $100 on top of the cost for the frames themselves. And that was on a cheap website like Zennioptical.

A.104 August 16, 2024 — Middlefield, OH — Migraine

I went to my bank while it was closed on the weekend to get money from the ATM, but there were so many LEDs that I had difficulty making out the buttons, I felt disoriented, and quickly started to have pain in my eyes and head, resulting in a low grade migraine. I had difficulty responding to the passenger with me in the vehicle and making quick judgements while driving afterwards. I had a

headache the rest of the day and into the next day after the couple of minutes at a machine to access my funds.

A.105 August 19, 2024 — Marietta, OH — None

I work mornings mostly, which means I'm on the road when it's dark out. Every led that passes me or gets behind me blinds me. Most times I have to stare down at the middle line to make sure I'm still on the road. Even dark dirt road my cars yellow brights work just fine. There's no need for someone to light up the whole state of Ohio

A.106 August 22, 2024 — Rocklin, CA — Autism

LED headlights, along with increasing levels of aircraft noise, have literally taken away my ability to live independently.

I was diagnosed with high functioning autism when I was 17 and one of my symptoms is a high sensitivity to light and noise, which is common among autistic people.

I worked as a mechanical engineer in the San Diego metropolitan area for about 3 years after graduating college in 2020. During that time, I was with a long-term girlfriend and was even living with her for the last year of my time there. While living in San Diego I was getting more and more anxious and overwhelmed to the point where I wasn't able to function enough to keep my job or be a good partner with my girlfriend. Eventually, I had something akin to a nervous breakdown and I am now living at home with my parents and working at my local grocery store (thank god I have loving parents who are willing to help me out).

I believe that the exponential increase in recent years of both LED headlights and ceaseless air traffic over residential communities were the main cause of my anxiety. As an autistic, I need to live in an environment that's a sensory safe space (dim and quiet) so that I can recharge from the stimulation of a full day in the hustle and bustle of life. When there's aircraft noise penetrating my room and LED light every time I drive, there's very little break from the overstimulation. If I'm not able to get this recharge time, the sensory overload causes a cumulative effect, and anxiety builds in me.

While living with my parents, in an area with much less air traffic, I've been able to work reduced hours and limit my nighttime driving. I'm starting to see my mental health improve. However, I still have to be careful not to drive for more than 15 minutes or so at night and I mostly have to stay indoors where I can control the lighting and noise levels.

I used to love exploring at night. In fact, I would often go out during the nighttime because this was when the noise of the city quiets down and I feel more comfortable. It's not fair that the world is taking this freedom away from me by creating an unnecessarily harsh environment for sensory sensitive people. I also used to love camping for similar reasons (it was an escape from the noise of the city), but the proliferation of aircraft have taken this escape away from me as well. I have done a lot of brainstorming and can think of several ways that we could make our world more sensory friendly without significantly reducing quality of life for neurotypicals, such as reducing brightness / adding diffusers to LED lighting, enforcing common sense vehicle noise laws, and creating no-fly zones over designated sensitive areas.

A.107 August 23, 2024 — Monroeville, PA — Autism

I am unable to focus when I drive at night due to LED headlights. I had zero issue driving prior to their introduction. Even during the transitional hours of morning and evening sometimes these headlights are too bright. I am blinded to the point that I see afterimages of the lights in my eyes even without directly looking at them as if there were many tiny suns on the road.

A.108 August 24, 2024 — Crawfordville, FL — Epilepsy

Hi! I was diagnosed around 27 with epilepsy, cataplexy, and narcalepsy. It is a rare condition. I am now 52. I lost my license to drive at 27 bc I had a grande mal seizure front the sun shining down through the trees and as I drove thru them the light would blink and next thing I had totaled my car. I noticed that the sun was a problem to me around the age of 16. Wearing sunglasses doesn't really help much. I am very sensitive to the light. My favorite thing to do is shop. The LED lights in the stores have now even made it to where I can not shop if they have the newest led lighting. I know what stores to avoid It will actually make me very sick if I go into a store w led. I'm not sure to tell you if I

am shaking but I do know I get very confused and I will pouring with sweat. It almost paralyzes me. I can barely move or walk. I recently was in Big Lots where I had my last episode less then a week ago. I'm begging someone to listen. I will even have my mom record an episode and send it to you. Many people are affected by this. I want to be the voice that gets heard. I am literally begging to make this lighting go away so I can safely buy groceries.

A.109 August 28, 2024 — Esparto, CA — Autism

I was driving and encountered a utility truck with both sets of headlights turned on. I turned on my non-LED high beams in the hope that the driver would turn off the high beams. Instead, the driver turned on amber LED flashing lights that incapacitated me. I was unable to proceed forward and stopped my car. Instead of driving off, the driver of the utility truck stopped also. My vision and cognitive abilities were severely impaired, with panic setting in. Finally, I started to inch forward, and then so did the utility truck. It seems like the driver was doing it on purpose. After he left, I spent several minutes simply stopped in the middle of the road, trying to breathe and let the panic subside.

A.110 August 29, 2024 — Christchurch, New Zealand — Sjogren's

I was driving and came to a set of roadworks where I had to stop at some temporary traffic lights. I was the car in the front of the queue at the light. There was a worker's utility vehicle parked right behind the light in my line of sight. It had its rapidly strobing lights on. I am unable to function if I look at strobing lights due to neurological and eye symptoms from my common autoimmune condition called Sjogren's (for example Sjogren's impacts an estimated 3-4 million people in the U.S.). I do not have trouble with sunlight or incandescent lights, but LEDs are painfully glaring to me, and strobing lights cause even worse disability. In the incident I am describing I had to block my eyes with my visor and arm, which meant I could not look at the traffic light and I had to wait until the car behind me tooted so that I could know when to drive on. Even then I had to do so VERY slowly as I had to keep blocking my eyes as I went past the strobing vehicle and there was a danger I could hit a roadworker.

A.111 August 31, 2024 — Madison, California — Autism

I was a passenger in a car. As we approached a roundabout, a truck with white LED lights, the circular ones near the bumper, struck me directly. I screamed profanity and began crying. The other 3 passengers all confirmed that the light was excessively bright. For me, however, it was severe emotional trauma. The after effects are very long lasting.

September 2024

A.112 September 1, 2024 — Novi Sad, Serbia — None

Dear FDA Representatives,

I am writing to bring to your attention a serious health concern I have experienced with MacBooks manufactured after 2022. All MacBooks purchased after 2022, including the MacBook Pro M2 Max, cause severe eye pain, muscle tension around the eyes, and migraines. These issues occur when using macOS, with symptoms appearing almost immediately upon using the device. I sustained a severe eye injury during testing, limiting my work time to 40-minute intervals. Even a year later, I cannot work for more than 8 hours a day. Despite consulting several ophthalmologists and specialists in binocular vision disorders, no significant issues were found, and all professionals confirmed that my eyes are healthy. My symptoms disappear when I stop using MacBooks and switch to other devices that do not use Temporal Dithering. There is a clear connection between my symptoms and the use of Temporal Dithering technology in MacBooks. More information on this technology can be found on the following forum: https://ledstrain.org/t/temporal-dithering. As further evidence, MacOS users who managed to disable Temporal Dithering no longer experience headaches or eye pain: https://ledstrain.org/d/2686-i-disabled-dithering-on-apple-silicon-introducing-stillcolor-macos-m1m2m3. I am deeply concerned that in the future, I may be unable to use any Apple device, compromising my rights and ability to work.

I urge the FDA to regulate the use of technologies that involve pixel flickering for color display in Apple products. Your intervention is essential to ensure that sensitive users can continue to use Apple technology safely and effectively.

A.113 September 2, 2024 — Zwolle, The Netherlands — Migraine

Hello, im am not able to use any screens that use dithering and low frequency of PWM. With in use of a product that use these technologies it will give migrenen instantly. I am really conserd of the future because more screens are made with this technology. I have 3 kids and for so long i can i will not let the use devices that use PWM on los frequency and dithering. It will do damage on the long run. For now there is to low attention for this problem and i hope senserly that in the near future this will be widely known.

A.114 September 3, 2024 — Deptford, NJ — Photophobia

I tried to shop at the Five Below in Deptford NJ on Almonesson Road. I only needed one item, I hadn't been in this particular Five Below before. I barely lasted 5 minutes in there before migraine symptoms started, even with the protection of my FL41 tinted sunglasses. The LED lighting is so intense it completely overwhelmed any protection. I was fine when I entered the store, but within minutes I felt nausea and the beginnings of the familiar headache. I had to rest for a few minutes in my car where it was dark, just to recover.

A.115 September 3, 2024 — West Deptford, NJ — Photophobia

This is an ongoing problem. For the past few years I have been unable to shop at the local Shop Rite ever since they doubled or even tripled the amount of lighting above the checkout lines. I get migraine symptoms within minutes even while wearing my tinted glasses and a wide brimmed hat to bloc much of the light. The lighting is that intense. I get visual distortions, nausea, and the Pain starts in about 5 to 11 minutes (I've timed it) I can no longer shop at my local supermarket. The manager I spoke to had callous disregard for my condition, and my emails to management have received zero replies of any kind. Other Shop Rites aren't nearly this bad. The Glassboro location recently remodeled and installed DECENT, HUMAN LIGHTING that doesn't bother me at all. Why cant all supermarkets do this? There is some financial damage from this: I've been paying the higher prices at Acme because I can stand the lighting, or driving the 16 mile round trip to the Glassboro location just to feel human when I shop, so thats extra gas and miles on my car every time.

A.116 September 5, 2024 — Keene, NH — Other

Driving down a tree lined road at around 6 PM (dusk) there was a vehicle stopped in the oncoming lane with their lights blinding me. As I slowed down and continued on my side, I saw a headlight blink. That was the only warning I had that there was someone in the road. I slowed down to a crawl, and the driver was out walking around their vehicle with the driver's side door wide open into my lane. If I continued going the speed limit (30 MPH) I may have hit the driver or at the very least hit their open door. I was able to stay calm driving home, but when I got home 10 minutes later and realized how close I came to possibly killing someone (because the LED headlights were blinding me) I had an anxiety attack, including shortness of breath, racing heartbeat, and a feeling of doom. I already only drive as strictly necessary because of these lights, and this incident further fuels my fear of these headlights causing me to get into an accident.

A.117 September 12, 2024 — Moorhead, MN — None

When driving on roads with multiple lanes last night, I turned my driver's side mirror out and flipped the tab on my rearview mirror because the headlights around me were causing me physical pain and making it nearly impossible to drive. I couldn't see the road in front of me when the headlights were reflecting from the mirrors into my eyes. After adjusting my mirrors, I couldn't see anyone on my driver's side without turning my head, and I couldn't see well behind me in my rearview, but I felt like a much safer driver with those changes because I could actually see the road in front of me.

A.118 September 14, 2024 — Vacaville, CA — Autism

I was driving at dusk when a fire truck or ambulance suddenly appeared with LED lights flashing. I immediately threw both of my arms in front of my face and hit the brakes to stop the car. I thought that this might be the end of my life. The LED flashing lights are sheer terror and I can't function. After the fire truck/ambulance passed by, I felt like I was going to cry from the emotional trauma. My brain then feels like it's dead even hours later.

A.119 September 16, 2024 — Kensington, MD — None

I have personally side-swiped a pile of debris on 270 that was jutting into the lane at highway speed that was **invisible** because of oncoming LED Headlights almost taking out myself and my family. Luckily it just scraped up the side of my car. On other occasions I have barely seen pedestrians on the street who were completely shrouded in darkness because of the contrast these ultra-bright lights create outside of their dazzling beams. I often find it very difficult to see the road markings or the actual profile of an oncoming vehicle because the only thing visible is the floating white ovals in my windshield.

A.120 September 16, 2024 — Nashville, TN — Other

I have Mast Cell Activation Syndrome. My body produces an allergic reaction to things that wouldn't normally cause anyone else a problem, including LED lights. My brain interprets the rapid flashing light as if there's something attacking my body, resulting in what we call a "histamine dump." Histamine dumps lower blood pressure. But given I have a condition known as Postural Orthostatic Tachycardia Syndrome, which already gives me low blood pressure, the combination of this condition with MCAS histamine dump causes me to go into hypovolemic shock. It causes the worst pain I've ever known, where my brain is screaming for oxygen and nutrients, fading in and out of being hyperaware of how much pain I'm in only to dissociate from it as a way to protect myself from the mental anguish of that pain. I've almost died from this several times. For almost a decade, I exhibited symptoms of hypovolemic shock at the end of nearly every day, only to be told it was a cervicogenic headache or migraine. Now that I'm diagnosed, I'm on a medication to treat it. But that medication isn't strong enough to counteract the effects of extremely bright LED headlights, let alone LED streetlights. Every time I leave the house at night, I get sick. I'm already disabled my multiple chronic conditions. My life is already limited. I don't know how to live life unable to even go outside at night.

A.121 September 16, 2024 — Shippenville, PA — Migraine

On August 27, 2024, my husband took me to an appointment with a Neurologist/Headache Specialist at the Cleveland Clinic at their Brunswick location. On the ride there I had a few minor hits from LED headlights which caused a migraine. While at the doctors office I was met with LED lights throughout the office. I got a severe migraine and a tingling feeling in my face. It made the visit with the doctor very difficult as I was unable to come up with the right words to describe exactly how the LED lights are effecting me due to the cognitive loss I had from the LED lights. During this visit it was stated by the Neurologist that LEDs are a common trigger for migraines.

A.122 September 16, 2024 — Shippenville, PA — Migraine

I was riding in a vehicle with co-workers as I am unable to drive because of the LED lights. I picked my head up to look around because we were in the woods when the vehicle in front of us hit their breaks and the lights came on and caused an immediate migraine. Note that the vehicle that caused this was a government vehicle. I had an aura and severe cognitive decline that lasted for hours. Also had a numbness feeling on the left side of my face around my eye and nose.

A.123 September 17, 2024 — Easton, CT — Electromagnetic Sensitivity

My neighbor keeps her very strong LED lights on over her garage all night long from 7 p.m. to 7 a.m. and I cannot sit in the room where their light shines into my kitchen area. I feel sick and nauseous. I feel there is a very strong connection with the LED and frequency that is generated by the towers, wifi-routers, smart meters on their home and my home since I cannot have it removed. I place a date in this form but it is daily I am subjected to these harmful energies from the LED. The bright light is a light trespass into my private space.

A.124 September 20, 2024 — Raleigh, NC — None

Headlights on newer cars make daytime and nighttime driving a constant safety and health risk. These weaponized devices are a clear violation of my rights.

A.125 September 21, 2024 — Shippenville, PA — Migraine

At the dance studio. A parent had suv running outside while child took class. So they were sitting not driving with the headlights on full (low beam). Plus there was this weird strip of running lights

wrapped the headlights and the grill. The lights were more white and not as purple as most. So the hit seemed a bit less. I know to not look up or towards the door. I always put up a hand by my eyes to block and avoid grazes. I've had troubles with headlights coming in the door historically. In which a seizure was triggered (in front of children). So now I always keep my head down and walk on the one side of the building to avoid the door to the outside. This door is a full see through business type glass. As I walked along the "safe" side of the building. The led headlights reflected off an interior (glass see through) door (it was at a slight angle), and hit me in my left eye, mostly. Part of the right eye. Instant reaction. Blink reflex. Yet couldn't open eyes. Couldn't walk. Felt short of breath. Almost threw up. Stood in a veg state for several minutes. Couldn't respond to anyone's questions despite hearing them. Slowly I pulled myself back to the world after 5 min or so and was able to walk away. Sat down. Couldn't do any of the work I was working on. Organizing and cleaning the teacher shelves. Etc. Couldn't even finish the task I started. Barely made it through our team meeting. Couldn't think or filter my thoughts and words. I had severe pain on left eyebrow felt like an ice pick stabbed in. Yet felt like a bomb went off in my brain. Pain was so severe. Eyeballs hurt. The clarity of my vision decreased. Couldn't read fine print like I usually can. Left side if my face went numb. Size of my fist of an additional throbbing pain around my eye socket. I got super super super cold. Started shivering and had goosebumps. I have an apple watch. My heart rate skyrocketed at the exact time I got hit. And continued to be high for 20-30 min. But the worst was immediately following the hit. When hit by LEDs I struggle to sleep at night. It's like my brain is sooooo tired and sore but it's wired. Electrified. I can't sleep no matter what I do. Yep this happened. Couldn't sleep well at all. Today I have a massive migraine. The whole left top side of my brain is beyond sore. Can't touch my scalp. My eyeballs are killing me. Left area around the eyeball is pulsing in like mini pulses. Quick but defined. I can't think. I can't come up with the right words. Im so tired. This is all because a led headlight reflected off a glass door.

A.126 September 25, 2024 — Anytown, VA — Other

In night time car headlights are blinding and the state does not allow you to tint windshield.

A.127 September 26, 2024 — Idledale, CO — Migraine

LED headlights have ruined my life by being the primary trigger of my migraine headaches. I never had migraines until these awful lights became common place. I can no longer drive at dawn, dusk, or night, and have frequently had migraines triggered by LED headlights during the daytime. I can't even stand the light from my own LED headlights and wish there was a way to replace them with halogen bulbs. Unfortunately my new car was pounded by hail shortly after purchasing it, or else I'd get rid of it in a heartbeat. When will these dangerous headlights be outlawed. As it is the auto industry and lack of action by Congress has forced me to stay home and limit my activities at night. I consider this discrimination.

A.128 September 27, 2024 — Bar Harbor, ME — Migraine

Have had migraines since youth, worsened by post-concussion syndrome in young adulthood. Construction vehicles, night driving, and even LEDs at pool facilities are intensely disruptive. Most recent example was a construction firm pickup with blinking yellow/white at 6am. Has seared my retinas for days and increased sensitivity to other lights. I already have to live with enough avoidance of crowded noisy places and entertainment venues due to strobes and music- LEDs make avoidance near impossible and driving potentially hazardous.

A.129 September 28, 2024 — Denver, CO — Other

This report is for many different incidents as I don't feel like submitting over 500 different incidences. It's a daily problem, every time I drive I am affected by these lights. There has been times I've almost driven off the road because I simply can't see the road from being blinded. It's absolutely absurd that this has not been regulated. I get migraines from these lights now, it produces extreme amounts of stress, it has made me dread night driving which I work a night job so I'm kind of stuck dealing with it. I've had pedestrians run out in front of my car and I almost killed them because I was being blinded. These are an extreme safety hazard and something MUST BE DONE.

A.130 September 30, 2024 — Westminster, CO — None

Sitting at an intersection with a car on the other side whose lights were so bright that the traffic lights could barley break through the "white out" effect from LED lights. Multiple people (myself included) flashed their lights at the driver in hopes they would turn them off but instead the driver made them brighter. Even if this person was not on the road with illegally modified headlights I come home every night with so many spots in my vision that I am almost blind and it seems to get worse with every repetition, I fear I might loose my eyesight.

October 2024

A.131 October 1, 2024 — Easton, MA — None

There are multiple times, almost nightly, that I would bet my paycheck that certain oncoming vehicles had their high beams on, and I would put on my high beams, only for them to flash their brights at me because I was wrong. I've been driving for almost 50 years and I have always preferred driving at night until the last 5 or 6 six years or so. It just seems as if EVERY oncoming vehicle have the high beams on. I try every trick in the book to not look directly at the lights, to focus on the right side line on the road and I've even purchased a few pairs of night driving glasses. The glasses reduce the glare a little bit, but doesn't help much. Most of the sunglasses I have work, but I can't see the road properly. After an oncoming car passes I have difficulty seeing, have spots etc, that last anywhere between 20 and 55 seconds where I have limited visuals on the road, instead of my usual 100% attention, while waiting for my eyes to adjust. Sometimes after I get to my destination, I realize I have a headache. My first car had two round, sealed beam headlights with incandescent lamps. Only one was functioning and that was plenty of light for me to see and drive. My current vehicle, a 2018 Silverado has more than enough light and projects for what seems like a half mile in front of me. I don't need to see that far down the road!. When I put the brights on, its crazy bright! I don't need all of that light. Things would be a little better if they eliminated to Auto-High-Beam function. Massachusetts drivers complained years ago of the brightness of the State Police emergency lights being too bright, practically blinding you as you were approaching the police cruiser. Eventually after a few collisions and unfortunately injured troopers, they changed the lights to be less intense. I get stressed out when I have to drive at night because of this easy-to-rectify problem with LED Lights being so bright, when they don't have to be.

A.132 October 1, 2024 — Elk Grove, CA — Autism

I attempted to enter a large box store that had installed collections of LED "white" tube lights in the ceiling. I glanced up at these LED lights and immediately felt eye pain. I turned and left the store, knowing that the situation would only get worse if I remained.

A.133 October 3, 2024 — Bethlehem, GA — None

I can no longer drive in what I feel to be a safe manner due to the piercing brightness of headlights. Over the last year they have become so sharp on the eyes that even in the various hours of the morning, dusk night and even overcast days I am forced to stare at the white line in the side of the road. Giant, oversized trucks with these horrid headlights are near perfectly at eye level often times leaving me stunned.

I've had my eyes checked to ensure they're is no damage to them or a condition being developed that's in need of correction. This is not the case as aside from a mild prescription I received a couple years ago, nothing has changed personally.

I've also made mention of the problem to friends and family and ALL agree that it's out of control. My mother refusing to drive at night as well at this point.

It's flat out dangerous to the public and out of control.

A.134 October 6, 2024 — Howell, MI — None

Nice to find out I am not alone regarding this topic Engineers at automotive companies are responsible for what I consider an environmental pollution nightmare. I never had any trouble driving at night until about the past 8 years or so when I noticed the blue LED lights being applied to more and more vehicles. At first, it was only a few vehicles so a bit of a nuisance, but manageable.

Now almost 80% of the vehicles on the road have these super bright blue spectrum LED emitters just blasting out light. I can literally feel the pain in my eyes when these vehicles approach. I started wearing my polarized sunglasses for driving all the time including nighttime. Does anyone know how those lights may be damaging our eyesight, especially at night when the pupil is dilated due to ambient darkness? Come on engineers, do your job! Ask the questions and demand the answers before you release products which can cause harm.

A.135 October 7, 2024 — Augusta, ME — Astigmatism

There are multiple times, every time that I am driving at night that certain oncoming vehicles had their high beams on, and I would put on my high beams, only for them to flash their brights at me because I was wrong. It seems to have gotten worse now that 1. I've been diagnosed with astigmatism, 2. I now live in a town that doesn't have street lights, and 3. I am driving more at night. It just seems as if EVERY oncoming vehicle have the high beams on. I try every trick in the book to not look directly at the lights, to focus on the right side line on the road and physically block out the lights with my hand. I am afraid my myself and the safety of others if I cannot see when I am driving, especially living in the state of Maine where moose are not easily seen in the dark.

A.136 October 11, 2024 — Brooklyn, NY — Other

Causes nervous system dysregulation which impacts motors skills & orientation, migraines, seizures, nausea, ability to digest food, vomiting

A.137 October 11, 2024 — Yolo County, CA — Autism

I was driving East on a County road in the day when a vehicle came towards me with intense, rapidly flashing amber LED lights. I felt panic rushing in and put my arms up to block the assault. Since I now couldn't see the road, I came to a full stop. Then somebody honked a horn. I moved my arms, and saw that the lead truck had passed, but a wide-load mobile home on a truck was inches from the left side of my car. These LED flashing lights are a menace and violation of our civil rights. My anxiety ran high for 30 minutes after the encounter.

A.138 October 12, 2024 — Esparto, CA — Autism

I was driving behind a vehicle when it suddenly pulled to the side of the road. Coming towards us was an ambulance with LED flashing lights. I felt like I was electrocuted and was going to go unconscious. I instantly closed my eyes and stopped my car. After a few seconds, a car behind me honked, and when I opened my eyes, the ambulance was already gone. Now I'm suffering the psychological after-effects.

A.139 October 18, 2024 — Portland, OR — Astigmatism

I thought I could get over it, because LED headlights are so unavoidable. I tried everything I could possibly do to cope. But lately it has evolved to suicidal thoughts, because I feel like I'll never be able to live a normal life again. I was thinking maybe I have autism, maybe I should get that checked out, but I feel ridiculous. Do I really go tell a therapist that LED headlights make me want to kill myself? Is that what I have to do?

A.140 October 20, 2024 — Harbor Springs, MI — None

I can't drive in the morning or at night because of these blinding headlights. This is crazy, worse than drunk drivers. What happened to the Auto Safety industry or safety regulations? I am either going to have to lose work/get fired because of this or literally drive blind and pray I don't die or kill someone else.

A.141 October 21, 2024 — Paoli, PA — Migraine

I have recently started to suffer from severe chronic migraines. As a result, I am photophobic almost all of the time. This makes LED lights not only painful and very uncomfortable when I drive at night, but also dangerous. Whenever a car with LED lights passes me at night, I am blinded for about three seconds. I have to pray that a deer or other animal will not run out in front of my car, especially now that it is deer rutting season and the deer are very active. This is all made so much worse by the fact that many people in my area have new cars, meaning ultra bright or powerful LED lights. I did not have a migraine earlier today, but I may develop one soon after driving tonight.

A.142 October 27, 2024 — Los Angeles, CA — Autism

My partner and I took turns driving from Sacramento to San Diego during the day. For the most part, the drive was without incident. At about 4pm, we were in the Los Angeles area.

First, we witnessed the result of a fatality crash, with about 6 emergency vehicles with red LED flashing lights. I was the passenger, and was forced to shield my eyes from the flashing LEDs. Then I was struck at close range by the blue LED lights on a highway patrol car further down the freeway, causing me pain and anxiety.

Around 5pm, the blue-rich LED headlights started appearing, causing me to have to look out the passenger window. Then the blue-rich LED streetlights started turning on, causing me to flinch with each exposure. Then there were blue-rich LED wall packs and floodlights on my right and left which increased my agitation at each exposure.

As the sun set, we exited on a ramp, and tiny yellow LED flashing lights on multiple curve signs struck me directly at close range. After dark, we were inundated with blue-rich LED headlights, blue-rich LED streetlights, blue-rich flood lights, LED business signs, parking lot lighting, and intense LED red taillights. A commercial truck had red LEDs wrapped around the entire back of the truck.

When we arrived at my my mother's house, a place I know well, I was hyper vigilant. Every light was now too bright. Every light was a danger. Everything was too bright. For the first time in my life, I was unable to greet my mother with enthusiasm. I was in shock.

My mother turned off all but one incandescent lamp, but when she asked me if she could turn on one more lamp, I broke down crying. I am now on edge. I am on hyper alert. Every light is an enemy.

November 2024

A.143 November 1, 2024 — Fresno, CA — None

The lights are so bright now, I hate driving at night to pick up my kids from activities. Now its dark earlier due to time change. It is terrifying. Seriously. Sometimes I just pray I make it. I have flashed before as a reminder the brights are for oncoming traffic. Numerous times they flash back and its even brighter! I get white spots in my eyes everyday. Im buying night vision glasses. Do ya′ll night drive at night or cant see from the back of your limo? What is going on?

A.144 November 7, 2024 — Vacaville, CA — Autism

I was in the city just after sunset and all the blue LED car headlights and blue LED streetlights started appearing. I started to go into a panic. It felt like it was an emergency, so I reached into the center console of my car and found some orange tinted clip on glasses. I put these on over my glasses, and the panic immediately stopped. All of the blue-rich LED lights were still far too intense, but the feeling of life-or-death panic was completely removed by putting on the orange-tinted glasses which filtered out the blue wavelength light.

A.145 November 8, 2024 — Sandpoint, ID — Other

Since LED lights have come out on cars (and especially pickup trucks) I have been unable to drive in the dark. The lights create a halo that fills my entire vision field, making it dangerous to me and others. I cannot see even the side of the road..... Even after cataract surgery. This has caused me to curtail all evening activities. I am retired & live in the country so this is very isolating and causes depression.

A.146 November 9, 2024 — Point-a-Pitre, Guadeloupe — None

(this is an automatic translation from a non-American language)

Unfiltered LED lights that emit excessive brightness levels and overly white color temperatures, which are harsh on the eyes, have completely disrupted my daily life and degraded my quality of life.

Their widespread and forced implementation for energy efficiency reasons, without any consultation with the general public despite warnings from scientists and health organizations, resembles a dictatorship: "the LED dictatorship."

Nighttime and daytime car lights, public and private lighting, stores, offices, business premises, public transportation, electronic devices, vending machines, etc., LEDs are everywhere and in excess. This overabundance now prevents me from living normally.

Manufacturers and installers have done whatever they want: everything seems designed so that current lighting is more about assaulting our eyes rather than providing proper and subdued illumination.

It is a dictatorship leading us to a dystopian environment for a portion of the population that suffers: "the LED dystopia."

Because of LED lighting and its daily impacts on our eyes:

I have to change my personal and professional habits; I have to flee at night and give up any outings or activities; I can no longer drive at night and stress about being assaulted wherever I need to go; I have lost the freedom to move as I wish; I am becoming socially isolated; I am losing the health of my eyes and fear losing my sight!

Furthermore, I can no longer tolerate seeing and enduring these "light signatures" from cars that cause retinal persistence phenomena or light trails, dangerously obscuring vision.

LEDs have created a real phobia in me: "LED phobia."

LEDs are a nightmare and a missed opportunity to reduce our impact on health and the environment at a time when it is impossible to gaze at the starry sky and biodiversity is collapsing.

A.147 November 11, 2024 — Waterbury, CT — Astigmatism

I am 25 years old and no longer drive after dark. In New England winters, this means 5pm. I drive a compact SUV and am 5′3. Most to all headlights on the road are blinding, and that is from both directions. In suburban and rural areas, the headlights feels exacerbated in strength with often nothing to contrast them. Lift kits aside, SUVs/pick up trucks seem to be eating their veggies and growing in size; their headlights are without a doubt, at my direct head height. There are highways and interstates I have to avoid because the headlights coming from the route opposite direction are too bright. Some headlights even cause reflective mile markers to flare into a ball of light. Too-Bright headlights coming from behind essentially flash bang my rear view and side views. I have driven through construction zones, 3 lanes to 1, at 10mph and been blinded by the work lights, the vehicle lights, even by parked cruisers using rear flashers.

I have never had driving induced anxiety; I have lived across states for college and been a confident driver always. Now a days I am nervously slowed to the right lane when cars are behind me, or hogging the passing lane out of keeping lights out of the driver-side side mirror. I have always had slight astigmatism, and always had corrective contact lens to support that. This year I had to seek out an optometrist because I thought the astigmatism must have worsened. Its actually improved! Both glasses and contacts are still corrected for them. No improvement for driving.

I feel like I really am going crazy over this! I have limited my night driving to short trips/around town. On occasion I have agreed to longer drives, and regretted each time. Its frightening. Its saddening. Its unfair. I hear people say, "people kept high beaming me, I had no idea mine were so bright!". I guess they cancel each other out. I am not faulting the individuals, the newer cars are just, like that. I am not as empathetic for after market installations. But how am I tell the difference?

I am weakened by it all. It seems silly, but its not. My heart pours for older adults who's independence and autonomy are already vulnerable. For pedestrians, who should have the option, ability, and safeguard to walk. For children who ride bikes. I hope to see change, and am happy to know others do too.

A.148 November 13, 2024 — Boynton Beach, FL — Epilepsy

My 3 seizures occurs in grocery stores- Publix and Aldi within a 1 year. I notice, that aura is comes as soon as I walk in the store. I never go there without my good sunglasses (Oakley's works the best so far) on. I change all LED light bulbs in my house to old style light bulbs and fill great. Never had an episode at home since. I drive at night with my sunglasses on, because cars light triggers my seizures as well. LED is epileptics enemy! I have few friends with epilepsy, who experience the same reactions from exposure to LED lights.

A.149 November 13, 2024 — Charlotte, NC — Astigmatism

I am writing to express a safety concern regarding the LED headlights on newer vehicles in the Charlotte area, particularly at night. I have found that the bright LED lights from oncoming traffic are significantly blinding and make it difficult for me to see the road clearly. This has become especially problematic for me now that I'm driving after dark, as I get off work when it's already dark outside.

On multiple occasions, I have almost been involved in accidents because I am unable to properly see the road or other vehicles due to the intensity of the headlights. The glare from these lights severely impairs my vision, and I am now feeling anxious and scared to drive at night because of this issue.

I wanted to bring this to your attention, as it is becoming a significant safety concern for me and I believe it may be impacting others in the community as well.

Something seriously has to be done with these vehicles with that style of lights. SOON!

A.150 November 13, 2024 — Houston, TX — Astigmatism

I am 39. I have been struggling with these high color temp LEDs for several years. This winter seems much much worse. I wear blue light glasses to reduce the effects as much as possible. But these high color temp lights are everywhere now. Headlights. Wallpacks. Street lights. Sports fields. I can barely leave the house at night any more and feel unsafe driving at night. I have never struggled with night driving until these lights. The light exposure creates a piercing experience in my eyes. Then I get agitated wanting to smash every bright light around me. Some days I can get used to the lights in the city if there isn't much contrast between dark and light. But most nights the city is rough as these headlights are now 6000-7000K color temp. Rural driving is painful, especially with the Texas piercing frontage road system where these gas stations and businesses have just hung 7000K color temp wall packs on their exterior walls or canopies. These can be blinding for a half mile. This is no way to live, especially when lower color temp LEDs can provide the same lumens and equal energy efficient results. I know I'm not the only one. And as a taxpayer I would appreciate if Congress would take action on a national simple priority such as this vs devoting their attention to way more complex and controversial affairs. This fix is simple. We used to get pulled over for driving with your high beams on when passing a car.

Please help. We only get one pair of eyes and I hate to permanently damage them or have an accident because we were too foolish to not deploy common sense regarding outdoor lighting color temp and its affect on humans (and plants and animals and light pollution)

A.151 November 14, 2024 — Brookville, PA — Migraine

On November 11, I visited an eye clinic for new glasses, only to find that LED lighting posed a significant obstacle. The clinic had no alternative lighting, so I had to bring my own lamp to examine the frames. Briefly removing my protective goggles to look at the glasses on the display triggered a migraine so severe that I ended up vomiting later and lost another four days to recovery.

The vision exam itself was even more problematic, as the clinic relied entirely on an LED screen for testing. Since I couldn't look at the screen without risking a migraine, they couldn't fully evaluate my prescription. We attempted to use a painting in the hallway as a substitute to check my sight, but the process left my eyes strained, and I struggled to discern any improvement between lenses. According to the clinician, the LED screen is their only testing method, leaving me in a position where getting a prescription update would mean knowingly inducing another severe migraine.

A.152 November 14, 2024 — Mangonui, New Zealand — Migraine

Swimming in a remote lake, 200m from road access, when a car pulled up flashing the red LED tail lights. I felt immediately nauseated and blacked out with brief loss of consciousness for a few seconds. I came quickly to and swam with difficulty back to the shore having developed blurred vision, pain at the occiput, numb left side of face and left arm (hemiplegic migraine)

A.153 November 14, 2024 — Shippenville, PA — Migraine

On Halloween night, despite every precaution I took, I suffered a seizure caused by exposure to blue LED headlights. I've managed to avoid seizures since early spring by being vigilant, especially on Halloween, a night known for overwhelming lights and harsh visuals from costumes and

decorations. I kept all the blinds closed, avoided the front of the house, and even have a canopy tent hanging on my front porch to provide added protection against stray lights.

Unfortunately, someone pulled into my driveway to turn around, and their headlights penetrated both the canopy and my opaque front door, reaching me in the back part of the house. The seizure was immediate and intense, with visual disturbances, uncontrollable shaking, severe pain, and confusion. The following day, I could barely function, enduring cognitive impairment and an excruciating migraine that lasted four days. Despite medication, I suffered through pain-filled dreams and could find no relief. This incident cost me two days of time with my family and two days of work, all because of a brief exposure to LED headlights.

A.154 November 17, 2024 — Bennington, VT — Astigmatism

I have a larger than normal optic nerve in both eyes. I can't really drive at night anymore with the brightness of headlights. Also, any type of LED lights are very hard on my eyes sometimes giving me migraine headaches.

A.155 November 18, 2024 — Lompoc, CA — Astigmatism

I have to turn all my mirrors away to just drive home from school in the evenings. I drive home on Highway 1 and sometimes the LED lights behind me are so blindingly bright I have to pull my car over because I cannot see while I'm driving if there is car behind me with LED headlights. This wasn't an issue for me in the 90's when car headlights were halogen. Please go back to halogen headlights are do something to fix the reflective glare and brightness. Bright LED headlights are dangerous and people are getting into car accidents and will lose their lives.

A.156 November 18, 2024 — Rochester, NY — Other

"Description of LED Incident or Impacts of LEDs on Your Life" ...YES EVERY DAY IS AN INDECENT! I risking loosing my job and my life. Its dangerous...period!

Vehicle, House indoor/outdoor, commercial, street lights et al. Way over the top! Even behind a vehicle the directional and tail lights hurt. I hated these LEDs when I first saw them 20 years ago. Incandescents are now outlawed...thanks big brother...stellar idea.

When is enough enough? Apparently someone must die before anything is changed. Hope it isn't me. This is getting 110% crazy out of control, compounded by this stupid daylight saving time clock changing BS we were supposed to fix years ago. I don't get out of work until 5. Its dark! Then I have to run the gauntlet of deer and on coming traffic melting my skull off my neck with these insane projector headlights. They gotta go and go now.

Night driving is like looking into the sun, it hurts! I've had to ask HR if I can come in early and leave early. They said I need a note from a doctor....gah! I attach a manila folder to my drivers side visor with a big binder clip so I can hide behind it when oncoming traffic approaches. Tell me, how safe is that!

All its going to take is someone making a left in front of me or a deer coming from left to right and pow I'm done! If LEDs were on the red spectrum verses the blue I believe this problem would be much less severe.

OK so I complained. Now whats the next step to actually making the DOT listen and for someone to take action with the auto industry. What can we all do? I signed the petition and had everyone around me do the same. HELP!

A.157 November 19, 2024 — Chicago, IL — None

LED headlights are blinding and I almost crashed because I could not see after driving and having LED headlights directly shining in eyes. It directly impeded my visibility. I cannot drive long distances in the dark because of the strain LED headlights cause on my eyes. I will go home after a 2-hour commute and my eyes will continue to hurt and I believe it is the cause of my headaches.

A.158 November 19, 2024 — Ketchikan, AK — Other

LEDS lights have literally shrunk my world in my ability to find safe places indoors and outdoors In FEB of 2021 the city of Ketchikan altered the city street lights to high intensity 4 to 5000 Kelvin LED lights without shielding or recessed that flooded all sides of my home that has led to a severe drop in

my health. Before that time, I had light sensitivity and now from the LED lights I have phototoxicity which caused my NEW disability They have damaged my CNS, altered and disrupted my cognitive abilities, disrupted my hormones, and have left me in chronic pain

When the lights came on that month, I could feel them instantly. It was like a electrical shock to my system. Since than I no longer get restorative sleep in my home, these lights have impacted my motor neuron part of the brain as well as pituitary, amygdala, hypothalamus, pineal, Insolent, and parietal and vision. They increase my allergy reactions to foods that I had mild reactions to before Leds I wake up to increased blood pressure, (I don't have high blood pressure). Before LED light my fibromyalgia was at a level 2 of pain and now fluctuates between an 8 and 10 on pain scale. This is from chronic exposure to my streetlights. All confirmed by 8 doctors. All these issues within a day to a few weeks are lessoned by 80to 90% when I go to a dark area without LEDS. Some are completely gone.

ACUTE symptoms when exposed to high intensity LED lights especially the flickering. Loss of sight in right eye Floaters, eye pain Extreme sharp pain from front of right eye to back of brain that can last up to 72 hrs (imagine a sharp knife going through your eye to back of brain) Nausea, and throwing up PANIC ATTACKS!!! tremors migraine Spike in blood pressure Immediate herpes outbreak (within hours of extreme exposures} incontinence drooling Severe scalp migraines Blistering of skin and oozing.

What's heart breaking is the fact the lighting industry ignored all the science and medical warnings about LED's especially from 2016 American Medical Assoc warning that they will make people sick. Over 20,000 peer reviewed research on the damming effects of LEDs WHEN WILL YOU LISTEN AND ACT?? Not acting is negligent

LED lights kill and injure and should have never been released to the public

A.159 November 20, 2024 — Marienville, PA — Migraine

When leaving my office, I often encounter an overwhelming amount of LED lights, both indoors and outdoors. On one particular day, the reflection of the sharp, laser-like beams of LED lights from a puddle nearly triggered a seizure. Fortunately, I only suffered a four-day migraine as a result.

The parking lot is especially problematic. The LED lights there create an environment that feels almost hostile both from cars and parking lot street lights. Every time a vehicle starts, its LED beams cut sharply through the area, creating an overwhelming and disorienting experience. It feels less like lighting and more like a physical assault.

On this day, as I navigated the parking lot, I inadvertently came too close to a vehicle that had been electronically started. A brief glimpse of its LED fog light—despite it not being directed at me—triggered severe symptoms, even though I was wearing IR5 welding goggles and red glasses designed to block all blue wavelengths. This intense combination of protection stops the seizures. It does not stop the migraines. The impact was immediate and profound. My face went numb, my eyes involuntarily blinked, and I experienced a deep, penetrating cold, a symptom often associated with migraines. The migraine that followed was particularly intense, accompanied by significant cognitive impairment. Even after resting and sleeping, my brain felt noticeably affected the next day.

(This is part of my report)

When will this madness stop? I just want to live my life without the constant assault of LEDs. I'm tired of enduring their relentless impact on my health and well-being. I just want to live my life safely!

A.160 November 21, 2024 — San Jose, CA — Astigmatism

LED light are always on when it's not appropriate. I drive a small car so there in my direction vision I have to slow down to avoid causing an accident.

A.161 November 22, 2024 — Oakdale, MN — None

Spun out on a snowy day because I could not see lane dividers due to an incoming car's lights. This car was in a highway lane separated from the other lane of traffic by ~100ft and was really not even close to me. I could not see how far the car in front of me was due to the lights of the incoming car and the blinding headlights of the truck tailgating me, so I braked and overcorrected because I could not

even see the lane dividers. Spun out into a ditch. If I were a worse driver or driving distracted I could have easily hit another car and injured someone.

A.162 November 22, 2024 — Springfield, MO — Migraine

After a TBI years ago, I am now a migraine sufferer. I cannot look at the flashing or strobe lights without instant pain. It has been so hard to safely pass by emergency vehicles as flashing and LEDs both blind and cause instant splitting pain. Trying to get by a wreck or incident is really really tough while you are trying go around and not hit people or cars in the road. I have literally stopped my car in the middle of the road at night, even on a curve, multiple times because I was so blind I could not see the road, the other vehicle - nothing! It's as if someone suddenly blindfolded me while driving. How are people navigating this terrible issue? Tonight was a little darker than usual, without a moon, and I was struggling to repeatedly get blinded/see on a long 2-lane rural road. Going over a curvy set of river bridges with rails was terrifying, leaving me blinded for a moment trying to navigate curves. Halfway through the 7-mile trip, the repeated brightness moved to migraine, nausea, and fear I was going to wreck. I was literally wondering what my future holds if I can't drive to see my kids, or even get home from work safely after dark because of these lights. It feels like no one cares - even insurance companies. They HAVE to know; they drive too! Even LED Christmas lights are too much when flashing. We also been blinded by directly placed LED garage lights on houses recently. It's like a direct police spotlight at a T-intersection. I can't see if anyone is coming to the left, due to one homeowners LED beacon staying trained right in my eyes. Tonight, I also made a right turn at a 4-way stop. Because of being blinded mid-turn, I couldn't tell how close the car waiting to turn was in front of me as I rounded to the next road. Not only did I fear hitting the other car right in the door I heard a sickening crunch as my back tire fell off the road edge and hit much further than the wheel rim.

A.163 November 22, 2024 — Washington, PA — None

LED headlights are absolutely destroying the ability for average people in average cars (SOME with major health issues that are now jeopardizing the safety of the person/s) to drive...no matter day or night because the light travels just as strongly when the sun is out. It's forcing people to take action on their own, some using spotlights against the blinding LED's...others using 3M reflective tape on visors and backseat headrests to shine it back in the eyes of the owner. We should not have to do these things. Furthermore, I've noticed an increase in incidents where they keep THEIR highbeams on with total disregard for others while they scroll on their phones or distract themselves in other ways. There is way too much entitlement and a total misunderstanding that these people have when it comes to blinding others. Something needs to be done before every vehicle on the road is equipped with these blinding lights and then we ALL develop vision issues and perhaps even other yet-unknown issues dealing with these lights. I appreciate you taking the time to read my 'rant' but the words stand true with SO many people.

A.164 November 23, 2024 — Camby, IN — None

They've annoyed me greatly the last couple years but this one has been the absolute worst and not getting better. I was driving home at dusk a few days back and was blinded by an oncoming car. As soon as I could see something again, there was a jogger right in front of me. Had to swerve last minute to avoid hitting him.

People are/will be hurt or killed because of these stupidly blinding lights. I can't believe the stock lights are coming out this way. Had both a police car and School Bus blinding me yesterday. Sad & Ridiculous. I feel the day coming that I have to refuse driving at night.

A.165 November 23, 2024 — Hermosa Beach, CA — Electromagnetic Sensitivity

It is painful and dangerous to drive at night anymore due to the extreme brightness and glare caused by oncoming and rearview LED headlights. I have to use one of my hands to physically shield my eyes or use the sunvisor to try to decrease the intensity of the light shining into my eyes. If I use or have exposure to LED lightbulbs at night, I experience headaches and cortisol spikes with delayed or interrupted sleep throughout the rest of the night if I can't reduce the intensity myself (if I am out in a restaurant for instance.) It is clear that there is a problem with the intensity and quality of light we are surrounded with in our modern lives. I hope to see a shift back to light that is more aligned with natural levels and frequencies.

A.166 November 23, 2024 — London, ON, Canada — Migraine

With the increased use of LEDs in many lighting scenarios, it is making it impossible for me to exist in the world. Both fluorescent lights and LEDs cause migraines for me. A mere exposure to these lights for 5 minutes can take me down physically for at least 24 to 36 hours. While it is always a challenge visiting establishments, and lighting my home, those are things I can somewhat moderate. I buy different lights, I just don't go into stores that make me sick. What I cannot avoid, and cannot mitigate, are the increased use of LED in the headlights of vehicles on the road. I can appreciate people wanting to have bright lights for scenarios where the increased brightness will increase safety, but that's why we have high beams on our vehicles. If you're on a country road at night, you turn your high beams on, and then when another vehicle approaches from the opposite direction, you turn your high beams off until you pass each other. You would not constantly leave your high beams on while driving in a city, that is lit with street lights. These excruciatingly bright LED headlights are making it impossible for me to have any independence after the sun goes down, as it is not safe for me physically when driving. Surely the selfish "right" to have the brightest headlights out there just in case you're in a very dark area is a lesser right than what is owed to the general population, let alone those with health issues, to have the right to be safe while driving. Please, please, before someone gets seriously hurt, regulate the type of lighting that can be used in vehicle headlights.

A.167 November 23, 2024 — Sacramento, CA — Autism

I was driving in town when I was struck by a debilitating blue LED flashing light in a store window. I have previously notified the owner of this store twice that I cannot neurologically tolerate the intensity and digital pulsing of this light, but they haven't acted to turn it off.

A.168 November 23, 2024 — San Antonio, TX — Astigmatism

I have to obstruct my own vision to block such ridiculously bright headlights, this is dangerous. I am left with dark spots in my field of vision, much like after staring directly at the sun. How is this legal?

A.169 November 23, 2024 — Yolo County, CA — Autism

I was driving on the highway when a firetruck with red and white LED strobe lights approached me. I could see it about half a mile away. I started to panic, knowing that I wouldn't be able tolerate it as it came closer. I pulled into a parking lot and waited for the firetruck to turn onto another street.

A.170 November 23, 2024 — Zimmerman, MN — Astigmatism

I can't see with the headlights. I'm tempted to put mirrors on my car.

A.171 November 24, 2024 — Bennington, VT — Epilepsy

I was taken to the ER for a medical emergency unrelated to my epilepsy. I've been to this hospital many times over the years to see specialists get health screenings, visit friends etc. My doctor had called ahead to the hospital, telling them about my LED-reactive seizures and how critically important it is that I not be exposed to LED light even momentarily. She told us the head ER nurse assured her the ER staff understood and would treat me in an LED-free setting. My doctor told my husband to remind whoever first met us at the ER when we arrived, just for reinforcement. We got there, he did, the attendant said yes she'd got the message, I was put in a wheelchair and raced inside - right into the LED-lit emergency room. I had on a hat and glasses but I instantly started to shake all over. My husband grabbed the wheelchair and got me out of there fast, leading to a fraught ordeal, trying to figure out how I could be treated for the medical emergency that had sent me to the hospital, without putting me at risk of potentially fatal epileptic seizures caused by the hospital's new LED lighting! Ultimately they managed to set up a treatment area in a back hallway near the ambulance bay, which had large windows and overhead lights which could be turned off. My husband had to push me in the wheelchair around the outside of the building and up a restricted driveway to reach it. If I hadn't been so sick, i would have been terrified that an ambulance would pull up with its flashers going. Thankfully all went pretty well from then on and I was released just in time to get home before the LED streetlamps came on. When I recovered, I called the hospital to discuss the need for a section of the ER and other parts of the hospital complex to be LED-free, clearly labeled, so that anyone with an LED-reactive medical condition can be safely, promptly seen and treated. I asked them to think of it as a disability aid, exactly like the need to have ramps and braille, to consider safe lighting a medical necessity, like being vigilant about dietary restrictions for their patients. The staff member

said they would pass on my request and get back to me in two weeks. Two months later, this is what I was told: The hospital had recently remodeled with all LED lighting and wasn't going to remove or alter any of it. If I have to go there again, for emergency treatment or anything else, my options are 1) call ahead and tell them I can't tolerate LED light 2) Be admitted under the LEDs and when I start convulsing they will give me lorazapam and put me on a lamotrigine drip for the duration of my stay or - if I'm not happy with either of those options - 3) go somewhere else. (Thoughts on those options: 1) My doctor did call first. Luck and scrambling got us through that ER visit, not planning and proper care, plus calling ahead obviously isn't always possible. 2) Do they know I can even take those drugs? Might being drugged interfere with whatever other procedure I went there to have? Will I be able to communicate with anybody? Give consent? And how do I leave the hospital if I have to pass under the LEDs after the lamotrigine drip is removed? 3) We live in a rural area. The next closest hospital is over twice as far away.) Quite the striking situation, isn't it? We're menaced with increasingly frequent medical emergencies, injury, and illness, caused by forced public encounters with demonstrably dangerous LED lights, and we need medical care, health protection and practical real-life solutions more than ever, but safety vehicles and hospital facilities are becoming yet another source of the threat!

A.172 November 24, 2024 — Esparto, CA — Autism

I turned right at a T-intersection and was immediately struck by amber LED strobe lights on an AT&T utility truck. I yelled out profanity, raised my arms to try and block the strobes, closed my eyes, and felt a sudden urge to drive my car straight into the AT&T truck. Instead, I pulled over to the side of the road until I recovered.

A.173 November 24, 2024 — Hickory, NC — None

Can no longer drive at night due to extremely bright LED headlights blinding me. I have no health issues that would cause sensitivity to bright light

A.174 November 25, 2024 — Manassas, VA — Photophobia

This incident occurred at night on November 24, 2024. I wanted to go see a friend who is moving out of town, who lives about about 45 minutes away and most of that is on the highway. I usually avoid driving at night, especially on the highway, but felt it was worth the discomfort to see my friend. The whole way there, donning sunglasses and squinting my eyes, was an uncomfortable experience to say the least, I'm in a low-riding sedan. But the worst part was, after driving 40 minutes I missed a turn, and ended up back on the highway. Then, I missed another turn, ending up on another highway. What a nightmare. I did not ever arrive at his house, because my missed turns took me 25 minutes off-route. I pulled over and cried, then drove home. It was the worst experience I've had with night driving to date.

A.175 November 25, 2024 — Vacaville, CA — Autism

I was driving East on E. Monte Vista Ave. when I struck by the LED flashing lights on an RRFB. Instead of the RRFB making me stop, I start yelling fuck, fuck, fuck, fuck, fuck, fuck as I tilted my head down and drove straight through to escape the LED assault and save my life.

A.176 November 26, 2024 — Montclair, CA — None

It’s blinding me. The cars lights are so bright I have to stop in the middle of the road because I’m blinded by these trucks and teslas with LEDS

A.177 November 26, 2024 — Van Alstyne, TX — Other

I get constant floaters in my vision that last up to an hour. These new LED lights are an extreme hazard to safety. There is no benefit to blinding traffic. It isn't safe for any party involved.

A.178 November 27, 2024 — Lancaster, ON, Canada — Electromagnetic Sensitivity

Screeching tinnitus, organ pain(liver, pancreas and kidneys), needles in the eye pain, extreme pain in bones, cranium, burning of the skin, migraines, worsening astigmatisms, extreme photosensitivity,

A.179 November 27, 2024 — Stratford, ON, Canada — Autism

I'm autistic and have migraines, playing hockey requires a lot of night driving home as well as driving home from my partners place. Due to how bright lights are now, they spike my sensory issues and migraines causing me to lose focus on the road. This was never an issue until the last few years with the spike of LEDs, the yellow tints were so much easier to deal with over the new blue. Even walking at night with my dog, the lights cause no one to be able to see my boy and I even when we are on sidewalks etc. it's awful having to dull down my own life and avoid things after dark just because everyone has sonic beams! It's dangerous as hell for everyone, why is this even a thing!?

A.180 November 28, 2024 — Eatonton, GA — None

Driving on a county 2 lane road I was approached by a late model "tall" pickup truck...that had very bright lights blinding me. I slowed down to 35 mph as I went by this truck. My eyesight definitely got the "halo effect"...a deer was standing dead ahead in my lane just as I got past the truck. Didn't have any chance of avoiding the deer. Front bumper got crunched inward...front grill destroyed...and the AC condensor coil ruined. Damage estimated at $2,400. I could not afford full insurance coverage as my vehicle is 20 years old. (My car looked and ran very good). Too many people just don't dim headlights for courtesy sake anymore.

A.181 November 29, 2024 — Middle Village, NY — None

Every time I get in my car, I am blinded by car/truck LED lights. So dangerous...literally can't see. Why is this allowed? Who is responsible?

A.182 November 29, 2024 — Monmouth, OR — None

The presence of LED lights from oncoming traffic vehicles causes temporary blindness which is unsafe for drivers on the opposite lane. If nothing is done, there will be more frequent traffic accidents and potential deaths on the road.

A.183 November 30, 2024 — Brighton and Hove, United Kingdom — (no category given)

My life is pretty much destroyed by LED's.

If I look at a bright bulb for even a few seconds it triggers brutal migraines & vomiting for up to 3 days in bed with unbearable pain. The longer I'm exposed the worse it is.

Tried all the fl-41 glasses. Forget driving as all the newer cars have the 'led daylight running lamps' by default. It's an effing nightmare.

A.184 November 30, 2024 — Fontana, CA — Electromagnetic Sensitivity

The new LED headlights are so bright and blinding that I have to look at the fog line to watch the road and keep straight so I can't even see straight forward or the whole road, I have to constantly keep my eyes focused on the right side of the road not to have the light directly in my face/eyes. The LED lights are pointing towards the oncoming traffic and it seems like it's almost on purpose. The light off the cars are not even on both sides, they are tilted more towards the left and directly on to the oncoming traffic lanes. You can see the lines that come off the car on the road and it's obvious they don't have there lights facing straight. I get migraines from the bright glare at night it has just made driving at night tremendously uncomfortable and dangerous. At least regulate or enforce the direction of the light or something cause On the highway or freeway it's even worse as I have hundreds of cars with a bright blinding light facing my driving direction and it seems blinding other drivers to me should be illegal because it feels like it isn't and no one does anything about it.

A.185 November 30, 2024 — Orlando, FL — Migraine

I can no longer drive outside at night due to ongoing issues with bright headlights. This is especially problematic during the fall and winter as the sun sets much earlier.

December 2024

A.186 December 1, 2024 — Bowie, MD — Astigmatism

I have astigmatism. LEDs in cars have made it difficult for me to drive at night. I almost can never go anywhere during the week from how early it becomes dark. I have been fearful of accidents ever since a close call. It's just impossible to see for a time if they are coming towards me.

A.187 December 1, 2024 — Cranston, RI — Other

I am 39 with no known vision issues but I keep being blinded by LED headlights in front and behind me. It makes it really hard to see and drive safely at night. LEDs commonly used in new cars are way too bright. I had to pull in my left side mirror and this makes me scared to drive at night.

A.188 December 1, 2024 — Greenbrae, CA — Other

The County I live in took away the shrubs in the median and now all I see are in coming bright headlights. I get a headache when I drive at nighy and makes me feel stuck at home at night. I get an immediate headache and feel like I'm going to crash my car. They also installed rows and rows of LED overhead lights and they flood into my backyard and shine brightly into my bedroom and living room. Marin County did this and someone needs someone to do something about correcting this for the sake of our health. Thank you.

A.189 December 1, 2024 — Greenbrae, CA — Migraine

The County of Marin installed massive LED lights along a road directly behind our house. There was no community input, decisions made by Supervisors claiming they were needed for "safety". There has been zero incidents warranting any need for LED lights. Over head LED lights now shine into our home disturbing our sleep And giving us migraines at night. On the road, the lights are so bright it might as well be a racetrack now. The County took out the center median that had various shrubs (now no longer) - so now on coming cars, both east and west bound (along Sir Francis Drake Blvd) shine directly in our face as we drive home every night. The issue is overhead LED and car headlight LEDs. No thought was given by Marin County when installing said lights, and now created a real safety issue! Shame on Marin County, CA.

A.190 December 3, 2024 — Chattanooga, TN — None

I do not have any health or vision problems. I am a perfectly healthy mid 20 year old, and have always had a passion for night driving.

I never really noticed major issues with night driving up until recently… the past few years. I've always noticed people with super bright blue-white headlights… typically just squinted and moved on.

Unfortunately, the majority of the cars on the road have these headlights. I was returning from Thanksgiving with my family and had a 7 hour drive home. There are no north/south interstates in this area, so a lot of my driving is on 2 lane and 4 lane state roads and US highways. I was on a very narrow and typically low traffic 2 lane in southwest GA heading back north. For the first time I had to slow down to about 20 miles per hour because I was completely blinded. I could not see the center line. I could not see the edge of the road. For about 20 seconds all I could see what white light.

This is not an eye problem. I had my eyes examined a few months ago. This is not a specific to me issue either, as I have no ailments and am in good health. This happened to your normal young American driving home from the holidays, and hoping to get home safely without being flash banged off the road.

I know SUV's and trucks are the most popular vehicles now, but I have always driven coupes, and lots of people drive those and sedans as well. We are not the minority. Please look into regulating these headlights. These are not "improperly aligned" these are straight from the factory and they seem to get worse every year.

A.191 December 3, 2024 — North Olmstead, OH — Astigmatism

They are blinding and they cause me anxiety while driving. I have to stop or turn down side roads to escape them.

A.192 December 3, 2024 — Salem, OR — Migraine

I get ocular migraines, and the most reliable way to trigger them is to get blasted in the eyes with some kind of bright light. It usually sets in within 10-15 minutes, and then my vision is just ruined for the next hour. I can't drive at night because I'm at risk of being temporarily blinded. I don't want to have to pull over and sit at the side of the road for an hour, waiting for the aura to pass. When I'm in cars at night, I try not to look out the window. These blinding LED lights are a nightmare, and they don't even illuminate the road as thoroughly as the softer incandescent bulbs of my childhood. I've spent a lot of time in cars. I remember what things looked like. LED headlights are just plain inferior and dangerous, and they need to be banned.

A.193 December 4, 2024 — Houston, TX — Astigmatism

It worries me when I am temporarily blinded by the unnecessary bright lights when I am driving. I instantly flinch to try to shield me from the harmful lights.

A.194 December 4, 2024 — Monroe, WA — Migraine

LED lights have only negatively impacted my life. I can no longer see when driving, especially the last few years. I have to close my eyes when driving for long periods of time, multiple times, because I cannot see with people's LED lights. I can't tell if people are using their brights or just have LED lights. I can't see if there is a pedestrian. I can't see turns. I almost crashed tonight because I didn't see a turn due to someone's LED lights in my eyes. I see spots in my eyes for my entire drive after seeing any and trying to keep my eyes open. I get migraines. I might have undiagosed autism as well, either way, I am extremely sensitive to light. I am scared I might die driving because of LED lights one day.

A.195 December 4, 2024 — Morganville, NJ — None

WHEN DRIVING ON SINGLE-LANE ROADS IS ALMOST IMPOSSIBLE AS THE AUTO HEADLIGHTS ARE SO BRIGHT IT MAKES IT IMPOSSIBLE TO SEE THE ROAD. DIVIDED HIGHWAYS ARE NOT AS BAD. I USED TO ENJOY DRIVING BUT NOW IT IS IMPOSSIBLE UNFORTUNATELY, I STILL HAVE TO DRIVE. I TRIED SPECIAL GLASSES TO REDUCE GLARE BUT THEY DO NOT WORK. PLEASE DO SOMETHING ABOUT THIS BAD SITUATION AS I KNOW I'M NOT THE ONLY ONE HAVING THIS PROBLEM.

A.196 December 5, 2024 — Willows, CA — Astigmatism

Can't drive at night anymore. Bought special driving glasses to reduce glare and they help a little, but after a few minutes driving against the oncoming superbright led headlights, I'm not seeing anything very well. Driving at night was never an issue before someone decided that putting these dangerous lights on vehicles was somehow a good idea.

A.197 December 6, 2024 — Unspecified, FL — None

I was almost forced off the road due to the blinding lights of an upcoming car. I could NOT see a single thing. I was not alone in the car and was with my son. We thought my tires were lost on the right side due to the sudden movement. What a horrible experience, to drive under these conditions. There was no reason to change from the soft yellow lights.

A.198 December 7, 2024 — Murfreesboro, TN — Migraine

I get migraine headaches very easily. I avoid driving at night as much as I can because of these horrible, bright LED lights! They are absurd and horrible. However, sometimes I have to. I have issues with being super light sensitive and they flat out blind me, followed often with a migraine! I've grown to HATE driving at night and even more so, hatred for all of these vehicles with these lights. It's extremely RUDE to own one of these vehicles! Once again, as I drive a sedan, a truck tailed me, BLINDING me safely driving on the interstate home from seeing my family for Thanksgiving! How can these lights be legal? They're dangerous!! I refuse to own a vehicle with these horrific lights! Please stop this dangerous condition to not be able to drive safe!

A.199 December 8, 2024 — Colorado Springs, CO — Other

My sensitivity to LED became worse after a TBI. I wear sunglasses indoors because I work in a Flourescent and LED hell in the evening and I wear sunglasses to drive home. It is the only way for

me to stop myself from horrendous kaleidoscope vision as a person with synesthesia and tetrachromatic vision with post concussion photophobia. Light pollution is killing us and it is worse at night and contributing to severe migraines. Light pollution is literally making some people dopamine addicts but what about those with dopamine autoantibodies? We cannot have a strong nation of healthy people if we have been made stupid and intentionally addicted or severely ill by light. Street lights and lights used at night near businesses are at times bright enough to lead a bird to its death.

Have you seen the Tesla bulbs that are similar to incandescent-the reformulation? We need to bring back incandescent light bulbs.

I have tetrachromatic vision and this intense monochromatic light is causing me to have sensory overload. My tetrachromia causes me to see colors within colors- it is not a disability but a different ability. To me one strand of a persons hair is a rainbow. Ink from a pen is not just black. It only began to impact me after a TBI when my vision and senses began to go into overload and I was in a lot of pain and a neurologist, and nueroopthamologist could not understand me. Instead they began to take notes because I was finding out on my own what was working.

Some people who know this about me will shine LED lights in my eyes on purpose and laugh. These people are bullies.

As a tetrachromat I am even impacted by Migraine lenses called Avulux. These Migraine lenses make me very sick and cause me to have a migraine because they over focus the lense on one color of light spectrum when I am not designed that way. This is why I do not purchase monochromatic lenses either. Sunglasses with UV protection that are light enough color to use indoors work better than monochrome tinted lenses with UV protection. Incandescent bulbs do not have this, they are a variety of spectrum at once and do not have flicker most of the time.

These people that banned Incandescent lights are discriminating against my differences as a Neurodivergent, and my disability with a TBI and they need to bring them back. We need to have a choice of what kind of headlight we use on a vehicle, the intensity of the light in our home, and what kind of light works for us.

A person with synesthesia has more than one sense connected together. If I start to get this pain and this type of vision my sense of smell and hearing increase. This increase can cause hyper smelling and hyper hearing. If I have no protection from the light I will have burning eyes where the whites of my eyes turn red, my nose begins to run and my sinuses swell because the exposure causes hyperesthesia of my nose. Hours of exposure to Flourescents and LED do this to me. My immune system thinks it needs to release histamine. TILT is known as Toxicant Induced Loss of Tolerance. Its definition only applies to chemicals, food and drugs. For me the definition applies but I have another category to add and it is Light Pollution.

We as US citizens are being bombarded by exposures and as we age our tolerance declines and some are more at risk for this than others. These risk categories are yet to be established; however, it is likely that for women Xist and Lyonization are at play. This Lyonization could tilt a person with a Redox disorder towards less tolerance over time. Other mechanisms are molecular mimicry and prior assaults to the immune system. TILT is related to Mast Cell activity but is not the only aspect of the the problem.

For those of us experiencing this we have to wear hats and sunglasses. The eye doctors I have seen do not deny what I have been experiencing. The equipment that they use cannot find the problem. They have several patients similar to me wearing Theraspec lenses. These lenses are not approved by the FDA but have been helping the patients. I have called my Vision Insurance plan to discuss this phenomenon and why NeuroOpthamology, Opthamologists and other eye doctors are not diagnosing or investigating this. They do not answer my questions and change the subject. As humans who work in the evening, driving home in this light pollution is an absolute nightmare. The oncoming beams and beams behind you are reflecting in your face. More and more people are confessing to wearing sunglasses who are not as severe as me. Why is this being ignored? TBI can impact the retinal ganglion cells and excessively bright headlights and bright lighting in the workplace is very painful. I have to deal with disrespect, being made fun of because I am trying to protect myself.

Now it is December and I am getting more exposure from peoples Holiday light pollution on their homes that is way too damn bright at night and extremely painful. It is the nature of humans and businesses to lie to the public for gain while conditioning people to think that it is better for them through omissions of critical information.

https://www.frontiersin.org/journals/neuroscience/articles/10.3389/fnins.2024.1378498/full https://www.ahajournals.org/doi/10.1161/STROKEAHA.123.044904 https://autism.org/webinars/toxicant-induced-loss-of-tolerance-tilt/ https://www.hsph.harvard.edu/hoffman-program/resources/chemicals-in-your-life/what-is-mcstilt/ https://tiltresearch.org/

A.200 December 8, 2024 — Harrison, OH — Other

I have noticed that these LED headlights are effecting my depth perception. When I look down the road at night to pull out of my street or any number of streets or changing lanes on the highway, and alI I see are bright lights, there is nothing to 'ground' my vision to judge how far away a vehicle is before I do these maneuvers, or even the size of the vehicle. I see nothing but bright lights. I had a truck coming at me when I pulled out of a driveway and I couldn't see anything but headlights. I couldn't see the road and I couldn't see the outline of the vehicle until it whizzed by. I had to GUESS where the road was and hope that I was on my side and I didn't run off the road. It was absolutely blinding and I drive an SUV! It was traumatizing to say the least. And that was two years ago! I could have been killed or seriously injured. Ever since then, with no standards as to what headlights are supposed to look like, how many headlights are allowed to be lit up at one time, style, etc. I'm scared when I get on the road at night and it's only out of necessity when I do go out, never for pleasure anymore. These lights have destroyed the ability to do the things I enjoyed after work. Shopping, water aerobics, dining out, etc. And then we're being advised to focus on the side of the road or the white line, if you can see it, so we can drive at night? We shouldn't look to see what's ahead of us or coming at us while we're driving because this is the only way to save our eyesight and life? We now have to drive dangerously to accommodate headlights. That kind of advice right there is a valid indication that these lights are wrong for vehicles. We shouldn't be looking down, or to the side while driving. That's like driving with your eyes half closed, which is really what one is doing following that advice. It only takes a second to hit a human being or an animal looking anywhere but in front of you. The ridiculousness of LED headlights is insane.

A.201 December 8, 2024 — Wakefield, MI — Other

Early onset, rapid decline cataracts, photosensitivity

A.202 December 8, 2024 — Wakefield, MI — Migraine

Vision assaulted by LED light bar mounted on front of a pickup truck. Temporary blindness, vision spots for hours, migraine. Ban these fu*ckers!

A.203 December 9, 2024 — Lake Forest, CA — Astigmatism

When I was driviing back from Las Vegas from Thanksgiving weekend I almost got into several car accidents because of being blinded by LEDs on curving two lane roads. It is impossible to see the lane markers when your night vision is destroyed by these new headlights. My girlfriend is almost completely unable to drive at night because of her astigmatism and how the headlight affect her vision.

A.204 December 9, 2024 — Portland, OR — Other

Almost got hit by another car (with LED lights) because their lights were so bright I couldn't see their turn signal blinking. I've come so close to hitting medians in the past too because LED lights are so blinding.

A.205 December 12, 2024 — Vermillion, OH — Migraine

in addition to migraine I have a condition called Mal de Debarquement syndrome. LED lights really trigger my symptoms. It’s very hard for me to go shopping or out to dinner and have a pleasurable experience. I always feel seasick.

A.206 December 13, 2024 — Boca Raton, FL — Other

Cant go out at night i suffer from seizures and i have head trauma makes is hard to go out at night with family there is no need for those lights we are not in the forest n some idiots drive with them on high beam blinds my wife at night n me she suffers from migraine this has effected our night life .i still don't understand how this passed with all health hazards

A.207 December 17, 2024 — King County, WA — None.

I became extremely nauseated and experienced a headache immediately upon entering Target and Safeway after they had just switched from fluorescent bulbs to led bulbs. I experience eye pain from led headlights and streetlights and have to shield my eyes wherever I go. I feel agitated around led lights at night.

A.208 December 18, 2024 — San Francisco, CA — Migraine

I have lived in the same building on Telegraph Hill for 30 years and the last series of led lights on the bay bridge increased my migraine headaches substantially. After they were removed my migraine decreased and my way of life improved.

A.209 December 18, 2024 — Springfield, MA — Other

Blinding headlights! It was very disorienting to drive. Eye doctor tested for cataracts by shining light in my eyes and then declared surgery for cataracts should help with the glare. What about windshield manufacturers helping, if FDA won't regulate the LEDs?

A.210 December 18, 2024 — Vallejo, CA — Other

My wife has conditions that include Hereditary Alpha Tryptasemia which is causing seizures. Bright lights can trigger them, too, so these LED lights are extremely harsh for her, meaning she cannot leave the house in the evenings anymore, or go into stores, doctor's offices, look at Christmas lights, etc., as they are all equipped with the new LED lights. We've resorted to not using the lights in our home as they are the new LED bulbs and we cannot purchase incandescent bulbs. Luckily we have two lamps with old bulbs that we can use. I do not have this issue, but when driving I notice how bright and blinding headlights appear to be these days. My first reaction is to think the drivers have their high beams on. The worst is large trucks with lights shining straight through the back window into the rear-view mirror. It's truly awful.

A.211 December 19, 2024 — Austin, TX — None

I am now too terrified to drive at night due to the blinding impact of LED lights, which cause me to not be able to see at all, have a panic attack, and swerve, endangering my life and the lives of others. They are much, much too bright. I had to drive from Texas to Louisiana at night last night for a funeral and I had to pull over four times because of the dizziness, fear and nausea of being struck by those lights which is almost like a heat lamp or a blow to the head. I cannot believe that something so dangerous as lights so bright they blind other drivers temporarily are allowed and unregulated. I can no longer drive at night in this environment.

A.212 December 19, 2024 — Canton, OH — None

I have almost driven off the side of the road and more time than not, I stopped in the middle of the road because all I saw what a bright light that blinded me and I could see nothing else. I cannot see anything after those lights pass me. if they are behind me, I have to make sure I am in the middle of my mirrors so it doesn't affect me. I have been wanting to go after the manufacturer for years now.

A.213 December 19, 2024 — Colorado Springs, CO — None

I was blinded by oncoming LED Headlights and turned the wrong way on a one way street. I have run intel two curbs due to to being blinded. They are DANGEROUS

A.214 December 19, 2024 — Heath, OH — Other

People with mild cataracts, like me, have problems with LED car headlights lights causing very bright sparkly halos around the headlights at night. This makes oncoming vehicles at night a big problem. The sparkly halos are blinding people and very unsafe. I avoid driving at night now. This has been a

well documented problem for several years. Note: I am a retired QA Manager from a large lighting company. I have a lot of experience with LED lighting.

A.215 December 20, 2024 — Drexel Hill, PA — Autism

I drive because it's difficult to participate in society if one doesn't, but my autism makes it very hard for me on multiple levels. For one, I am very sensitive to light, and overly bright headlights not only hurt my eyes but also obstruct the shapes of vehicles and the flow of traffic, making me afraid that I will collide with someone because I can't properly sense how their car takes up space. There is no valid reason for headlights to be that bright. Even those with weaker vision, such as my grandfather when he had cataracts, used to drive just fine with a softer beam. I have seen and heard others complain about these lights as well, such as my father and various social media users. Please don't make life harder for people with disabilities than it already is.

A.216 December 20, 2024 — New Orleans, LA — None

I cannot drive at night now because the superbright LED lights make me see halos about 20 feet high and wide around oncoming vehicles or vehicles behind me. I cannot see the road, the signs, the lines, pedestrians. It is sudden and violent to the eyes and the brain and nervous system. Now I am being advertised to by Amazon and Google to buy LED bulbs to replace the halogens in my own car headlights. I will not fight fire with fire and blind other people so I can compete with these atrocious tools.

A.217 December 21, 2024 — Olympia, WA — Other

Upon returning to my booth at an outdoor/covered Farmers Market, the Governor allowed "non-essentials" Crafters/Artisians could return. My soft lights didn't get moved to my new booth space. The first day my eyes ached (which I'd never experienced in 60 yrs). I recalled an by article Dr. Mercola who interviewed an Ophthalmologist who explained LED lights and eye damage. My instinct was to stand in the sun...no eye ache: BINGO! I knew it was the damn lights. I researched and purchased blue blockers and a wrap around my head visor because lighting came in from all directions.(And horribly had to wear a mask too = hell on earth!). I went to an micro-current intuitive healer who said it's your optic nerve especially in the left eye. I had had several treatments over the years and got better, thank Buddah, Allah, Godddess, Jesus and everyone! However I always carry blue blocker glasses in the car and a sun visor...because I never know how the lights in whatever store will affect me. It's been a huge challenge, life-style shift for me... even visiting friends homes I must be prepared. I'm much better. Although I went back to the OFMkt and had had my gear, went to the car to drop off stuff didn't think I'd need my visor, nor that I'd stay long. I sat on a table, waiting for a buddy and instantly my eyes started tweaking, and ached for hours afterwards. I've learned to try and not drive at night the headlights are horrific, especially first responders= blinding! I've learned to drive w/my left hand up to shield my eyes from the oncoming headlights. Years ago I titled all my mirrors waaaay out or up, I can lean to see when necessary. My question is whom decided LED's were the new way? Politically -- $omeone must be the king-pin-of-LEDlight$? I actually lucked out and purchased an entire box of 60watt bulbs at a used store, just as a volunteer walked in with a huge box of new bulbs for $10 (i know)! Before that I was purchasing used ones from Habitat for Humanity resale stores for $1 a bulb, and felt grateful for that!!! Thank you for your research, time and effort in this important area. I had no idea the ranges of challenges people continue to face. Big love to you and yours in this journey to educate. WE ARE NOT ALONE! Cheers.

A.218 December 21, 2024 — Port Colborne, ON — None

I crashed my car, totalled it because someone with LED headlights decided to enter and exit a roundabout with their high beams on. They were coming towards me and I was completely blinded by them for about 15 seconds before they passed me. I will take some fault as I was speeding a little but at that point it was too late and I crashed directly into another vehicle all because of LED light. They are too damn bright!!

A.219 December 22, 2024 — Sebastopol, CA — None

My eyesight is pretty good except for needing reading glasses for seeing things up close. But ever since the new super bright headlights have come out, I really don't want to drive at night. They are blinding and very dangerous, since I can't see anything else when they're coming at me. I adjust my

rear-view and side mirrors so that the lights don't shine in my eyes. That reduces my ability to see behind me, but it's safer than being blinded by those lights. I thought maybe it was just my eyes getting worse, but I notice that if a car is coming toward me with the old fashioned headlights, I can see totally fine. No problem. With the new headlights, I sometimes have to hold my hand up to block them so that I can see where the road is. Otherwise, I would be totally blinded. Very dangerous! I can't believe these are legal. They also hurt my eyes, and I'm sure they are damaging to vision.

A.220 December 22, 2024 — Vancouver, BC — Electromagnetic Sensitivity

Since so many vehicles are now using these bright, white LED car headlights it is practically impossible for me to drive. I have to hold my left hand up as they are so blinding, even in the daytime. Even sunglasses do not cut the bright light. I even drive at night with sunglasses on. This is very dangerous! When a car comes up from behind I have to hold my hand up by the side mirror as it also blinds me from the side and from the rear view mirror. It has become so dangerous for me to drive and has affected the quality of my life in so many ways. I don't know who gave these car companies permission to use these very bright LED white lights? It's like the whole city driving around with their high beams on or even worse! This must be rectified by the federal government! This must be stopped immediately!

A.221 December 23, 2024 — Portland, OR — Photophobia

Bright LED headlights on vehicles have become a significant challenge in my daily driving. On multiple occasions, cars equipped with excessively bright LED headlights have nearly caused accidents. When these lights shine directly into my eyes, especially from oncoming traffic, the glare is blinding and disorienting. Even vehicles behind me can create dangerous situations when their LED lights reflect intensely through my rearview or side mirrors.

To cope, I've had to resort to putting my hand up to block the glare while trying to maintain control of the car, which is both impractical and unsafe. This issue has led to numerous close calls where I almost veered off the road or into another vehicle. Additionally, the harsh intensity of these lights causes severe eye strain and headaches, making the driving experience not only stressful but physically painful.

These incidents have made me anxious about driving at night or in poor visibility conditions, as I'm constantly on edge, anticipating these blinding lights. It's clear that while LEDs have their benefits, their use in vehicle headlights needs better regulation to ensure road safety for everyone.

The Impact of Bright LED Lights on My Driving Experience

Bright LED headlights on modern vehicles have become a significant hazard while driving. On numerous occasions, these lights have nearly caused accidents, whether from oncoming cars or vehicles behind me. The glare from these excessively bright LEDs blinds me temporarily, often reflecting off my rearview or side mirrors, leaving me disoriented and forced to put my hand up to block the light. This is an impractical and unsafe solution while trying to maintain control of my car.

A particularly concerning issue is the auto brights feature in many modern cars. These systems frequently fail to detect other vehicles properly, leaving the brights on when they should dim. This not only creates an unsafe driving environment but is also a clear violation of traffic laws, as having your brights on within a certain distance of another vehicle is illegal. Such violations should be actively ticketed to deter this reckless behavior.

The cumulative impact of these bright lights has been severe for me. I've had multiple close calls, almost veering off the road or into other vehicles. Beyond the immediate danger, the glare causes eye strain, headaches, and general discomfort, making nighttime driving a source of anxiety and physical pain. While LED headlights offer benefits like increased visibility for drivers using them, they need stricter regulations and better technology to ensure they don't endanger others on the road.

A.222 December 24, 2024 — Anytown, NJ — Astigmatism

I have never hated driving so much as I have hated driving this year.

At night, thanks to the glare, I cannot see road signs without reflective coatings. When it rains at night, the combination of windshield fog, glare, and wet-pavement are brighter than the Lines-on-the-Fucking-Road. High-set SUVs with Bright As The Goddamn-Sun headlights shine directly into

my vision which, due to an astigmatism, breaks into a fireworks show in my eyes. Oncoming traffic actually hurts--like getting snipped with nail-scissors in the back of my head.

On one particularly vile strip of road I became paralyzed, unable to see my turning lane, and it was only by a Grace of God that I did not have an accident.

It used to be that this glare was only an occasional inconvenience--some thoughtless driver who forgot to turn off their high beams. Now between the strength of headlights and the height of cars, every minute spent driving at night is a damnation; miserable American roads befitting a miserable American people.

There's something poetic, something uniquely American, about the state of our roads at nights; they've become a dick-waving contest measured in lumens, fueled by selfish idiocy, gagging and slobbering for "MOAR BRIGHT" until nobody can fucking see.

Thank you for providing a space to voice these concerns. I eagerly look forward to seeing our regulatory institutions ignore this problem until it inconveniences someone important.

A.223 December 24, 2024 — Los Angeles, CA — Photophobia

Post mTBI: chronic migraine, severe neuralgia and dysautonomia all triggered by severe photalgia due to ipRGC retinal sensor injury - https://pmc.ncbi.nlm.nih.gov/articles/PMC7682828/

A.224 December 24, 2024 — Wichita, KS — Autism

Multiple brain injuries left me with diagnoses that include migraine, severe photophobia due to a retinal sensor injury - ipRGC's the Light Meter for the eyes which regulates circadian rhythm. It also manages retinal light adaptation. Exposure to LEDs and any blue spectrum bright light, especially light that flickers or moves, causes me intense pain, violent nausea, vomiting, weakness, chest pain, shortness of breath, a lot of the symptoms of a heart attack or a severe panic attack. It took me many doctor visits to learn the cause of this severe photophobia and flaring systemic symptoms . I also learned that I have a diagnosis of autism spectrum Level one which explains my severe sensory overwhelm experience to light, but that combined with this retinal injury has rendered me unable to drive at night at all in these new lighting conditions. It's so unsafe even wearing blue light blocking glasses with glare blocking appliqués in my windows to block headlights in my side views and the oncoming traffic.

A.225 December 26, 2024 — Seattle, WA — None

I'm 51 and have struggled with bright blue/white head lights for many, many years. Because most new cars come with them and many people are using LED bulbs in older headlight fixtures, the situation seems to be compounding exponentially.

I often get a headache from the eye strain and increasingly plan my life to avoid night time driving when possible. I have even begun using both a dark sun visor and yellow/amber tinted lenses to make night driving tolerable. This is not my preferred way to drive at night as it makes it more difficult to see dark objects or people dressed in dark clothing.

I find my need to do this ridiculous. I also don't know a single person of any age, that seems unbothered by the changes that have brought so much bothersome glare into our eyes as we drive.

Something needs to be done about this sooner than later and it is going to take a lot of work to change out or update all the headlights that are blinding me and everyone else I talk to.

Why are we allowing this unsafe way of illuminating our driving to continue? I want the department of transportation and/or the FDA and/or congress to begin addressing this problem NOW so that we can all drive more safely and with less eye strain and pain.

A.226 December 27, 2024 — Blanco, TX — None

There's a difference between brightness and color temperature. Brightness is measured in Lumans. Color temperature, in degrees Kelvin. It is not so much the brightness of these new headlights that causes so much irritating and dangerous glare as it is the very high color temperatures of 5,000, 6,000 or higher Kelvin. If the new vehicles simply used low Kelvin LEDs...2700 Kelvin or lower (a golden yellowish light), much of the annoyance would be alleviated.

A.227 December 28, 2024 — Taos, NM — None

Dusk and sun setting, combine that with LED headlights and it's impossible to see the road ahead. The LEDs are so bright that you cannot tell the make of the automobile.

A.228 December 30, 2024 — Anytown, MO — Astigmatism

I'm unable to see the lines on the road when someone uses LED lights. Almost everyone I come into contact fills the same way even if they do not have an astigmatism. LED lights are very dangerous for the most basic and single most important reason of all... TWO LANE ROADS!

Many people can drive just fine at night even with varying vision problems or none whatsoever with regular halogen or non-LED bulbs.

When someone uses brights they should see far and wide so they can look for deer and other animals etc.

However when a car is within 500 ft or less not even the brightest halogen should be used for low beams as this endangers not only the person who has the lights shining in their eyes, but it endangers the person shining the lights and someone else's eyes because it could create a head-on collision.

In fact, I'm willing to bet that many head-on collisions are result of LED lights on two-lane roads over someone looking at their phone.

If more intensive research was done you'd most likely find out I'm right since as a genius I'm right about 99% of the time about my speculations.

A.229 December 30, 2024 — Holly Springs, NC — Astigmatism

We live in a part of North Carolina that does not have street light coverage. In short it is VERY dark here. Driving at night here is quite a challenge. The blinding on coming headlights make it almost impossible to navigate the roads safely. Combine that with what appears to be distracted driving and you are taking your life in your hands just trying to get to the market. Something must be done to reduce the brightness of these dangerous headlights.

A.230 December 30, 2024 — Paterson, NJ — Other

The car lights are way too bright that blinds you

A.231 December 31, 2024 — Armada, MI — None

My wife just ordered a pair of night driving sunglasses which made me realize these modern LED headlights are just too bright, dangerous, and out of control. My wife (54), my son (20), and I (52) have been complaining about the bright headlights for the last couple of years. Another red flag is that my son also complains, and he's only 20 with perfect vision.

These dazzling lights diminish night vision and distort the field of depth. Both oncoming and rearview traffic dazzle. You can dim the center mirror, but side mirrors are not dimmable.

These headlights are dangerous to all people on the road and need to be regulated so they are either toned down or use a friendlier light frequency.

A.232 December 31, 2024 — Cherry Hill, NJ — Astigmatism

Bright LED Headlights have significantly impacted me, and my freedom to travel when and where I want to. I have an astigmatism, and have recently developed a driving phobia, which is largely connected to me getting overstimulated while driving. Nighttime used to be my preferred time to drive, as the roads were quieter. Now, with the LED lights, it's unbearable. Not only can I not see with the blinding lights in my face, but it greatly increases the chance I'll need to pull over and calm myself. I struggle greatly getting to all the places I used to go, and the bright headlights make the process even worse.

I genuinely feel like it is not a problem that will solve itself. In order for others to feel safe competing with the other blinding headlights (I often feel like I cannot see after passing a car with these and often in the moment wish my lights were brighter) they too need to get these LEDs. Manufacturers won't care, if anything they can advertise being the brightest.

We desperately need some sort of deterrent, because I fear for my life when I get blinded on the road at night, and wonder how many life-altering accidents have been caused by this issue. Or even what the long-term effects of these are. I wish to be free to travel where I want without this unnecessary harm.

A.233 December 31, 2024 — Orléans, France — None

It's New Year's Eve, and for the fifth consecutive year, I'm staying home and not participating in any festivities because of the blinding LED lights that are now everywhere and assault my eyes.

When the first street lights and vehicle LED headlights appeared in my area five years ago, I realized that my daily life would be completely turned upside down. I feel like I've been condemned to no longer live normally, like I used to, especially in the evenings. I can't live freely in society anymore, with a clear conscience, without the fear of having my eyes constantly assaulted by these completely excessive lights.

I'm tired of all this. Tired of having to endure these car headlights with insane brightness levels, at night JUST LIKE DURING THE DAY, forcing me to look away and leaving trails in my vision. Tired of noticing that many designs and installations of lighting fixtures are systematically done thoughtlessly, over-illuminating the entire neighborhood. Tired of these street lights that repel me and prevent me from being out at night.

The world has plunged into a light arms race that I don't understand and can no longer tolerate! Why have we come to this? Who decided this on behalf of everyone else?

Science had warned about LEDs, but it wasn't listened to. Many people complain, but they're not heard.

What's happening? What's the plan? How much longer do we have to protest and shout for the LED monster, created by a greedy and careless industry, to stop spreading uncontrollably? I deeply curse everyone who created this monster, and every day I wonder how much longer I can endure this situation before I decide to move far away so I no longer have to suffer from it.

In any case, we need to unite to make the global LED industry bend so that acceptable lighting standards for everyone are established and enforced.

Happy New Year to everyone and stay strong.

Reports received in 2025

January 2025

A.234 January 1, 2025 — Cypress, TX — Migraine

It breaks my heart that this is the case today. I remember seeing maybe 1 in every 25 cars with LED headlights, now it's 1 in every 25 that have regular, soft white/yellow lights. I literally cannot drive with these vehicles on the road. Migraine disorder means extreme light sensitivity for most of us who suffer from migraines, not only when migraines are happening, but always. I usually end up with an uphill battle of pain after getting home from driving. My friend has said to me, "Well, how about you don't look at them?" And this is where some people may not understand; people with epilepsy, migraine disorder, and light sensitivity will feel actual, visceral pain in our retinas, even when the light is in our peripheral. On top of that, our eyes are perceiving them brighter than other people. The cars are driving towards our direction, and the light will engulf our vision. I cannot stress it enough: We cannot see. We cannot see, and it hurts, a lot.

A.235 January 4, 2025 — Shippenville, PA — Migraine

My wife recently experienced a debilitating migraine triggered by using a computer with an LED screen. Not only was it the screen that caused this but the LED backlit keyboard. Within moments of exposure, she felt an intense, throbbing pain above her right eye, accompanied by a piercing headache that grew progressively worse. The migraine not only impaired her vision but also left her feeling nauseous and hypersensitive to light and sound, making it impossible for her to continue with her activities. The overwhelming pain and discomfort forced her to retreat to a dark, quiet room for

relief, underscoring just how debilitating the effects of LED screens can be for someone with her sensitivities. It got to the point where she vomited later in the day from the intense pain and nausea.

A.236 January 6, 2025 — Manchester, NH — Migraine

Driving at night has become basically impossible. The worst culprits I have noticed are Jeeps and newer Honda SUVs. I come home with a headache every single night. I am tempted to tell my work I can no longer work nights because driving home is nothing short of painful and dangerous. As cars with newer LEDs pass, I can not see anything and I am forced to look away from the road. This is hazardous for obvious reasons. I'm hoping this website can make a change.

A.237 January 7, 2025 — Philadelphia, PA — Other

Started watching a lot of internet on smartphone in 2020 6 months later left eye got worse than right eye. Can still use right eye. Go in soon hope they can repair it .Eyes bleary after screen use.

A.238 January 9, 2025 — Anytown, TX — Astigmatism

Car headlights blinded me for a minute, I had to park until the dark spot in my central vision was gone. I am thankful I was not traveling on a highway or a street without a safety lane

A.239 January 10, 2025 — Livonia, MI — Other

November 6 of last year I'm taking my grandson to preschool. It's 7:30 in the morning and raining. I'm in the left-hand turn lane and the truck in the opposing left-hand turn lane facing me headlights were so bright that I could not see the oncoming traffic in order for me to complete my turn. I was temporarily blinded all I seen was white spots after the truck had made his turn and I had to sit through to the next light. Everybody knows you can't complete left-hand turn until the light is almost red anymore and even then people are still coming through. and this was the case that morning. I was frozen like a deer in the headlights, I could not turn. people behind me were blowing their horns motioning me to go go go. I didn't want to risk my life or my grandson's life. So I sat all the way through to the next light after the other truck had turned then I could see beyond to the oncoming traffic.

A.240 January 11, 2025 — San Diego, CA — Other

Led car lights are a daily problem for me. The blaring lights are debilitatingly blinding while driving. It's scary and unsafe. It's forcing me off the road at a young age. Force a recall on these lights.

A.241 January 12, 2025 — Ames, IA — Migraine

Single incident? No, EVERY TIME I drive from when they first came out. I did not know what a migraine was until then. It would have been fine had I never experienced it/them. I am a lighting consultant among other things. Some lighting is designed - you see the illumination of a target as opposed to the source and is has to do with humans/living things in a pleasing and functional way without stress on the user/beneficiary. Even the blue spectrum/high k temp lights are somewhat bearable if designed and aimed well but I still wear brown lens, wrap around sunglasses all the time I drive for incidental exposure. Not ideal but they protect my health. Then there are the engineered super bright lights that just puke out as many lumens as possible in every direction. They are as bright or brighter than the sun and headed straight towards me often during the day and night. They bother me from miles away. The new LED driving lights are brighter than my high beams!!! I use my sun visor to block out these bright as the sun headlights along with most of the vehicle. They have then on in the name of safety causing me to protect myself by doing less safe things. I can see the bottoms of the cars in front of me when the offensive lights are approaching - that's all - it does not keep me aware of the bigger traffic picture. In other words they are a hazard to safe driving on the order of texting while driving - a huge distraction. Why do someone(s) have to die before these obviously poorly designed products are taken off the market? I'm sure to has happened countless times already but not been attributed to that. I am tempted to make a scene on the order of a federal case by smashing the most offensive ones (pick up trucks) in public to get national attention for this it is so bad. Nothing short of that will get things changed it would seem.

A.242 January 12, 2025 — Brunswick, OH — Astigmatism

My eyes cannot adjust to the extreme brightness of LED headlights. I have astigmatisms which already makes nighttime driving difficult. Almost causing accidents due to the lights and stopping on the road is also dangerous but it's because the lights coming towards me and behind me are so bright my entire car is lit up. How is any of this safe? We all know safety isn't your concern and couldn't care less about potential and accidents that have already occurred from this.

A.243 January 12, 2025 — Glenside, PA — Photophobia

I had a recent situation in the movie theater while watching “Wicked” that sent me into a blackout paranoid state; after leaving the theater, the oncoming auto lights/traffic lights/police lights just exacerbated the situation. I have no memory of the evening. I went to the emergency room in the morning and blood/urine tests showed no drugs or alcohol. I do not have epilepsy and have no medical conditions. I have been using candlelight and red lights at night in my home since 2020 and rarely drive (2018 car with only 17,000 miles). I had a similar event about two years ago after watching a TV series that used flashing strobe lights. I have a PhD and have been looking for research and case studies on the topic of the health consequences of light/flashing lights at night. My goal is to 1) figure out what happened to me, and 2) help others who would just attribute this to being "crazy." Thank you!

A.244 January 12, 2025 — Twentynine Palms, CA — Other

Cannot drive at night anymore due to the extremely brights white lights on cars. They hurt my eyes and cause neurological problems. They are extremely dangerous.

A.245 January 13, 2025 — Halifax, NS, Canada — None

As a car enthusiast who use to love going to shows, events, and night driving, LED headlights have now ruined this hobby and causes me anxiety to drive at night. Last Friday (1/13/2025) I had to drive at night. The trucks/jeeps/SUVs with LED headlights 6 feet off the ground make the road so unsafe i cannot use my mirrors when they are behind me and cannot see when they are in front of me. While a truck was behind me it made it so difficult to see that I almost hit a pedestrian on the road who was crossing (illegally but still). This is not safe! I don't hate LED lights, I just feel if the headlight is above the average eye level of a car (car is above the cutoff shield) then LED headlights should not be allowed. We are also seeing this in large 18-wheeler trucks now, some having 6 LED headlights (4 lights + fog lights). Please stop this nonsense, it's a marketing scam and the transportation safety board is doing nothing to stop it. We could all see fine 10 years ago with non-LED headlights.

A.246 January 13, 2025 — Scappoose, OR — Other

Full fledged anxiety because being blinded puts me into fight or flight adrenaline mode, because if I am not vigilant I could crash. LED lights are so bright, I cannot see in front of me, beside, or behind me. I am not at fault for being blinded, they are at fault for blinding me.

A.247 January 19, 2025 — Norman, OK — Astigmatism

It’s become impossible to drive at night anymore. I have astigmatism in both eyes and LED headlights have become so bright that it gives me terrible headaches.

A.248 January 24, 2025 — Stockholm, Sweden — Other

I hate driving car at night. I have a short kia so the light of these led SUV and not even subs always just goes right into my car making me unable to see what's Infront of me nor what's inside my car so I could not even turn on the warning blinkers to signal for them to pass...

A.249 January 31, 2025 — Middlesex, NJ — Astigmatism

Hello, I just found out about this and I wanted to share that I used to love driving at night when I first got my license! I’m a bit of an anxious driver so driving when there were less people on the road gave me some peace of mind. It’s been almost a decade now and car headlights have only gotten brighter and brighter, especially Tesla. There is absolutely no reason for these cars to have headlights this bright as the world didn’t get darker nor did we lose streetlights. Now I am no longer able to drive at night. I have an astigmatism in my left eye, mild in my right eye and I do have glasses with anti glare on them which I paid a good chunk of money for, it hardly helps. I bought the yellow glasses, they

hardly help either. These lights are blinding and I feel like as a result, people who already can't see drive around with their high beams on to counteract that. I used to love driving at night, now I dread it, especially if it's raining. A few years ago when Teslas started ramping up in popularity, I was driving down a road at night in my old car which was a 2015 Kia Forte EX. I was so badly blinded by this Tesla coming from the opposite direction, I couldn't see and the next thing I knew, I heard a smash from the right side of my car. I had lost my right side mirror to a full garbage can on the side of the road due to my inability to see properly and had to replace it. I'm grateful that's all that happened. Now whenever cars with those bright headlights come at me, I have to slow down significantly to avoid a repeat of that. Nothing I do helps, it's not like I'm blind. I just have an astigmatism in one eye. It never bothered me a decade ago and it was always this bad growing up. It saddens me nothing is done about these cars and how it's so clearly a threat to the public's safety, but we as a country set our sights on other, less important matters. These need to be regulated, how many accidents happen or go unreported due to these headlights? How many other people avoid driving at night because of this? How many other people crashed into something, lost their mirror, what have you? Thank you for your time.

February 2025

A.250 February 2, 2025 — Los Angeles, CA — Astigmatism

Driving in the evening or at night has now become an impossible, highly stress-inducing task. I have almost been in an accident so many times due to having to look away from the road to avoid being blinded. This is insanity and I cannot imagine having to deal with this for the rest of my life. I have never felt more unsafe driving on the road and it seems insane to me that there has been no regulation on these blinding lights. I am begging someone to help put an end to this nightmare.

A.251 February 2, 2025 — Ovilla, TX — Other

Momentary blindness that occurs repeatedly during nighttime commute to work.

A.252 February 4, 2025 — Vancouver, Canada — Electromagnetic Sensitivity

Since they have started using LED car headlights and also LED street lights I am unable to drive in the evening and at night as well as find it very difficult to even drive during the day. The lights are blinding from head on and also from behind in the rear view mirrors and side mirrors. This has affected my life and freedom immensely. It is even difficult to go for a walk through the streets because when these car lights come at you they are blinding.

These lights are ruining the ambience of the city as well.

Another problem is that the moth population is not breeding due to these very bright LED lights. This is going to have a terrible effect on the ecosystem. These need to be stopped from being used immediately! There are many other negative health effects of LED lights which I will submit later.

A.253 February 4, 2025 — Weaverville, NC — Other

Driving at night has gradually become more dangerous due to the increasing presence of blinding LED headlights. One has to either: look away or physically block the insanely bright blue light, lest they be blinded. The risk is so blatant, I do not understand how ultra high beams are not only legal, but becoming the norm.

A.254 February 6, 2025 — Atlanta, GA — Other

The new LED headlights are blinding! They hurt my eyes and distract me. Instead of helping they are detrimental to everyone else on the road. Especially in urban areas there's no reason for regular lights to look like "brights"

A.255 February 6, 2025 — Gray, GA — Migraine

my husband works as a domino's delivery driver and frequently drives at night. he usually ends up getting migraines from these incredibly bright LED lights. he has told me he cannot see and it is difficult to drive and has to take aspirin often to just get relief from the migraines they cause. not only do the headlights that drive past him bother him, the headlights from people from behind also prevent him from seeing the road clearly. it is especially dangerous since we live in the country and

there very well could be a deer and he would not be able to see it. its even worse when it is raining. these lights should be illegal for how dangerous they are to drivers.

A.256 February 6, 2025 — Mabank, TX — Migraine

I have documented light sensitivity. Before, halogens easily triggered headaches and migraines and I have installed 2000K bulbs in my house, placed "night mode" programs on computers and on phones before they became standard, and seen multiple doctors on how to best deal with it. My eyes cannot handle cool white lighting and can barely tolerate warm white lighting. Any form of blue-tone lighting will trigger headaches and migraines that make my vision blur and my head pound. With the introduction of bright cool white LEDs in headlights and streetlights, my ability to drive at night has gotten much worse. I am forced to wear tinted sunglasses while driving, which reduces my visibility, because the other option is being unable to drive. While I understand LEDs are more energy-efficient and effective at light distribution, the fact the color is a cool and very bright white has reduced my quality of life severely. I used to love driving at night, as it was much easier on my eyes than driving in the daytime, where my eyes have a very hard time handling sunny days. However, now there is no time of day where I can enjoy driving without any impairments. LEDs are not the problem, I can handle LEDs of other softer colors, but the white of 5000-4000K has made life much worse.

A.257 February 6, 2025 — Richmond, RI — None

I get temporarily blinded when oncoming vehicles have their bright LED lights on, it's hard to drive when being blinded from both in front and behind with the glare of bright led headlights reflecting off both my left side mirror and rear-view mirror.

A.258 February 11, 2025 — Manassas, VA — None

Driving in the rain at night with everyone's headlights behind me it is nearly impossible to see the road in front of me. Thankfully there were trees blocking the oncoming traffic's lights, otherwise I seriously don't think I would've made it home. It's incredibly dangerous and I could've gotten into a very serious accident, I had to slow down and even pull over at a certain point to let people pass me so that I could see the road again. Regulate the brightness of these new headlights!

A.259 February 13, 2025 — Battle Creek, MI — Migraine

I bought a box of led lights because that was all that was available at the store. I put them in my bathroom fixture and every time I turn the light on they flicker so much I have to turn the light off. The same in my kitchen. The flickering causes me to get Ocular migraines on a regular basis. This causes nausea and balance problems and I can't drive. I have quit driving at night because of the led headlights afraid I will get a migraine and not be able to get home. I suppose they save energy if you are afraid to turn your lights on at night.

A.260 February 15, 2025 — Baltimore, MD — None

I almost hit a car while trying to shield my eyes from an oncoming car with bright lights. I have driven all over the world, I see we are way behind with light sensitivity, we have been for decades - look up how Brazil has managed this for decades. Please help stop this unsafe and unnecessary bright light issue.

A.261 February 16, 2025 — Amelia, OH — None

Was driving on a narrow two lane road. A car with the LED headlights was coming towards me. It was snowing out. The road was covered on both sides of the road. I slowed down to 15mph. As he passed his mirror hit my mirror. Causing damage to his mirror. He had a dash cam and it showed me on the yellow line. Had he NOT had the LED lights. I believe it never would've happened. I also got a $125 ticket for driving left if center. Im 35yrs old and ive never been an a "at fault accident" nor a ticket! I 100% blame the LED lights!!

A.262 February 16, 2025 — Woodbridge, NJ — None

I am a school bus driver in Central NJ. I am also a "car guy" for life! I've been working on, fixing and racing/driving since I was a teen. I own a 1995 VW Jetta 5speed that is 98% restored/tuned. Drove it 253,000 miles on the original clutch and shot a Mobil1 commercial with it in 2015. Google: David Alston + Mobil1.

I do not have any vision impairments or health issues. I also have incredible vision in the dark. A lot of these newer cars are annoying as hell with these "ridiculously" bright L.E.D. headlights. Hondas. Ford F150s. Kia. Tesla. Why are these vehicles "allowed" to be put on the road with these "stupid-bright" lights?!! And if you need lights "that bright" to see at night, you SHOULDN'T be driving!!!! This is EXTREMELY URGENT and SOMEONE NEEDS TO ADDRESS IT RIGHT FUCKING NOW! I am a "former" Fed. I worked in IT 16 years in DC. NHTSA needs to get off their ass and fast! Sick of these stupid L.E.D.s!!!! Google: David Alston + C.I.A. - NJ.com.

A.263 February 17, 2025 — Anytown, MI — Autism

I have astigmatisms, photosensitivity, and am currently in the process of being evaluated for autism. These LED headlights are violently bright and trigger physical pain starting behind my eyes that shoots through to the back of my head and causes emotional distress, to the point of once pulling over (nearly crashing in the process) and engaging in self injurious behaviors due to dysregulation. They have nearly caused accidents to myself and others on numerous occasions. This is an issue far from limited to those with disabilities; anybody I ride with will feverishly complain whenever being faced with or followed by an LED headlight bearing vehicle. Pedestrian deaths have only increased since the switch, brightness is utterly unproductive if it blinds every other driver on the road. We need regulation on the harshness and we need it now.

A.264 February 17, 2025 — Yolo County, CA — Autism

I was driving east on Hwy 16 towards Woodland, when I noticed intense amber LED flashing lights close to a mile ahead. I started to slow down. As I reached the LED flashing lights, the intensity and digital pulsing was unbearable. There were multiple vehicles. The panic started to set in. I covered my eyes with my hands and slowed to less than 20mph, basically trapped by the LED lights. I crept forward in my car, blocking nearly everything from my sight except for a narrow sliver of road near the center line that I could see. Major panic started to set in as I passed the vehicles, which turned out to be about 3 Yolo County Sheriff's vehicles. After I passed, I glanced back in my rear view mirror and was struck by red and blue LED flashing lights. I let out a scream of agony. I suffered significant emotional trauma from this event.

A.265 February 19, 2025 — Hammond, IN — Astigmatism

I used to love to drive. I've driven hundreds of thousands of miles all over this country. LED headlights are without an ounce of hyperbole: painful. Even LED billboards cause discomfort. I have to take my eyes off the road when there's oncoming traffic with misaligned LED head lights. They need to be banned.

A.266 February 24, 2025 — New Prague, MN — Astigmatism

I am 19 years old and generally have decent eyesight, aside from my astigmatism. I have noticed consistently that after driving at night there will be spots in my vision on my left eye, and my vision is noticeably worse on that side. I drive a small car, but that shouldn't mean I deserve to be blind. The main issue is large trucks and SUVs that put on lift kits and aftermarket headlights that aren't using the same light geometry as the OEM. There are sedans with bright lights but it's far less common.

A.267 February 28, 2025 — Salem, OR — None

I am regularly blinded by oncoming traffic while driving at night, and can only hope that no pedestrians, animals, or other motorists are in my path while the oncoming traffic passes. The problem is not only the brightness or quality of the light, but also the angle. The height of modern trucks and SUVs puts the beams directly into the eyes of people driving normal height sedans, coupes and hatchbacks.

March 2025

A.268 March 2, 2025 — Detroit, MI — None

I just took my first road trip of roughly 360~ miles and part of it was during the night time, I had to drive on a highway with no lights so the only sources of light I had were other vehicles. Every so often, I would have to deal with the blinding LEDs of a typically newer model vehicle either driving up on me from behind and blinding me in the mirrors, or an oncoming one across the highway that I could

spot from miles and miles away as if they were the sun. As an automobile enthusiast, it really bummed me out to have to get a harsh slap of reality that driving at night isn't as fun as my parents told me it was when they were younger due to the constant visibility issues caused by these LEDs, and I challenge every vehicle manufacturer and the NHTSA to work together to lower the legal lumen output on vehicles so we can all experience safer road trips and nightly commutes.

A.269 March 5, 2025 — Arlington, TX — Astigmatism

A truck with LED headlamps and also aftermarket LED off road lamps was behind me. They were so bright that I could not see anything else around me, except for the truck. This sort of thing happens all the time. Sometimes the only relief I can get is if I put on sunglasses driving on the freeway to cut the extra bright blue light down. LED lights will cause me momentary blindness, and eye pain at times. It is extremely annoying and very dangerous!!

A.270 March 5, 2025 — King of Prussia, PA — Photophobia

HOA upgraded all outdoor lights in lamp posts to 5000K, 3000 Lumen bulbs that shine in all directions, including into my end unit. My once-beautiful panoramic view is now dominated by an arsenal of glaring "headlights." The lights also have faulty sensors so that they turn on 90 minutes before sunset and also turn on when their are cloudy/rainy conditions. It has major effects on my mental health and my vision that I am trying to preserve by avoiding super-bright light.

A.271 March 7, 2025 — Anytown, FL — Photophobia

On the bottom of your HOME page, under the Sign Petition is a paragraph that is, in a sense, incorrect. The very last sentence stats that there is little to no government regulation (on the LEDs) and that is NOT correct. The fact is that was phenomenal government regulation, and it was all FOR LEDs. They banned incandescent bulbs and forced people to buy LEDs. President Trump changed that in his first term in office, and I do not know what has happened since then, but I do know that even if incandescents are now being sold, they have basically changed over the lighting industry to the LEDs and it is extremely difficult to even find Incandescent, especially in the higher voltages (200w, etc). It would be educational if you added to that paragraph the involvement of the government in this blinding debacle! Thanks for your work! PS: I am a redhead and I love strong lights (redheads are the only "species" that make D3 thru their eyes and they seem to have an strong affinity for light), but these LEDs are going to cause blindness. We have a family member who has severe photosensitivity, and they are tortured by the LEDs ! PLUS, the frequencies of LEDs are harmful to the human biome.

A.272 March 8, 2025 — Easley, SC — Photophobia

Blinding and destruction of clear vision during and after on coming traffic.

A.273 March 8, 2025 — Troy, OH — Migraine

My life has changed completely because of LED! I have suffered 49 years with migraines, and recently, LED lights are a contributing factor in me qualifying for disability benefits. LEDs trigger migraines, and are everywhere - stores, computers, cars, doctor offices - everywhere I go I am walking into a landmine. We built a house, and I stocked up in enough incandescent bulbs to last me the rest of my life. Even buying a new car has become difficult, because of all the blue interior LED lights. ENOUGH already!

A.274 March 9, 2025 — Phoenix, AZ — None

Momentary blindness is caused when hit with bright LED lights. Which in effect can cause a car accident either with another vehicle or pedestrian.

A.275 March 15, 2025 — Seattle, WA — Photophobia

I suffer from a neurological condition triggered by the COVID-19 virus, which has resulted in heightened sensitivity to various forms of sensory input, a challenge faced by tens of thousands experiencing long COVID in our country. Initially, this condition was somewhat manageable; however, the increasing prevalence of excessively bright LED headlights has rendered me completely unable to leave my home. Encountering these headlights is catastrophic for me.

It induces significant eye strain, excrutiating pain behind my eyes, extreme tension in my chest and shoulders, heart palpitations, and severe tension headaches; followed by a state of utter panic in my nervous system that persists for days, sometimes weeks, interrupting sleep and severely hindering my quality of life.

My partner, who is neurotypical, has reported that these lights are blinding when oncoming at night, leading to near-collision incidents for both of us on multiple occasions. I have yet to meet a single person who has not raised concerns about the safety risks posed by these headlights within our communities. By their very design, headlights are intended to enhance nighttime visibility, not hinder it. Therefore, I strongly advocate for their prohibition, as this matter has become urgent. The consequences of this issue extend far beyond individuals with medical conditions; it adversely affects the entire population. Countless individuals are forced to abandon driving and travelling after dark, which diminishes the working population and compromises the economies overall functionality.

It creates hazardous conditions for all road users, increasing the risk of physical harm and even fatalities. I urge you to take action on this pressing matter to safeguard the well-being of citizens who urgently seek protection from the dangers associated with this new "technology."

A.276 March 19, 2025 — San Diego, CA — Migraine

Last night a truck with LED lights triggered another painful, nauseating migraine. I used to love driving at night and going out late. Now every time I go out at night, I have a strong chance of triggering a debilitating migraine due to the blinding LED lights that flash and move with their vehicles. When cars hit bumps or dips, it makes their lights bounce which makes the effect so much worse. Please do something about this, at the very least, put a coating on the lights to dim their brightness

A.277 March 20, 2025 — Kuna, ID — Migraine

God save us 8-5 workers driving sedans in the winter. Never a workday I don't have to drive in the dark for my 1hr commute. I used to do delivery service a lot in recent years and it gets worse and worse every year with how blinding headlights are. Not a fan of showing up to work--a deskjob where I'm already staring at a screen all day--and feeling like I just had a fresh lobotomy. Can't even tell you how many times I've driven over road lines because I just can't see them while getting flashbanged then having a lingering sunspot center in my vision. It's ritual for me to keep my rearview mirror turned up and point my side-mirrors down just to drive safely... I hope one day Europeans won't have a good reason to keep laughing at how technologically behind our country is. >_>

A.278 March 20, 2025 — Manassas, VA — Astigmatism

I mainly drive on roads with many hills, bumps, curves, etc... You're going to get beamed no matter how "properly aimed" the headlights are. However, while I can quickly recover from halogens (high beams even) and still see what's ahead, LEDs leave me blinded for multiple seconds at a time and even cause headaches. Looking away does not work and even if it did, you're still driving blindly with no idea if there are obstructions, animals, or pedestrians ahead.

This is further worsened by the fact that Auto High Beams do not work. They do not respond quick enough and oftentimes flash high beams while there is still oncoming traffic.

Driving on highways, the guardrails also cause intense light to flash rapidly which is a huge health and safety hazard.

A.279 March 24, 2025 — Manheim, PA — Migraine

The headlights lately have become increasingly bright. I am a 45 year migraine sufferer and over the last couple years anytime I drive headlights are terribly bright and trigger a migraine aknots immediately or within 12 hours. It's really hard to drive when it's dark and sometimes even during the day because the extremely bright headlights. I Shoukd not be able to see with the headlights behind me lighting the way or blinding me coming towards me . I either have to wear sunglasses or cover my eyes (kinda a problem when driving) there was a newer dodge ram with headlights so bright that driving was almost impossible (oncoming traffic). I'm not sure who is regulating this but they surely must not be ever driving. I was told by the local government offices that they are after market

lights. That many people do not put after market lights in their cars. There are so many incidents of bright lights

A.280 March 24, 2025 — Springfield, OR — Electromagnetic Sensitivity

LEDs are disruptive and they are found everywhere, from your very own personal factory car to the street lamps on every street you journey. I for one am tired of the blue lights that I have been told are "broken" in my own township of Springfield, OR.

No one seems to care that something that is considered "broken" has gone unfixed. I have shared my concerns with the local officials, anywhere from the Mayor's chat on Instagram to directly contacting our local electric company, SUB, who is in charge of them. The message is "we're working on it", "be patient with us", "this was approved", "it's gonna be fine", "we'll fix things when we can". And here we are two years later and the "broken" blue lights have remained.

These lights on cars cause me night blindness, force my husband and myself to switch between brights and dims as a way of expressing to other drivers on the road that were are considerate of other drivers--it's just our dims look like brights because our car is so tall (and this affects others even in the same kind of car as us). These blinding lights can cause accidents and are very dangerous for this reason.

I know that blue light affects people because it affects me. My mood shifts to somber and dull. I feel ill and just want to get away from the area as fast as possible.

These lights must be removed and we want our soft yellow incandescent bulbs back that do not cause the light pollution that these bulbs have caused our civilization to suffer. Remove all the LEDs and even outlaw their production, as they cause more harm than good to every person who comes into contact with them.

A.281 March 26, 2025 — Donalsonville, GA — Astigmatism

My neighbor keeps her led amber patio lights on 24/7. Even after she knows they bother me, knows they keep me from seeing the sky for sky watching, the lights spill into my yard and into my kitchen. I've had to put up curtains and shades to block the lights. She told me at first she was forgetting to turn them off. I told her they are "not bothering me", but is she were to remember that'd be fine. She never remembered. And the light just seemed to get worse as time went on. Which is now about 6 months. Now she knows they are a nuisance to me, but she has ignored my letter to abate. She took the letter and threw it back into my yard, like a child would do. She is fully aware that her lights are a nuisance but has become increasingly hostile. When I mentioned earlier incidents she said, "doesn't know what I am talking about" like a Narcissist. I think she enjoys bothering me. But I am about to call the code enforcer and considering small claims court. I have taken pictures of the outside and inside my kitchen to show the extent of the light pollution. I've mentioned my eye health to her on several occasions. She's been in my house and has seen the curtains and shades. She is obtuse to the fact that I don't like confrontation and will you please take a hint. But she never does. When I did finally confront her she was in denial and hostile. I am 66 years old with astigmatism and cataracts. I like the dark rural area I live in. My eyes are very sensitive to light. Thank you for letting me vent. Today I talk to the code enforcer.

A.282 March 26, 2025 — Greensboro, NC — Photophobia

Certain bright LED lights, particularly house flood/security lights and car headlights, give me an instant headache behind my eyes. These headaches last anywhere from 30 minutes to 2 weeks. These headaches are not "psychological "; I've been evaluated by several doctors and my condition is 100% real. I'm not quite sure what's causing my photophobia, it might be migraines and dry eyes. The common belief that "led lights are flawless and superior" is completely false. These lights emit way too much blue light and have a bad flicker. Incandescent lights are more expensive because, like expensive healthy food, they are good for us.

A.283 March 29, 2025 — Melbourne, Australia — Other

Unfortunately, I will not be going to the Australian Ballet or Opera Australia performances any more due to the after effects of the LED (not strobe) lighting from the stage which shone into the audience. I am neither epileptic nor autistic but suffered vertigo and vomiting after one performance and

nausea and headaches after their next performance even though I covered my eyes when any LED lights shone from the stage. Apparently, vertigo and vomiting can be induced by LED torches called “Sick Sticks” or “Vomit guns” that are used for crowd control in some jurisdictions. Does this happen to other people? It is disappointing that this is going to have a negative impact on my life if I am unable to attend other forms of live performances.

A.284 March 30, 2025 — Mauldin, SC — None

I no longer find it safe to drive at night due to the blinding LED headlights of oncoming traffic. I refuse to drive on roads that I am unfamiliar with at night. I hate that it limits me traveling even short distances at night. I am 43 years old, no vision problems as of yet. However, these damn bright headlights sure make me feel like I have major vision problems on the road after dark. Something's gotta give!

A.285 March 30, 2025 — New York, NY — None

I had to stop driving at sunset! One evening driving at night I came to an absolute standstill due to the headlights in the opposite lane.

A.286 March 31, 2025 — Cedar Lake, IN — Migraine

I am only 20 years old but I struggle so much with driving at night or on a cloudy day. Basically every single car (since they all have LEDs) blinds me as they drive past. Just looking at the side of the road doesn't work for me. It is impossible for me to see the road or anything else when there is a car with LEDs. It comes at me from cars driving towards me, through the rear view mirror, and the side windows. Also, the flashing LED lights for ambulances/police cars at intersections make me feel nauseous and like I am going to get a migraine. I have suffered from migraines for many years, so I am light sensitive. However, the LED lights are the worst thing for me during the day and night time.

A.287 March 31, 2025 — South Saint Paul, MN — Migraine

Light-triggered migraines with aura, I'm effectively blind for and hour following exposure, then typical migraine symptoms for 1-2 days. Have been restricted to side of road or parking lot unable to return home until aura passes. Headlights and some streetlights and home lighting trigger events.

A.288 March 31, 2025 — Southwest Harbor, ME — Other

I can barely drive during the “dark winter”. In Maine at Christmas time, dusk starts around 3:30. It is particularly difficult at Christmas time to drive. I am blinded. I did buy those “yellow glasses” that you can buy and it definitely helps, but it makes it difficult to wear my prescription glasses. I do not have to wear my prescription glasses legally, but I prefer to see as well as I can. Next year I don’t plan to go to Christmas events because I am so blinded by oncoming lights

April 2025

A.289 April 1, 2025 — Baltimore, MD — None

Not only are exceedingly bright and misaligned LED lights physically painful to my eyes, but the blinding glare from both oncoming cars and cars behind me make it so that I am unable to see properly while driving at night. It is genuinely dangerous. I have tried everything in my own capacity to diminish the effect of bright headlights on my ability to drive at night, such as changing lanes when possible, averting my eyes and focusing elsewhere on my surroundings, and changing the angle of my own mirrors. These solutions work minimally to alleviate the brightness issue and are dangerous to have to implement. In my Honda Civic, which is not an excessively low to the ground sedan, the majority of other cars I encounter on the road either have lights that are too bright or lights that are pointed directly in my eyes, and frequently both. The intensity of headlights needs to be regulated and the appropriate alignment of headlights needs to be enforced. I'm 24 years old and I have to avoid driving at night. It shouldn't be that way.

A.290 April 1, 2025 — Oceanside, CA — None

On my commute for the past 3 months, once sunset hits, all the bright led lights beam my face on the opposite side of the road , obstructing my vision. Basically the intesection of the main hwy is just a sea of bright lights that I sometimes duck my head under.

Oh and don't let it be some a hole behind you on the express way ... I've had more than a number of jerk drivers beam me from behind (one time is was for a legit reason)) but seriously who tf are these wanna be cops with their bright lights. At this point, I use anti glare shades or just beam my beams bac at them bc why not....

A.291 April 2, 2025 — Newman, MA — Astigmatism

I struggle with astigmatism and migraines. It is hard enough as it is to drive at night with these two setbacks but the LED lights make them considerably worse. LED lights are extremely ignorant and cause so many people distress and harm. I used to enjoy driving at night as a sense of peace and calm and now it causes me extreme distress and strain on my eyes. I have almost gotten into many accidents due to coming around a corner and these lights blinding me. If I have to drive at night, it comes to the point that even the lights behind me are so bright that I have to turn my side mirrors out of my sight or darken my rear view, which is not very safe either. Please make some sort of regulations for headlights or ,yet I say, ban these lights and bring back the soft yellow lights for everyone's safety.

A.292 April 3, 2025 — Mountain Home, AK — Autism

There's a newer model large truck that has very very bright led headlights. I dread running across him every weekday morning. One time I flashed my halogen headlights at him and he flashed his back and that's how I realized he didn't have his bright lights on, it's just his normal lights that are very very bright.

A.293 April 7, 2025 — Albany, NY — Photophobia

I have to drive, day and night, with one hand blocking my view of oncoming traffic. Sometimes I have to tilt my rear view completely to the side because up is not enough. I have debilitating migraines and laser to prevent narrow angle glaucoma. SUV, trucks and car of certain manufacture almost continuously assault my neurocortex. The terror and anxiety I experience driving decreases the quality of my life and I'm certain I will die or kill someone from being visually impaired by others cars. LED lights are a great a public health concern for all on the road as drunken drivers and car manufacturers must be held to account before further lives are lost and the precious ability to see and drive, walk safely is compromised. In the name of goodwill of man to man, all measures must be taken to stop the blue white fatal hellscape LED has made the roads

A.294 April 7, 2025 — Bremerton, WA — Autism

For the past seven years I've worn sunglasses when outside of my house, even at night due to prevalence and ubiquitousness of blinding LED lights on cars, my neighbor has an LED floodlight without any kind of diffusing, a blinding LED streetlight has replaced one of the older bulbs in the streetlights on the road outside of my house.... I'm living in an unregulated LED hellscape, the only relief for my eyes is not wear sunglasses at all times when outside of where I have direct control over all the lighting

A.295 April 7, 2025 — Brookings, OR — Electromagnetic Sensitivity

[My neighbor's] light, lights up my house and property. But instead of being a good neighbor, she defamed me on TikTok.

A.296 April 7, 2025 — Chicago, IL — Migraine

Oh my God where do I start everyday we wake up we have to deal with this it's affecting our mental health and our vision today on the way to work there was a guy behind me I slow down to let him pass he pulled up closer to me put on the extra super bright the lights that were on were already bright and he sat there behind me then he pulled up next to me and looked at me so now people are using it as a weapon they don't care there's no kindness or compassion there's no relatability to anyone else all that everyone is self-centered with these lights and this issue the ones who won't take them off in the daytime or you know when someone's coming towards them which they don't need amount of the day that's pretty stupid it shows how dumb society's gotten so now it's becoming more dangerous for me to travel the police here are not doing much I believe there's some laws in place in Illinois there's something that I found and I'm going to show it to them and they keep saying I know I know but they

don't do nothing laws are not good if they're not enforced it's going to turn the violence if it hasn't already

A.297 April 8, 2025 — Livonia, MI — Other

Had to go shopping yet our local Meijer here in Livonia on Middlebelt and Schoolcraft. I'm in the pet department looking for charcoal for our fish tank and Within minutes, I start getting this irritating, mild thumping pain behind my eyes. I'm thinking I'm having a stroke or something like that but The same thing happened to my wife a couple weeks ago and she realized the lighting so I just got out of there, reported it to the manager, and he kind of laughed it off.

A.298 April 8, 2025 — Orem, UT — Astigmatism

I was driving from Idaho to Utah after a family reunion. I was going through a mountain pass when all of the sudden, im blided by a line of LED headlights. I side swiped the concert barrier, not only damaging my car, but it made it difficult to pull over and assess the damage. It of course doesn't help with an astigmatism, but even with special glasses for it, LED headlights make it worse. I have to call my insurance tomorrow for the damage for my car because car companies don't give two shits about the drivers.

A.299 April 9, 2025 — Washington, DC — None

Not yet an incident - you need to get this out on every instance of the Nextdoor app in every city. Get more signatures!!

A.300 April 16, 2025 — Cincinnati, OH — Other

Today's automobiles, specifically SUVs made by Toyota, Hyundai, Kia, Honda and Acura have headlights that are WAY TOO BRIGHT!! When these vehicles come at you on a dark road, their light spread is literally blinding and especially on a rainy night, this has almost caused me to have a crash several times and always I'll see spots for several minutes after encountering one of these cars. I've noticed vision problems as well as increased frequency of headaches as of late and I have changed nothing in my lifestyle other than having greater exposure to these lights. And we shouldn't forget that the light bars on police vehicles and tow trucks are also retina-searing bright. We can see a flashing incandescent beacon on one of these cars from plenty of distance at night. This needs to be a class action suit against the auto manufacturers or the lamp manufacturers.

A.301 April 19, 2025 — Kalispell, MT — Autism

I'm tired of being blinded in the middle of town, day and night, with drivers in cars that are completely oblivious (or malicious) to the danger and pain they are causing others. I have had to stop dead in the middle of the road out of fear or driving off the road. Adaptive headlights are not a perfect solution, and after-market installs with no regular checks to ensure safety are putting so many people in danger. I had to quit my driving job because of the physical and mental toll this has caused me. I used to love driving at night, now I can't stand it. I wish someone with the power to make a change even cared.

A.302 April 19, 2025 — Key Largo, FL — Other

Health issues aside, to which there are many from LED's, there needs to be standardized warmer lights for our country at night. All the new vehicles with 5000 or 6000k lights are ruining our experience and our atmosphere. It is completely alien, cold, and soulless. Night driving used to be a beautiful experience. Now it looks like morgue lighting. Its an atrocity to the sensibilities of life on earth. It is damaging to our circadian rhythms and nervous systems and needs to be stopped. Please place rules on car manufacturers and cities to go back to warm lights.

A.303 April 19, 2025 — Salisbury, MD — Migraine

Bright LED lights triggered migraine started around 9:09 pm tonight after driving home from grocery store. These bright lights are ridiculous and cause "floaters" shortly after returning home I felt a headache coming on.

A.304 April 25, 2025 — Humboldt, TN — Other

Unable to see officers without reflective gear during accident events. Corner Mitchell and East St 1730.The officer had 3 units with Blinding strobes behind him. Washing him completely out of view in low light conditions.Especially for drivers of vehicles low to the ground. And Multiple units on site from other directions with Blinding strobes.

A.305 April 25, 2025 — Iselin, NJ — Other

I had optic neuritis and now have a blind spot in my left eye. Today I went into a department store and the flickering was so bad from the LED lights that my eyes started to flutter uncontrollably. I have never had this happen before today. I just happened to be under a flickering led light. They are awful, and I have trouble seeing with them.

A.306 April 25, 2025 — Wynantskill, NY — Other

Street light is EXTREMELY bright. Lighting up whole side of house flooding into rooms including two bedrooms. Interrupting people and pet natural rhythms . Hard on the eyes when walking and driving. Noted increase in agitation an anxiety. Town said they added light because kids were waiting for bus in the dark. Simply not true. At no time are kids waiting for bus in the dark (bus picks up kids after 7am). There has been little to no crime in this area for the 30 + years we've lived here. 3 generations of kids (including mine) have picked up the bus at that corner with no problems or concerns. A single recent new resident (who happens to be friends with the town supervisor) asked for the light to be installed. The other 3 residence on the corner do not want or see a need for the light. The other street light on the road are considerably less bright and are positioned over the road (not facing houses). There was no notification, or opportunity for discussion/debate on the installation. I wish there was a way to include a picture, Seeing research where this type of light has health implications which is concerning and stressful.

May 2025

A.307 May 3, 2025 — Seattle, WA — None

Blinded by lights in traffic, rendering inability to see where I am driving. Pain and danger. Even own rental car lights reflecting off of car in front of me blinds with daytime running lamps. Cannot turn off and end up having to slow dangerously on freeway.

A.308 May 5, 2025 — Chicago, IL — Electromagnetic Sensitivity

OMG where do I start?? Multiply this report for every day until this STOPS for GOOD!! We are living in a pure nightmare of torment and torture. We are being conditioned for insanity and violence. These lights have a strong effect on vision and brain and right now my head hurts as I saw the BRIGHTEST AND WORST EVER today!!! How are people allowed to harm us and use this as weapons!!???? What will we become??? Nothing done and it's getting worse and our freedom to drive is stolen at all times. This is just the beginning of worse. My sanity is almost gone.

A.309 May 20, 2025 — Kokomo, IN — (no category given)

These headlights give me a migraine every time. Whether it's a vehicle behind me, coming towards me, or in my line of vision at all. They blinding and definitely interfere with driving. I've had to pull over because of these. I just quit leaving my home at night. A migraine takes you down, fast, and for a couple of days. The so called safer visibility for the owners, well those are called "brights" to be used as necessary.

A.310 May 21, 2025 — Chicago, IL — Other

TODAY AS IN EVERY DAY!!!!! F*** my eyes!!! Seeing spots several super bright ignorants and NOTHING STILL being done !!!! They are conditioning us for insanity and violence. Why is the world doing this???????? I feel sorry for babies and animals who don't know NOT TO LOOK. Health is harmed and this is severely criminal by Feds and Automakers and Eye Dr's. ignoring this.

A.311 May 27, 2025 — Avon, MN — Astigmatism

I am middle-aged and have had keratoconus/astigmatism for at least 25 years. However, I have NEVER had so much difficulty with headlights as I have in recent years with the explosion of LEDs on

the road. Mind you, this is not just a night problem. I've already given up driving at night at this point. But DAYTIME driving is nearly intolerable as well, since these LEDs ARE ON ALL THE TIME. Although they are all too bright, some are very clearly worse than others, either because of their design or poorly placed after-market lights. Obviously, this is a regulatory FAILURE as our roads are a Wild West of mildly irritating to extremely glaring and dangerous lights with ZERO accountability for the offenders.

I wear layers of various tinted lenses to mitigate the problem, but for some lights, it is not enough. I often have to resort to holding up my hand to block the oncoming lights. This is obviously not ideal as it obscures a large portion of the road, but this is what you are forcing me to do. Add to that the tension and anxiety this triggers in me, and you have a recipe for increased accidents. ANGRY DRIVERS ARE NOT SAFE DRIVERS.

At this point, I don't dare take a job that isn't 100% work-from-home. You have needlessly constrained my options.

There was absolutely nothing wrong with incandescent headlights. LEDs are completely unnecessary, and manufacturers have been marketing these to Lazy Entitled Drivers. Serious regulation of these lights is LONG OVERDUE. Every day you fail to act, you are causing us harm.

A.312 May 27, 2025 — Woonona, NSW, Australia — Migraine

I have a condition which causes intense headaches and eyestrain when exposed to almost all OLED and, more recently, newer LCD panels (e.g. latest MacBooks), presumably due to PWM and/or PAR.

It has never occurred with CRTs or older displays. I have had extensive eye checks with multiple ophthalmologists, but they can find nothing wrong except mild astigmatism. The general diagnosis I have been given is "idiopathic migraines" and advice to "avoid such displays."

However, they are now everywhere. Apple, for example, doesn't make a single laptop or phone anymore that uses their older non-flickering tech. Other manufacturers are starting to do the same. There's no single flagship phone that doesn't use OLED with PWM. As my entire career has been built in IT, this is slowly becoming a huge concern. As the older hardware becomes outdated, breaks and becomes harder to find, I might find myself completely unable to interact with modern tech. I have written to accessibility teams at Apple, Google and Microsoft to ask for possible tuning options to no avail.

A.313 May 28, 2025 — Henrico, VA — None

Driving at night here is increasingly dangerous LED lights on any vehicle are 95% blinding to facing drivers. Many people drive with their bright lights turned on as well, it says if nobody is taught or educated how to drive anymore. So bright lights coupled with LED bulbs.. LEDs need to be banned that's the first step. The next step is to make sure every state mandates that lights be checked annually and pointed down towards the road. The third step is that every person has to know how to work the bright lights in their car and know when they should and should never use them.

A.314 May 30, 2025 — Milton, DE — Migraine

Our Small town in Milton Delaware has begun installation of LED lights on our residential streets. There’s lights are cause sleep disturbances and severe migraines. Walking the streets is like walking through a filly lit stadium. We live in the Broadkill River where birds migrate. We have all types of wildlife which will be negatively impacted by 150 W LED lamps.

June 2025

A.315 June 3, 2025 — Tomball, TX — Photophobia

My husband can't safely drive at night because of the bright lights. He often misses turns and scares me because he often has his mirrors turned away. I'm less sensitive to light, but I still have issues with lifted trucks ocassionally blinding me through my mirrors. When this happens, I literally can't see anything on the road and it's terrifying. This usually happens for 20+ seconds. Imagine not looking at the road for 20 whole seconds! Sounds dangerous, right?

A.316 June 4, 2025 — Fairfield, OH — None

Bright LED headlights are too bright for safe driving on the road. Every time a car with bright white LED headlights is driving behind me (either directly behind me or behind me in an adjacent lane), their blinding headlights reflect in my side mirrors and/or my rearview mirror and blind me. I have to switch lanes and/or speed up to put distance between myself and the LED car so I can see. Oncoming cars with LED headlights are just as bad. The lights come right at me and blind me. Many people driving cars with LED headlights do not know when to dim their lights. Often, they do not dim them at all, meaning that either they forgot their high beams were on or they only had low beams on to begin with and if the low beams are blinding me, that is a real safety issue. But even when oncoming drivers do dim their lights, it is often only once they have gotten close, because they do not realize that their high beams can blind people even far away. I have a really hard time driving safely when I cannot see the road, the cars, or the people in front of me due to other cars′ LED headlights either behind me or in front of me. I drive a high-seated car, a Ford Escape and cars of all sizes still blind me with their lights on level ground. It is way worse on uneven ground like on a hill.

I know I am not the only one who is blinded by LED headlights. I work at a restaurant and I often hear customers in the drive-thru complaining about the car behind them having their high beams on. When the offending car pulls up to the window, I let them know that their high beams may be on and they usually say they don′t have their high beams on; they just have LED headlights.

A.317 June 11, 2025 — Tulsa, OK — Astigmatism

Driving at night has become increasingly more dangerous for me. The glare LED headlights cause is blinding and even more so if it's raining. I feel like I'm driving blind when one of these vehicles with LEDs pass. It makes it hard to see medians, traffic lights, and pedestrians. Not to mention it hurts my eyes and my head.

A.318 June 13, 2025 — Bonney Lake, WA — None

Every single day I am blinded by white LED headlights. The worst ones will leave a burned in spot in my eyes for 5-10 minutes. And while I'm driving I am blinded for several seconds. Enough for hundreds of feet of blind driving and it's caused by these irresponsibly blinding headlights. Why can't we just put dimming and yellowing film on these headlights? Make it law.

A.319 June 18, 2025 — Chicago, IL — None

I really hope something gets done about the extreme bright headlights, I get totally blinded when I encounter one head on, just last night I was trying to turn left at an intersection and had to stay put til the car facing me was stopped also turning the other way , cars beeped their horns but I could not see a thing til the car turned. It a horrible feeling and only happens with very bright lights.

A.320 June 23, 2025 — Las Vegas, NV — Astigmatism

I am signing this petition because I believe modern LED headlights pose a serious danger to drivers at night. As someone who is required to drive after dark, I am regularly and severely affected by the intense brightness of these lights. I do not need to look directly at them to be blinded; simply being in their presence, whether from oncoming traffic or vehicles behind me, causes extreme visual discomfort and temporary vision impairment.

Just the other night, June 21, 2025, while yielding for a left turn, an oncoming vehicle's LED headlights were so overwhelmingly bright that I could not safely determine if another car was approaching and had to wait until the other car moved so I can "see". After making the turn, I continued seeing "afterimages", bluish spots that appear after staring at an intense light source, for three blocks. This is the same kind of retinal stress we were warned about as children when told not to stare at the sun or a light bulb to avoid permanent eye damage.

This is not an isolated event. Nearly every time I drive at night, I experience this blinding effect to the point where I feel it is unsafe to remain on the road. I have had to pull over or deflect light back at vehicles simply to maintain visibility at stoplights. Before 2012 here in Las Vegas, vehicles with such dangerous lights would be ticketed for failing safety standards and causing visual impairment to others on the road.

If drivers are legally prohibited from using high beams unless absolutely necessary, why are these ultra-bright LEDs permitted at all times? It feels like a double standard that prioritizes aesthetic or marketing trends over road safety.

I firmly believe that these headlights have contributed to the rapid decline of my vision. My astigmatism has worsened dramatically since I was forced to regularly drive under these conditions. The constant retinal stress and lingering afterimages cannot be harmless and may be causing long-term damage to countless drivers like myself.

I truly believe automakers and regulatory bodies should be held accountable for allowing such dangerous technology on public roads. At minimum, I would support serious restrictions and at maximum, I would support legal action against manufacturers for compromising public safety and health.

A.321 June 23, 2025 — Superior, CO — Migraine

I am prone to Migraines and have astigmatism. I moved about an hour away from my family for a job but still go visit for holidays, birthdays, or dinners. Driving home has become unbearable and puts me at risk of a migraine. My family has taken to planning things earlier in the day so I can drive home when it is still daylight out. Even then I will encounter cars whose LED lights are so bright they are blinding IN THE DAYLIGHT. How has this come to be?!?! PLEASE HELP!!

A.322 June 28, 2025 — Chicago, IL — Other

Worsened vision and spots after affect

A.323 June 30, 2025 — Santa Barbara, CA — Other

Incident report on Media due to lights causing death in Santa Barbara CA.....https://www.noozhawk.com/pedestrian-dies-after-being-struck-by-vehicle-on-calle-real-in-goleta/?utm_medium=email&utm_campaign=00a03ef2ba-EMAIL_CAMPAIGN_2025_06_23_07_50&utm_source=Noozhawk&utm_term=0_-00a03ef2ba-247218029

July 2025

A.324 July 6, 2025 — Oviedo, FL — Epilepsy

I have to constantly close my eyes where there might be flashing lights or cause me to avoid certain places which puts me in a down mood because I feel like I can’t even leave my house due to fear of having a seizure. It can be depressing since your social life is limited. I remember in the past being in a club and I had a seizure because they turn on their strobe lights. I wish they would just be banned completely since they are not good for the eyes and cause so much harm.

A.325 July 8, 2025 — Malden, MA — None

For years I thought all these people where driving around with high beams on!! I often find myself having a difficult time seeing after someone pulls in behind me with these LED lights. I'm thankful that I'm able to focus on the road but I now know others have not been so lucky. I don't even think most people are aware of thier bright head lights if they have them and when you're at the auto parts store you could easily buy a set of head lights that are WAY brighter then you'll ever need. Softer lights will definitely save lives and change them. I don't know how these bright lights are effecting wild life but if we're suffering, they probably are too.

A.326 July 10, 2025 — Vacaville, CA — Autism

I was at a restaurant when a woman at the next table turned on a device that was about the size of a cell phone, but had a ring of intense, blue-rich LED lights, acting something like a flashlight. I was struck directly by the LED lights, and a few seconds later began going into a panic and meltdown. I got up from the table and began breathing hard and made my way outside, and then collapsed to my knees and began crying.

A.327 July 15, 2025 — Sacramento, CA — Other

This July, 2023 study describes how an LED light can cause macular injury. (https://pmc.ncbi.nlm.nih.gov/articles/PMC10404656/). This report is contrary to the FDA's position that LEDs are benign and don't need regulation.

A.328 July 16, 2025 — Yuba City, CA — Other

My wife and I are in our 60s and the glare from LED headlights makes driving at night dangerous. Even looking at the fog line on the road isn't enough to mitigate the blinding glare on our rural two-lane roads. Pickup trucks, SUVs and Teslas seem to be the worst offenders. We do not have this problem with approaching vehicles using standard halogen headlights.

A.329 July 17, 2025 — Jacksonville, OR — Other

Driving home from the grocery store was blinded by LED lights from a passing truck. Roadway was two lanes, one in either direction... How anyone can conclude that intensely bright LED headlights are not problematic when they are temporarily blinding drivers, making driver avert their field of view, etc., is beyond me. What is wrong with this picture???

A.330 July 18, 2025 — Houston, TX — None

I was at a stoplight and a new truck pulled up and stopped behind me. The headlights were so bright in my mirrors that I had difficulty seeing ahead of me. I adjust the mirror inside for nighttime, but it wasn't enough the side mirrors, especially the driver's side was focusing the light into my eyes even while I wasn't using them. I adjusted them so that they were useless and I actually had to pull off the road and wait until I could see again.

A.331 July 24, 2025 — San Francisco, CA — Electromagnetic Sensitivity

I have nonionizing radiation sickness. I get migraines, sharp pains in my heart, heart and brain inflammation, it feels like a tight belt is strapped around my chest sometimes, I get full body inflammation, bloating, weakness, chronic fatigue, shortness of breath, muscle weakness, a feeling of hopelessness and desperation to escape this toxic environment, eye pain, floaters in my eyes, 'starburst' patterns of white light bursts when I close my eyes sometimes, hot and cold flashes, a sensation of being roasted in buildings with bright LED's, extreme thirst and need to urinate frequently in the presence of intense LED's.

A.332 July 29, 2025 — Chicago, IL — Astigmatism

BLINDED DAILY WITH SPOTS AFTERWARDS EVEN IN THE DAY!!!!!!!!!!

A.333 July 31, 2025 — Chicago, IL — Migraine

My place of employment has installed bright LEDs directly above and across from the service desk where I work, and I have had to call out sick due to migraines caused by them.

August 2025

A.334 August 6, 2025 — Cambridge, NY — Epilepsy

On Thursday, July 24 at about 11 am I was sitting on the front porch with my wife when a white Department of Public Works pick up truck drove by with its strobe lights flashing. This caused my wife instantly to have a seizure and during the seizure she fell to the floor hurting her arm, her hip and her knee. Fortunately the glass she was holding did not break when she dropped it. The DPW truck was travelling north. It did not seem to be related to any work going on on the street. I tried to make my wife comfortable on the porch and then when she regained consciousness I helped her into the front hall where she was at least safe from more strobing lights. It was several hours before she had recovered enough to speak, stand, or walk, and she was incapacitated with headaches and nausea for the rest of the day. We have spoken to the DPW, the Police Department, and the Village Board about this previously.

A.335 August 7, 2025 — Oakland City, IN — None

I was driving home and nearly missed a stop sign because I was unable to see it due to a police officer's headlights.

A.336 August 14, 2025 — Vista, CA — None

Within this month, there has been numerous incidents with those damn led headlights. They shine from either behind or taking them head on.Taking the LED headlights head on, made me pull over multiple times due to the fact that they're bright and blinding. I had to turn on the emergency lights one time when I was getting flashed both ways, one from my mirror and the other was from a truck. I thought I was meeting my maker due to the combination of how bright it was. These damn LEDs is just an accident waiting to happen, without studies, and proper research I want proof that LEDs don't harm the eyes physically or cause temporary blindness when driving.

A.337 August 18, 2025 — Chicago, IL — Other

PAIN IN EYES FROM SEVERAL EXTREME LED'S AT MY VISION. MULTIPLY MY DATE TIMES EVERY DAM DAY!!!!! MY VISION IS WORSE!!!!

A.338 August 23, 2025 — Hurley, WI — None

While looking left waiting for an extended period for traffic to pass before making a right turn on to a US highway on a darker cloudy afternoon, one semi with multiple, glaring LED headlights and one or two trucks passed by. Once I pulled on to the highway, I noticed that my vision seemed distorted a bit, and it lasted during the couple mile drive to work. Once I got back into the office, I noticed visual disturbances in both eyes, kind of a pulsating disturbance on the periphery of my eyesight and a blank spot head on. After about 1/2 hour of anxiety and closing my eyes, the disturbances dissipated, and I came to the realization that I was even though I was not looking directly into the bright LEDs, that the intense light likely got into my eye causing disturbances in both eyes.

A.339 August 24, 2025 — Edgewater, FL — Photophobia

I bought a home in a beautiful retirement community where we all have a lamp post in the small front yard we have. My neighbors have recently changed out their lamp post to LED lights with clear glass. Our lampposts are at eye level. I have Photo sensitivity where just a glance at an LED light burns my retinas, then causes migraine headaches for days. I thought I could live in this community for the rest of my retired life but now at age 70 I have to move somewhere safe. I am so sad, please bring back incandescent lights so I can live out my life without this agony. Thank you

A.340 August 30, 2025 — Portland, OR — Migraine

I am regularly blinded by LED headlights. This is problematic in the wintertime when the sun sets at 4:30pm and it rains nonstop.

A new issue has arisen, however. As LED headlights go out they develope a strobing effect similar to flouresent bulbs as they die. This leads to vehicles on the road with high intensity strobe lights. I suffer photosensitive migraines with an aura that interupts my vision, rendering me near blind. I've never been triggered by halogen bulbs, but the prevalence of LED headlights on the road has made driving dangerous to myself amd others. I, like many americans, am not so privledged that I can give up driving. My livelihood depends on reliable transportation.

As LED research brings in new data, such as macular eye injuries from short term exposure, as well as the higher sensitivity the human eye has to blue light wavelengths, it is abundently clear the FDA needs to reevaluate the safety of LED headlights. It is negligence on their part. We are 15 years behind the rest of the world in mitigating the dangers overly bright headlights pose.

That LED headlights strobe as they die, a problem not seen with halogen bulbs, is a clear and direct violation of the ADA, and if changes aren't made soon, A class action lawsuit is inevitable.

https://media.rac.co.uk/blinded-by-the-lights-nearly-one-in-four-drivers-think-most-car-headlights-are-too-bright-3166996

September 2025

A.341 September 3, 2025 — Smyrna, GA — Astigmatism

I was on a two lane road in the middle of the night, and it was foggy. I'm not sure if their high beams were on or if it was their regular lights (which is another issue. Your regular lights shouldn't be so bright that I think it could be high beams) but the headlights mixed with the haze of the fog made it so

bright that I basically had to come to a stop before I could proceed. I couldn't see the road! It was honestly dangerous because if someone was behind me I could have been hit since they wouldn't have been expecting me to stop like that, OR they might have been blinded by the lights too and not realized I was stopping.

A.342 September 4, 2025 — Chicago, IL — Other

OMG tonight while riding my bike down non busy side street 2 cars with BLINDING LIGHTS ALMOST HIT ME!!!!! GOD DAMMIT DO SOMETHNG NOW DO I HAVE TO DIE LIKE OTHERS???

A.343 September 5, 2025 — Sausalito, CA — Other

Our city replaced the warm lights of our street poles with LED. They stream into our homes and surrounding environment. I am working hard to try to get them to rectify this, so the light is no longer blinding me when I look out of my window (which is unavoidable considering how small my home is). I have PTSD and photophobia at times (sensitive to light). This gives me anxiety at night and mild headache.

A.344 September 9, 2025 — Woodland, CA — Autism

I went to the health clinic to have my eyes checked. The clinician had me put my chin on a chinrest in a device that they called an optomap. They then moved the machine around until a blue LED light entered my eye. I closed my eyes because it was too bright. The clinician told me that I had to open my eye. When I opened my eye, the blue LED light was aimed directly into my right eye from a few inches away. The intensity of the blue LED light caused me to leap out of my chair, yell profanity, wander down the hallway, fall to the floor and start crying. The health clinic then told me that the eye doctor refused to see me and they sent up a security guard and I was kicked out of the clinic.

A.345 September 12, 2025 — Washington, DC — Migraine

I have had issues with LED headlights for years - they're often so blinding that I can't see well when I drive on dark roads at night, and they leave afterimages for sometimes minutes after exposure, but today I had a specific incident that triggered a migraine, something that has never happened before.

I was in the grocery store's parking garage this morning, and an SUV across from me was backed into a spot with their headlights facing outwards, directly at my car. For some reason, they had both their LED headlights and their brights on, and they sat there without leaving for several minutes. I waited a bit and finally had to back out of my parking space into the direct light, and I unfortunately have an older car without a backup camera - so I had to look.

Not only did I have to pull over after leaving the parking garage to be able to see again and let the afterimages fade, but I also began to get a migraine about 10 minutes later that has lasted most of the day, making me unable to work. Drivers are by nature going to do irrational and strange things - but LED headlights are a serious health and safety hazard that needs to be addressed, either on the state or federal level.

A.346 September 13, 2025 — Parrish, FL — Astigmatism

I recently began a position where I commute home around midnight after working my shift at the hospital. I have had multiple incidents where cars surrounding me on the roadway either approach me from the opposite direction or pull up behind me with extremely bright LED headlights. These headlights are significantly brighter even than roadway lamps or any other cars' headlights. I find that my eyes are blinded to the point where I struggle to see safely see other vehicles on the road and certainly to see the vehicle itself and perceive its depth or distance from me. I wear corrective lenses and have perfect vision while wearing them, but feel these headlights pose a grave danger to other drivers on the road.

I also have noticed an increased number of roadway lamps that are purple or deep blue in color which are clearly LED lamps. They do not illuminate the roadway but in fact make the surrounding areas seem even darker. It is difficult to distinguish other vehicles and certainly pedestrians when these roadway lamps are used. It is drastically easier to see under truly bright lamps.

I worry that prioritizing cost-effectiveness of LED lamp bulbs versus roadway safety is ultimately a potentially deadly and terribly unwise decision.

A.347 September 14, 2025 — Copake, NY — None

Within the last couple of weeks I went from driving a small SUV to a low, flat wagon- both of these cars are from the mid 90′s. I live in a rural area where people have more dollars than sense, coming from both sides of the political divide. The villages and hamlets where we live are 20 to 30 minutes away from each other. Taking a route last night I′ve driven many times, I was tailgated by pick-up trucks, three in a row, all using bright-hot white LED′s. Since my new car is lower, I am noticing the problem more than before. I really, really could not see. The closer the tailgaters got to me, the more I had to slow down. For quite a distance there was nowhere to pull over. Finally, I let one of the trucks go around me. By the time I got home from what had been a pleasant evening, I was extremely stressed-out.

LED′s, in combination with grotesquely large vehicles, are contributing to an air of aggression and hostility, all hidden behind anonymity. With such enormous beasts at their disposal, people are given more power than they should have. Just because they have money, it doesn′t mean they should have the opportunity to dominate and ruin other peoples′ lives. We all share the planet together. There should be room for people who want to drive smaller, more sensible and economical cars. The auto industry is a shadow of its former self, existing only to serve its greedy ends. The idea that LED′s are here to save us from climate change is big, fat joke.

In a couple of weeks I′m supposed to start a job, two evenings a week, a half hour away. With shorter days coming, I am worried about the drive home. I already work one evening a week at another job, also a half hour away. None of my friends who are older drive at night any more. With each year I see the problem worsening. Automobile manufacturers must be held accountable for the enormous problem they have created. It′s dehumanizing and it′s disgusting.

A.348 September 15, 2025 — North Canton, OH — Migraine

I have both migraines and astigmatism. The lights caused me to temporary legal blind while driving, which is unsafe. Also makes it difficult to find where I need to turn

A.349 September 15, 2025 — Sacramento, CA — Autism

I was traveling North on I-15 between Sacramento and Woodland, when the traffic slowed due to a crash. As we approached the crash driving slowly, a CHP motorcycle suddenly came into view that was using auxiliary blue LED flashing lights. The sudden impact of the extreme-luminance light knocked me backwards into my seat. I grunted in agony, and closed my eyes. After several seconds, I squinted my eyes open again and kept my left eye closed to enable me to drive past the motorcycle.

A.350 September 17, 2025 — Poway, CA — None

The headlights of other cars are so bright I cannot see the road properly. In addition, the automatic switching to high beams is blinding and very dangerous. Who signed off on these lights without first assessing whether they decreased traffic safety.

A.351 September 18, 2025 — Woodland, CA — Autism

As I drove through town, I heard emergency vehicle sirens, and then I saw two fire trucks turn towards me with dozens of intense red LED flashing lights that overwhelmed my senses and caused me to stop my car in the middle of the road, close my eyes as tight as possible, and put my fingers in my ears. My heart rate increased dramatically and I went into a panic. I attempted to squint open my eyes, but it was impossible and terrifying. I waited for the sirens to fade and when I opened my eyes, I saw that traffic was backing up behind me. I pulled into a parking lot. Afterwards, I was like a zombie and it took me hours to recover from the trauma.

A.352 September 20, 2025 — San Francisco, CA — Electromagnetic Sensitivity

I stayed in a rural area with few LED′s to recover my health from radiation sickness due to high density LED′s in my city, San Francisco. Before I left SF, I could barely walk as I had little energy and my muscles were very weak. I had to drag my body to walk to the store. I′ve lived here for about 30 years. I walked briskly to the store all the years, until recently. I could tell they turned up the power

on the 5G LED grid because my symptoms became far worse and my download speeds became much faster. I had a hard time staying awake. If I drove ten minutes to the beach, I was zapped so much by the LED lights on the way, that I could only sit and sleep when I arrived. It was very tiring just to walk across the street to use the restroom. My body would be severely bloated, and I'd have a migraine.

I feel more energetic now, after a two week rest in the countryside.

A.353 September 23, 2025 — Chicago, IL — Other

Pain in my eye from all day and part of the night getting hit physically by white light like flares or welders my eyes actually hurt today that's how bad it was and I almost hit a couple with a baby walking across the street from all this stress of driving distraction not only does it kill our vision it just it's a distraction it's a danger and it's a crime and no agency is stopping a regulating this things will escalate and it's gotten much worse in Chicago it's absolutely horrible how people act here they don't even care about what they're doing they see it too and they just don't care people are not human anymore

A.354 September 23, 2025 — Lake Ariel, PA — Astigmatism

I am a commercial trucker and these headlights -especially the giant, ornamental displays that people with phallic sorts of size insecurity issues attach to their lifted pickup trucks- are a regular hazard every single time I drive after dark. Seeing road signs, approaching road hazards, stopped traffic, and pedestrians is impossible to many tens of thousands of truckers a few dozen times per shift, especially a shift when it rains.

It does not take a genius (not that this one particular iteration of our federal government is blessed with many of those) to figure out that dozens of accidents a night are caused by this issue, one whose contributions to accidents are routinely ignored by the responding officers. Hundreds of lives per year are undoubtedly lost or irreparably altered when an 80,000 pound truck's driver is rendered blind by people who need attention and by an auto industry whose commitment to safety is somewhat further down theist from "profit" on their list of priorities.

Everyone on every roadway is at risk of being killed by a truck because of these lights.

A.355 September 24, 2025 — South Lake Tahoe, CA — Autism

I attempted to walk down the third floor hallway to my room at the Hampton Inn in South Lake Tahoe. The hallway was filled with 3000K high-luminance LED lights that were unshielded. I felt like I was walking through a radiation bath. I covered my eyes, but by the time I reached my room, I was nauseous and entering into a panic attack. I was unable to stay at the hotel.

A.356 September 25, 2025 — Wasilla, AK — Photophobia

I was sitting in my friend's living room. A van pulled in the driveway. I was wearing my blue light blocking glasses, but I accidentally looked at the van when it pulled in. I accidentally looked directly at the light. I immediately got severe eye pain and a headache that lasted for several hours. My vision faded, as it does immediately with "white" or blue LED exposure. My doctors say I need to avoid lights that hurt me because it is causing my remaining vision to fade. "White" and blue LED lighting in public means I do not have access to public places, and the accidental exposures that come to me are causing me to become more blind.

A.357 September 30, 2025 — Tipton, IA — Electromagnetic Sensitivity

I am highly sensitive to the visible light radiation emitted by Light Emitting Diode ("LED") products and have suffered adverse reactions when exposed to many types of LED products. My adverse reactions include pain and tightness in my suboccipital muscles and neck, vertigo, dizziness, and migraines. This impacts my life negatively in limiting my mobility, and my work and home life significantly. Many regular activities are negatively impacted and are limited for weeks or months after significant exposure, or I can no longer participate in these activities depending the severity of the exposure.

October 2025

A.358 October 1, 2025 — Huntsville, AL — Other

Caused Stanley to have a car wreck coming down Monte Santo mountain in rush hour traffic, eye sight issues due to age however inside a curve these headlights cause complete loss of vision rendering the drivers in incoming traffic to be 100% blinded. It's unnecessary for drivers to be using extremely bright headlights which is stronger then high beams. Car flipped almost killing Stanley

A.359 October 2, 2025 — Mobile, AL — Astigmatism

These bright lights are so dangerous. While driving when dark out I am blinded for several seconds when these cars pass me or are in my rear view or while at stop light across the way from me. Then for several minutes my eyes struggle to adjust back to normal. These lights are seen on more and more cars making the issue even more dangerous. When being hit with this intensely bright beams I fear every time that I will drift into that car or off the road because every thing becomes white until the car or cars pass. These dangerous lights need to be banned for the safety of drivers.

A.360 October 3, 2025 — Los Angeles, CA — Electromagnetic Sensitivity

very bright LED lights in Costco in Inglewood. after half hour in the store causing headaches, dizziness.

A.361 October 7, 2025 — Kihei, HI — Migraine

These new LED lights have impacted my life in that I had to stop driving in the dark completely! Not just that suddenly being blinded by these lights can cause an accident, they also trigger migraine headaches for me.

A.362 October 10, 2025 — Pflugerville, TX — None

Over the last few years especially, super bright white LED headlights blind me every single night when I drive. I drive a lower car (Honda Civic), and when any newer car (especially Teslas, trucks, SUVs) is behind me, I need to not only turn my rearview mirror reflector on (fine, I guess…), but also need to cover my left eye due to the headlight reflecting in my left side mirror. It's not only really frustrating, but really dangerous. It feels like all new cars always have their brights on (not sure if they are actually brights or just normal headlights).

It would probably at least help if they were a warmer color, as the pure white light is much more blinding. But the brightness seems too strong as well.

A.363 October 12, 2025 — San Antonio, TX — Astigmatism

I have both astigmatism and autism. I drove to work the other day while it was still dark out, around 6:30am. I have a 1999 car, my high beams are nowhere even near these new cars' low beams!!! The amount of times I was blinded was insane. I was extremely anxious and was going a lot under the speed limit because I literally couldn't see and there was nowhere to pull over. I'm pregnant with my first child. It's extremely unsafe to have such blinding headlights on the road.

A.364 October 14, 2025 — Warren, NJ — Astigmatism

LED headlights in the cars driving in the opposite direction caused me to end up in an accident that totaled my vehicle. I was driving home from work after sunset on a road that has very few streetlights. So after passing another vehicle, it feels like (despite my own vehicle having partially-LED headlights) going back to nearly pitch black while my eyes adjust. Because of this 5 seconds of adjustment my eyes take to be able to see ANYTHING on the roads, I did not see a deer running across the road until it was too late to avoid it.

I have both astigmatism and light eyes so my vision is very easily effected by overly bright lights and how long it takes for my eyes to refocus after being blinded by lights. I am lucky that it was a deer that ran out and not a human because otherwise, I fear I would be in prison right now because of these headlights causing my accident. How many people currently are in prison for that, I wonder? How many children and adults will have to die or experience life-altering injuries for legislation to be put in place to protect them and all drivers?

A.365 October 14, 2025 — Woodland, CA — Autism

On October 14, 2025, at approximately 11am, I was traveling east on Gibson Road near Hwy 113. About 1/4 mile ahead of me, I saw extremely intense flashing yellow lights. The sky was overcast, creating a stark contrast between the ambient light and the LED flashing lights As I approached, I saw that the flashing lights were from a Woodland police vehicle, and that there were blue, red, and yellow flashing lights. The vehicle was in the right lane. To be able to navigate past the flashing lights, I closed my left eye, pulled down my visor, and raised my right arm. I slowed to approximately 10 mph and attempted to look straight ahead. However, when I was just a few feet from the police vehicle, I was struck by the intense flashing light from the side of the vehicle and felt a sharp pain in my eye, like a needle stabbing me. I yelled out in agony. I was able to proceed forward, but was left with lingering psychological trauma and I felt that I was in shock.

A.366 October 15, 2025 — Barron, WI — Photophobia

Blinding, pain. A police officer pulled me over, and was highly concerned that I could cause an accident by flashing my brights at him. He did not give me a ticket. If he is so concerned about this issue, they should change out their lights to the old halogen lights. He said that it's the new LED lights fault and there's nothing he can do about it. This is freaking America. Can we not do something to help people be able to drive at night without being blinded?

November 2025

A.367 November 4, 2025 — Lancaster, ON, Canada — Electromagnetic Sensitivity

I can hear the radiation. I know immediately when Laser Emitting Diodes are on. They screech at temperatures upwards of 5000. The tinnitus is my ears hearing the diodes. Blue spectrum, being THz radiation can cook skin, see through material, and when it goes through my walls or comes through the windows, those optical lasers that are being fired 20,000,000 times per second, burn my skin, bruising pain on my legs, the feeling of a tumor growing in my head(at different areas depending where it's coming from), instant what I would call temporary arthritis in my knuckles and hips, shoulders, and ankles, bone on bone pain in my knees, vertigo if standing, pain like needles in the eyes, burning of the eyes. I find my gums start to get super inflamed and the roots of my teeth are being cooked as well as my cheek bones. I lost one vehicle because the highway salt trucks had its entire back wall lit up with yellow LED completely blinding me. I don't drive anymore. Nevermind the fact that the American Medical Association put out an industry wide warning in 2016 that LED cause glioma, leukemia, pancreatic cancer, testicular and ovarian cancer, cancer of the eyes, and the list goes on. Nevermind that a prominent medical association in France concurred with their findings. And, of course nevermind the fact that a prominent Spanish medical association came to the same findings. .Radiation amplifies radiation. Add in RFR, infrared, altimeters, smart meters, NAV systems, towers. modems and baby monitors and you've got one hell of an electromagnetic invisible flux chaotic super smoggy storm. And people wonder why I am an insomniac!

A.368 November 6, 2025 — Vista, CA — Migraine

These bright LED headlights are out of control!!! I fear for my life when I'm blinded and can no longer see the road. I have to drive with sunglasses to reduce the strain on my eyes but this makes seeing pedestrian's and cyclists hard to see but the bright LED lights also make pedestrian's and cyclists difficult to see when I'm blinded by oncoming traffic so there's no winning in this situation. "Yellow night glasses" do nothing so I'm stuck with sunglasses and interior lights on in the car at night. I have accidentally gone over a median onto the other side of the road because I was completely blinded by the brightness of a supernova. I come home with migraines most nights. Ban bright LED headlights NOW!!

A.369 November 9, 2025 — Cincinnati, OH — Electromagnetic Sensitivity

I was driving home Friday night at about 7pm and it was dark and I was coming around a curve that also was coming downhill and was blinded by LED headlights and almost went off the road and down the ravine because of being blinded by the LED headlights shining directly into my eyes. Most of the time I try to look away which isn't safe when driving because they are blinding and completely disorienting and give me a headache, but when driving on curvy or hilly roads you don't have the option to just look away for a moment. These LED headlights must be banned in the name of safety

on the roads or you are going to cause many serious and fatal car accidents. Also, I was at my moms visiting for a couple weeks recently and was dealing with brain fog, fatigue, sleep issues, and severe anxiety. I couldn't understand why as I travel to my mom's house in the country to escape all the cell towers and Smart meters in the city. Then I discovered that she had LED light bulbs in her lamps that I was reading next to all the time. These lightbulbs emit RF radiation and damage the eyes and brain and irritate the nervous system with their constant flickering. You must bring back the old incandescent bulbs and make them affordable for everyone not just the wealthy.

A.370 November 11, 2025 — Davis, CA — Autism

I was driving and came to a stop at a traffic signal, about three vehicles behind a fire truck. Suddenly, the fire truck turned on several extremely intense red LED flashing lights. The sudden shock caused me to scream in agony, and then a few seconds later I began crying uncontrollably.

A.371 November 11, 2025 — San Francisco, CA — Migraine

Driving ~45 minutes at night in the city gives me blurred vision and headaches for the next several days due to the intense lights, especially the LED headlights shining into my eyes. It also feels very dangerous as the hills in San Francisco often cause car headlights to shine directly in your face. Walking in the city at night similarly bothers my eyes because of the intensely bright street lamps.

A.372 November 13, 2025 — Jackson, CA — None

It's made driving home in winter nerve-racking and dangerous. It's dark and rainy and the opposing traffic has leds and the traffic behind me have leds. I can't see. I just can't. Today I totally lost the lines and 100% could not see them. I'm scared. I can't keep driving out here like this. I'm gonna get killed by these headlights.

A.373 November 15, 2025 — Burbank, CA — Electromagnetic Sensitivity

Frequently when driving on long trips at night I encounter drivers with extra bright lights. If they are close enough to me I and up getting blinded and I find it impossible to safely change lanes to get free of it. Most recently this happened on a return trip from seeing my mother.vvits a long trip, but it's important that I visit her as my father has passed on and she needs more contact with family to stay healthy.

A.374 November 15, 2025 — Sacramento, CA — Other

Purchased home 1984 and for over 30 years street light shared with next door neighbor providing wonderfully bright, safe, non-intrusive lighting. Then we received notice in the mail around 2015 that new LED lights would be installed on poll replacing old (working just fine!) incandescent bulbs. The project throughout our suburb and beyond took 5 months to reach our street with 3 such light polls covering 18 houses. Every resident shocked how much less coverage and less bright the LED lights were. Less than 50% as bright as before. Effectively they are useless as far as night time safety purpose and if polls were completely removed no one would hardly notice. Another failure by government do-gooders who ruin as much as they improve things.

A.375 November 16, 2025 — Adrian, MO — Astigmatism

I hate these bright LED blue headlamps and street lights they are extremely blinding and distracting and create hazards when driving. I drive at night for my work and this puts a big strain om my eyes. Many times I have to stop and let oncoming traffic pass by on 2 lane blacktops because I can't see. Also it causes me stress when cars approach me from behind with these car lights and I often have to speed up to get some distance between my car and the vehicle behind me just so I can see and get away from the lights reflecting in my mirrors. This could put me at risk for an accident because often deer and other animals cross the road at night. I hope the industry examines the hazards associated with these type of lights and puts consumer safety first.

A.376 November 16, 2025 — Anonymous — (no category given)

Blinding light. Complete vision obstruction. Crossing a four lane interstate and stuck in the middle to cross the highway. I couldn't see a thing as a trucks lights blinded me at the stop light across the hwy! This is a busy highway. I had to sit there blocking traffic east and west. I wasn't about to pull out onto the hwy and cause a tragic accident. As the truck inched forward I put my hand up and covered my

eyes enough to get across. I was so shook up I had to pull into a business lot and calm down. LED LIGHTS ARE LIKE HAVING an LED FLASHLIGHT POINTED RIGHT IN YOUR EYES! It's also abuse to anyone with the slightest vision impairments. You can no longer drive at night and could actually run a pedestrian or bike rider over. You cannot SEE! ESPECIALLY if trucks with lift kits DO NOT ADJUST THEIR HEADLIGHTS! Yes, people are that dumb! Very dangerous! Also our neighbors lit their front yard up like a prison with LED! THEIR YARD LIGHTS LIGHT UP OUR WHOLE HOUSE INSIDE! WE HAVE TO SHUT ALL OUR BLINDS AND CAN NO LONGER ENJOY THE STARS AND MOON! I despise LED!

A.377 November 16, 2025 — Anytown, AL — (no category given)

Blinding LED Lights on vehicles causing severe dangerous vision issues while meeting oncoming vehicles on roadway

A.378 November 16, 2025 — Centreville, VA — Astigmatism

I only have a minor astigmatism in one eye, but the LED lights in modern cars are so bright that the glare can completely obscure both the lines on the road and potential pedestrians/obstacles. I find myself squinting and physically lifting my hand to block the worst of it, especially when a large truck is either right behind me or included amongst oncoming traffic. Driving in the DMV area is dangerous enough with the number of cars on the road. There is absolutely no need for these intense blue/white lights.

A.379 November 16, 2025 — Chico, CA — Migraine

Eyes are burning. Eyesight is deminished and compromised. Blurred vision. And migraine headaches. Headlights are blinding, and cause burning in eyes. Cause migraine headaches, and insomnia, lack of focus and confusion. Thank you!

A.380 November 16, 2025 — Clearwater, FL — Other

There were lights installed on the causeway between Largo , Florida and the Belleair Beach area. These new lights had a purplish color and I looked that the lights a strong nausea turned on. This nausea would stop if I looked away. These lights were eventually changed back to the normal color and no nausea occurred when now looking at the lights.

A.381 November 16, 2025 — Fairbanks, AK — Other

Floaters in my left eye have appeared almost instantly after installing led desk lighting along with headaches that I never get. Please bring back incandescent lighting. Bring back our "Fundamentals " please. Thank you

A.382 November 16, 2025 — Faribault, MN — Other

Diabetic

A.383 November 16, 2025 — Las Vegas, NV — Other

Overt light pollution..effect on eyes when driving at night..blinding lights from on coming traffic..also blinding from side view mirrors..making me see spots at times after being blinded..makes for unsafe driving conditions. Highway patrol lights have the same affect..at time even worse if strobes are in action..these lights present a hazard to all driving the roads..they shall be illegal on vehicles..

A.384 November 16, 2025 — McGregor, MN — Migraine

They are horrible and getting worse every day. I have to drive more at night now and there and too many cars with headlights not angled down or too bright of an LED light. It is to the point of constant headaches and dizziness while driving which is unsafe as I drive my children

A.385 November 16, 2025 — Peabody, MA — None

Since the bright LED have been put in cars I can no longer drive at night. I have been blinded by the light and white knuckled the steering wheel until car or cars pass. The combination of the rain and blue lights is so dangerous for my vision I won't go out. I do not have this trouble with the older yellow lights. I also have tried using LED book lights, the strobing makes it difficult to use and generally wait for the daylight.

A.386 November 16, 2025 — Readington, NJ — Astigmatism

They installed led lights in my favorite library. The overhead light is so bright, I can't read the spines of the books on the shelves. It hurts my eyes and gives me a migraine to even look toward the shelves. I need polarized sunglasses to enter the library!

A.387 November 16, 2025 — Scappoose, OR — (no category given)

The new LED lights on cars are horrendous, way too bright, which impacts visibility and driver safety. Makes it way harder to drive at night. I have been forced to wear slightly tinted sunglasses at night when I'm driving . Also, I work at a hospital and they decided to put bright white LED lights in the laboratory I work at. They are 3 to 4 times brighter than the old lights. I know this because I brought any Lux meter and tested them . I made complaints to management and they did nothing . Since the hospital has installed these new LED lights I have had to have special prescription glasses made with slightly tinted lenses so that I can make it through the work day. These lights cause me fatigue ,irritability, severe eye fatigue, nauseous, headaches, anxiety. I come into work feeling great and by the time I leave I feel extremely tired and fatigued. It's getting to the point where I'm starting to think about a new career. Please do something about these horrendous lights , they are not good for us!

A.388 November 16, 2025 — Walnut Creek, CA — Other

I've noticed two things. 1- I can feel a negative effect on my skin. Feels very hot almost like I'm under a food warmer at a restaurant. Two- I listen to am radio at work daily. When I turn on the led lights in a house the radio goes static. I believe these led lights cast a frequency that interferes with the am signal. Since the human body is made of frequency and chemistry there must be an effect there!

A.389 November 16, 2025 — Wappinger Falls, NY — (no category given)

Cars behind me while driving emitt such high light output onto my side mirrors it is literally blinding. Unable to see oncoming traffic. Also oncoming traffic especially in rain or snow. Studies show amber light is better and doesn't reflect so much.

A.390 November 16, 2025 — Westminster, CA — Astigmatism

Every time I drive at night, I have to either hold my hand OR a piece of cardboard in front of me to avoid my eyes from being accosted. When my eyes are exposed to this overly BRIGHT light, they cannot adjust fast enough to the night. Is this safe? PLEASE rethink these hazardous lights for driving. Example: when you have your eyes dialated...do you go right out into the sunlight? NO of course not.. you wear protection, sunglasses! So now you are requiring us to wear sunglasses at night!!! Because of these hazardous lights, our freeways are having to raise the height of the center dividers. The COSTS of this could have been better spent on pavement refurbishment

A.391 November 17, 2025 — Austin, TX — Other

I try to avoid driving at night. Every time a newer vehicle is driving toward me I am unable to see the road in front of me, and am still somewhat impaired after they have passed. I have to literally shield my eyes with my hand and look down and follow the yellow line to stay in my lane, praying nothing happens on the road in front of me such as a stopped car, or wildlife passing in front of me ... until I can "see" again after my eyes adjust from "glare blindness".

When a vehicle, especially a pickup or commercial truck is behind me, I have to flip my rear view and readjust my side mirror so the lights are out of my eyes since it's very blinding to the darkness outside my windshield. As you might imagine, that makes it very difficult to drive safely. It's blinding and i can't see what's in the darkness next to me. This is especially problematic driving at night in the country or suburbs. There needs to be a limit on the lumens allowed for lights on cars and get rid of these blinding blue white lights!

A.392 November 17, 2025 — Edgewater, FL — Migraine

My neighbor across the street used over 200 LED lights on his home to decorate for Christmas. I have photo sensitivity and get migraines from the exposure. I have spent hundreds of dollars trying to protect myself and have failed. I had to sell my home and bought a home with an empty lot across the street.

A.393 November 17, 2025 — Knox, ME — Electromagnetic Sensivity

The intensity of LED car headlights is so dangerous it's caused me to avoid driving at night if at all possible. And LEDs at home are equally disturbing; the flicker and depth of the blue/white light cause me to lose my balance and feel as if I'm falling forward. I've been experiencing the dizziness for several years, about the same time we were forced to convert to LEDs. Docs have said it's a thyroid condition. I work at a historic preservation site and we only use incandescents there (when we can get them) and I find the rooms w/incandescents are MUCH more comforting and relaxing to be in. All in favor of incandescents! Thanks for the opportunity to say.

A.394 November 17, 2025 — Los Angeles, CA — Migraine

LED's are destroying my life. I'm struggling driving at night. Car's are blinding, trucks strobe, & it's making night time driving nearly impossible. People can't see half the stuff on the road & it's making life very difficult. Cheap LED lights are being advertised as "flicker-free" & they continue to flicker all across the worsening state of California. These lights are making it impossible to continue every-day tasks at night, giving my husband & I migraines, & destroying every walk of life. Having an astigmatism doesn't help in the slightest. It's making our lives, family, & friends miserable on a daily/nightly basis. I thought this was a problem on the west coast, & it seems to be affecting every walk of life in the United States. So happy you guys started this foundation to speak for those who are struggling with the extremely harmful effects of LED lighting. Just know, you are all not alone with this issue. Let's get this problem solved together!

A.395 November 17, 2025 — Rockwood, TN — Migraine

LEDs cause significant impact to my life. It is very difficult to drive at night with the LED headlights being too bright and causing dangerous situations as my eyes readjust. In addition, the large LED lights on the side of the road are a safety issue. Please consider a step forward so the nights are safe for all of us.

A.396 November 17, 2025 — Tucson, AZ — Photophobia

Way too bright LED lights in car behind me were affecting my ability to see additional vehicles in all three lanes traveling in my direction.

A.397 November 18, 2025 — Belpre, OH — Photophobia

The bright white LED headlights and streetlights that are everywhere now have made night driving genuinely miserable for me. They're painfully intense; when a car approaches, the glare floods my vision, forces me to squint or look away, and leaves big streaks across my eyes that take far too long to fade. Judging distance and speed is so much harder—oncoming traffic often looks like a wall of light instead of individual vehicles, which makes pulling out or changing lanes feel risky. One direct hit from those headlights completely trashes my night vision for minutes afterward, leaving everything else in the dark looking blacked-out by comparison. It's not just annoying anymore; it's stressful enough that I now avoid driving after sunset whenever I possibly can.

A.398 November 18, 2025 — Saint Petersburg, FL — None

While riding my motorcycle home a pickup truck entered the roadway behind me. He had a light bar that spanned the entire width of the truck on the roof, and a SECOND bar on the hood. Had all of these lights on behind me. I was blinded and literally could not see in front of me. The glare in my mirrors was so bright it interfered with my vision, which caused me to start losing balance and tipping over because I could not visually orient myself. I had to change lanes and focus my vision on the curb next to my front tire, release the throttle and slow to below 30mph and let him pass. Despite him passing, I'm seeing spots due to the brightness I experienced and had to continue another 2 blocks below 30 mph until my eyes adjusted again from the massive glare. VERY dangerous when riding on 2 wheels. (Wondering who will say it is my fault for choosing to ride on two wheels instead of four).

I understand that we are allowed to accessorize our vehicles as we want, but why is law enforcement not stopping vehicles that have such bright lights? We need laws to keep people from using these flood lights on the road, keep them for off-road all terrain use, as intended. Our APPOINTED OFFICIALS need to pass legislation that will help to keep all drivers safe.

A.399 November 20, 2025 — Anytown, WA — Other

I received a free LED light bulb from my power company a number of years back. I installed it into a lamp to try it out. After one hour I had a headache. And I NEVER get headaches. Removed the LED light bulb, reinstalled an incandescent light bulb, end of problem. Years later and I have not yet again had one single headache due to my lights. I refuse to put LED bulbs into my house.

A.400 November 20, 2025 — Danville, IL — Astigmatism

These LED headlights are blinding, I already see halos from lasix and astigmatism so these headlights make it very difficult for me to see at night. From the front and behind me reflecting in my side mirrors it is very dangerous. I have to limit my driving at night because of it. They need to be banned!!!

A.401 November 20, 2025 — Janesville, WI — Migraine

Simply driving to a friend′s house in the evening caused me a migraine. This is very unsafe on the road, and it ruined my evening.

A.402 November 20, 2025 — Lugoff, SC — Migraine

On country roads at nights, the blinding effect of SUVs, crossovers, and trucks is exceptionally terrifying. I have to squint and try to avert my eyes to the white line right above my car′s hood to be able to continue to see the road any time another driver with ultra bright LED lights comes my way. I also have to position myself extremely uncomfortably when there is a vehicle behind me with ultra bright lights just to prevent the lights from coming in through my side mirrors. When I was a new driver, this situation only happened infrequently when driving in front of an oblivious driver that left their brights on. I physically hurt from cramping up my body and squinting my eyes on my commute home from work. I get migraines. I live in the country providing healthcare to patients that live in a healthcare desert. Vehicles like fuel efficient cars will probably become less popular as more and more drivers are tired of having their eyes in pain due to ultra bright lights at night.

A.403 November 21, 2025 — Norwalk, CT — Photophobia

Photophobia

A.404 November 22, 2025 — Lake Monroe, FL — Other

Bright LED spot lights at apartment complex are aimed at the street and my property. It is blinding to drive on the street and blinding to go through my own yard. I fell twice due to tripping because of the blinding lights ruining my night vision. The lights are even bright in daylight. The lights are still bright with a shade 5 welding lens. The light from these spotlights is harsh, and disorenting. This is dangerous for drivers and walkers and prevents me from being able to use my backyard at night. I can′t leave my dog out because the extreme light causes shadows that frighten the dog and causes all night barking.

In other areas I have noticed some of these road LEDs on the road are UV or purple. It is blinding at night and terrifying to drive because you are blinded by these lights, as well as the over-bright headlights from cars and it is awful to drive at night--even if you have good night vision--because these lights are making it impossible to see. This needs to be regulated. Go back to amber street lights--or at least soft white and cut down the blue and UV. There is no reason they cannot be made in a decent color spectrum.

A.405 November 23, 2025 — Chicago, IL — None

LED headlights are blinding at night. Been off road 6x and in 2 accidents .

A.406 November 23, 2025 — Toledo, OH — Migraine

I no longer drive at night, I cannot see. I have near constant migraines IN MY OWN HOME because you made incandescent bulbs impossible to get. I cannot walk through stores or work because the lights hurt so bad.

A.407 November 24, 2025 — Desert Hot Springs, CA — Astigmatism

I am a 23-year-old resident of the Coachella Valley, and I would like to bring attention to a growing road-safety issue affecting drivers in my area. Over the past year, there has been a noticeable increase

in vehicles equipped with extremely bright LED headlights, including trucks and off-road vehicles. These lights, combined with the fact that many local roads lack adequate street lighting, have created increasingly dangerous driving conditions.

Recently, I have experienced several incidents where the brightness of oncoming LED headlights made it difficult to determine whether drivers were using their high beams. Even while stopped at traffic lights or stop signs, the glare is intense enough to temporarily impair my vision. On one occasion, I nearly struck a pedestrian wearing dark clothing because an oncoming vehicle's LED headlights overwhelmed my field of vision. This was especially alarming given that the Coachella Valley does not have the level of street-light coverage found in larger cities like Los Angeles or Palm Springs.

The situation has escalated to the point that I sometimes need to pull over to recover my eyesight after being exposed to the glare from vehicles behind me. These repeated exposures seem to be worsening my existing vision issues, including astigmatism, and I now struggle to see my phone unless it is extremely close to my face.

I am requesting attention and assistance regarding this matter. The combination of ultra-bright LED headlights, insufficient street lighting, and inconsistent driving practices is creating unsafe conditions for both drivers and pedestrians. Improved regulations, headlight-aim enforcement, or expanded roadway lighting may help reduce the risk of accidents and long-term eye strain for community members.

Thank you for taking the time to consider this issue. I hope steps can be taken to improve visibility and safety for everyone in our community. In further information feel free to contact me.

A.408 November 25, 2025 — Chicago, IL — Other

Well it′s come to violence now. Today I got blinded and shined my light and she followed me and blocked me in my parking and sat there with BRIGHTS on ...started videorecording and I told her to STOP. She refused and I moved to another space away from her she then followed me and continued to shine a light at me with another SUV blocking me in. I called Police and they did NOTHING for this extreme harassment all on video. Security tried to help. The lights were so massively BRIGHT I still see spots right now and have pain and this was over an hour ago.

A.409 November 25, 2025 — Stout, OH — Other

When kept indoors, reptiles require full spectrum incandescent light for their metabolism. Without it the animals get sick and die. Incandescent and halogen heat lamps are also required for keeping reptiles. Oftentimes these heat lamps are just normal everyday bulbs with enough wattage to produce the desired amount of heat. Because of their use in the pet industry, these bulbs will remain readily available to the public at major retailers and pet stores. I purchase these lightbulbs for personal use in the home and office.

LED lights make me physcially ill. I can always see the flicker, and the light is refracted in so many directions that it is impossible to focus. I have 20/15 vision and especially good night vision. I avoid driving at night now if at all possible (does not work in the winter when the hours of daylight are pushed to the morning). LED headlights are blinding, especially the flashing lights of patrol cars and emergency vehicles. Use of LED lighting in vehicles is especially ludicrous because the power comes from the alternator which is running with the car no matter what, so no energy is saved.

LED lights are horrible for the environment with a huge negative impact. LED lights requiring rare earth minerals and microchips. The cost without taxpayer subsidies would be outrageous because LED lights are 25 times more expensive to produce. All the factories are overseas, so American taxpayers are paying for the foreign manufacturing of products which harm Americans. There is no shortage of tungsten, glass, or the metals used to produce incandescent bulbs. The environmental destruction, personal harm, and increased risk of injury or death associated with LED lights far outweighs any energy savings that could be claimed. The energy consumed in production of LED bulbs is many times more than the energy saved on the grid.

I used to love Christmas light displays this time of year. Now, because of the prevalence of LED lights, I cannot even look at them. It is criminal that these dangerous products are allowed on the market. The fact that government regulations promote them is an atrocity.

A.410 November 27, 2025 — Centerville, OH — Other

I am increasingly noticing that not only do LED/HID/XENON headlights and light bars ruin street and highway driving for everyone, they also shine into restaurant windows from parking lots and ruin dining. They also shine into house windows and blind neighborhood walkers. These overly bright lights cause stress and ruin quality of life. There seems to be no refuge anywhere.

December 2025

A.411 December 2, 2025 — Chicago, IL — Other

Physical eye pain and multiply this times every single day today I was parking and because I was sitting still two cars blasted me with unbelievable bright light brighter than the average horrible LED I think the lights are getting brighter and I rather extremely dangerous level for vision it felt so strong I had to sit down and close my eyes for at least 5 minutes and they were hurting this city is not doing a goddamn thing people are sick assholes who don't give a s*** about no one but themselves and they're too stupid to even realize or care they got people real done with their phones and then they decided to do this demonic thing which lines babies who cares and people are getting killed who cares money is more important than life and vision

A.412 December 3, 2025 — Chicago, IL — Other

My health issue would be insanity knowing I have to deal with this every single day has changed me it's causing mental health problems and nobody's doing a damn thing even the drivers they could cover these lights such a simple simple thing to do it would take less than 1 minute to cover them or shut them off and why they think they need a man of the daytime it shows beyond me the average person is really ignorant and stupid when I drive in Chicago maybe one out of 50 cars we'll have their lights off in the day that's how bad it's got and not only that they're super bright they're even brighter than they were I'm living around a bunch of idiots and ignorant people who doesn't give a damn about the other guy

A.413 December 3, 2025 — Davis, CA — Autism

I was driving by a shopping center when I was struck in the eyes by a strobing blue LED light from an LVT mobile surveillance system. This caused me to shout out in my car because of the shock and eye pain.

A.414 December 3, 2025 — Pleasant Hill, OR — None

Too bright hurts

A.415 December 3, 2025 — Yolo County, CA — Autism

I was driving west on a county road when I came across road construction where the vehicles were using multiple intense amber LED flashing lights at about 1 mile away. By the time I got to about 0.5 miles away, the intensity and digital flashing were already overwhelming me and I determined that there was no way for me to get through these illegal amber LED flashing lights, so I made a U-turn and drove an alternative route which increased my drive time.

A.416 December 8, 2025 — Middle Village, NY — None

It is impossible to see with LED lights in rearview and opposite traffic lanes. I had a close call trying to change lanes as I could not see!

A.417 December 9, 2025 — Chicago, IL — Other

Oh my God had to drive at night again unfortunately got blasted solar blasted several times on the way home it was a 2 mi ride physical pain in my vision they ain't doing a goddamn thing about this s*** it's going to come to up to us to do it I support fully any action done against these damn headlights

A.418 December 9, 2025 — Redmond, OR — Migraine

I'm writing this incident submission to share the debilitating effects that the blinding lights have on my life. It is impossible to drive at night or on inclement weather days due to the blinding lights. The lights not only cause more accidents due to being blinded but also trigger migraines with loss of

vision and excruciating pain resulting in loss of work. These lights on 80% of the cars is a living nightmare for so many people. They need to be banned on cars!!

A.419 December 10, 2025 — San Diego, CA — None

I've been concerned about these bright LED headlights ever since they became the new standard a few years back. There have been many times where I pass a car coming from the opposite direction, and I legitimately can't see the road anymore. I just sort of keep going on my trajectory and hope I don't hit something, until the car has passed and I can see again. Sometimes I slow down to try and mitigate risk. By the way, I'm 28 years old with 20/20 vision, and this was never an issue before these LED lights became popular.

There's also, of course, the issue of cars behind you with bright headlights. Even if I set my rearview mirror to its "tinted" mode, the light coming off of my side mirrors is still so bright. It makes it almost impossible to see out of my mirrors, such that I can't see what's behind me or next to me, and it even affects my ability to see right in front of me. Not to mention, it's distracting and frustrating, which makes it harder to focus on driving safely.

Given how bright these LED lights are, it's no surprise that the high beams are even more blindingly bright. And to make matters worse, many of these new cars have high beams that automatically turn on and off. Oftentimes when I'm driving in a poorly-lit area (mountains, farmland, etc.), oncoming traffic will shine their brights right at me, making it impossible to see. Even if I flash my brights back to indicate that their brights are on, they have no way to manually turn them off. It's such a danger, and there have been multiple instances where I've gotten very scared and even started to panic a because I thought I was going to crash. When you can't see, all you can really do is cross your fingers and hope you don't die.

A.420 December 12, 2025 — Cheboygan, MI — Astigmatism

For the last year now I have had to quit driving while it is dark out because of being blinded by oncoming vehicles with intense LED headlights. I can no longer go to work in the morning and have to wait until it is light out and have to leave work early to avoid driving home in the dark.

I am losing significant income and I am no longer able to go to functions such as my Marine Corps League meetings, church functions, family dinners and other social functions and this is having a significant impact on my social life, I feel as if I am in prison and all alone without the ability to be around, talk, i and interact with others.

This not only impacts me but impacts the community who I help by being a member of the Marine Corps League, with programs such as Toys for Tots, Honor flights, donations to veterans and families in need of our assistance, and other community needs. It is absurd auto manufactures were allowed to implement blinding LED headlights with apparently zero oversight from NTHSA and they continue to endanger lives, take lives, cause accidents, drive up insurance costs, and a myriad of other issues with all new vehicles having these lights installed.

A.421 December 13, 2025 — Detroit, MI — None

The headlights on these newer cars is awful. There has to be some sort of regulation on them… It’s terrible

A.422 December 14, 2025 — Pensacola, FL — Astigmatism

Every single night whenever I drive home, about 40% of cars on the road have LED lights that cause me to struggle seeing the road. I have been blinded going home at night after work over hills on scenic, it's so bad that I have spots in my eyes after they drive by. Ive had to slow down on MULTIPLE occasions because the lights are so brights I feel like I'm driving into the sun and I can barely see the road. I had to pull over one night because they were so bright they gave me a headache. These lights should be illegal and mandated because its selfish and dangerous. I'm afraid I'm going to drive into a ditch because I can't SEE. Please, we need these lights to be illegal.

A.423 December 16, 2025 — Elk Grove, CA — Autism

I was a passenger in a car about 50 feet behind a motorcycle cop. The cop suddenly changed lanes and turned on an intense blue LED light that filled my field of view, causing me to shriek and then I began sobbing uncontrollably.

A.424 December 18, 2025 — Chicago, IL — Migraine

Today I was driving and sometimes I'll shine a light at drivers that blind me and they do blind us but I accidentally caught a cop with my light and he pulls me over tells me take out the little piece I have in my window that blocks these lights from blinding me and I tried to explain the lights blind me they're very bright and he acted like he didn't know what I was talking about actually he had his lights on that's why I shine my light and he wanted a ticket me and he told me I shouldn't drive anymore now they telling us our own public safety supposedly he's telling us not to drive now we're wrong and that the lights are fine basically that's the message we're getting from the police and whoever else so my report is my eyes hurt right now from all the bright lights I saw including his and that if you try to conform your car to make it better for you to drive and not see these lights the police are going to take the driver side that's blinding you that's the way it is now at least in Chicago it's pretty bad here

A.425 December 20, 2025 — Buffalo, NY — Migraine

I have had horrible migraines growing up. I am also autistic. Bright lights have always been a major trigger for my migraines, especially paired with stress or eye strain. The ever increasing brightness of LED headlights is getting absurd. I've had to get special tinted glasses for daily use due to my increased light sensitivity that has only gotten progressively worse in the past three years.

A.426 December 21, 2025 — Woodland, CA — Autism

I was at a restaurant and encountered a half-naked man passed out in the bathroom. I notified the manager who called emergency services. Before I could leave, the police, ambulance, and fire truck arrived with sirens and dozens of strobing LED lights. The lights and the strobing were so intense that I forced myself into a corner with my eyes closed. Yet, the energy level was so high that I could feel the lights pulsing, even with my eyes closed. I was forced to either endure the LED flashing light assault, or flee the restaurant. I chose to flee to my car, with my head down and my arms up, running through the gauntlet of strobing LED lights. I am still traumatized hours later.

A.427 December 23, 2025 — Anytown, NA — Astigmatism

these lights are blinding me, very difficult to drive down a rural road when snowing and white xmas lites lite along the property lines. blinding and distracting.

A.428 December 23, 2025 — Anytown, PA — Other

I have Seasonal Affective Disorder. They changed my light therapy to LED, it sucks and doesn't even come close to a therapeutic effect. Here in Pennsylvania we have mostly overcast skies from October to April. No fun with S.A.D. and LED lights. Change these lights please.

A.429 December 23, 2025 — Davis, CA — Autism

Soft Lights Foundation President Mark Baker was interviewed by Clayton Morris on the Redacted podcast. (https://www.youtube.com/watch?v=BH9JrRSqb6Q)

A.430 December 23, 2025 — Missoula, MT — None

The New LED Headlights are extremely blinding. It can make night travel dangerous. My shift ends at night and I drive back to my house with cars that are blinding me with their LED headlights. The street lights that are upgraded with LED are blinding. I believe it impacts my health in a negative manner.

A.431 December 23, 2025 — Prospect, KY — Autism

I can not tolerate LED lights in my home. I am highly sensitive, neurodivergent/ASD. I will use candles before I put an LED bulb in my home. I can’t believe the lengths I must go to to find incandescent bulbs for my home. Mostly I use the Amber incandescent bulbs because they were still being produced. I also use machine bulbs. I suffer LEDs in restaurants and other peoples home although I have found over the years I don’t like to leave home anymore. I don’t visit my family out of

state unless I absolutely have to and I just leave home less and less. I never associated that with the ubiquitous LED lighting but it could be a factor. I don't feel like I live in America, home of the free, any longer when we are being ruled by a global tyrannical federation. I am glad half my life is over although I love life immensely. I can't bare what this country has become with its lean toward brutalist, institutional, communistic aesthetic. It's devastating to my soul. I am so sensitive to my surroundings and I guess I am a rare breed because I am frustratingly one of the few that speak up about it. Freedom, beauty, truth and the golden rule are the lost cornerstones of our America. The house is crumbling on YOUR WATCH. Be better. This world is nothing but your soul is eternal. Use this world to hone your soul. Start today. God bless.

A.432 December 24, 2025 — Calgary, AB — Astigmatism

sensitivities, strain, intrusive, distracting, hurtful to see, not natural

A.433 December 24, 2025 — Decatur, GA — Electromagnetic Sensitivity

I have a difficult time sleeping from all of the LED lights. I get very agitated and irritated since they came out. I really dislike how the blue street lights make me feel.

A.434 December 24, 2025 — Easton, PA — Astigmatism

LED street light shines directly in my bedroom with dirty energy

A.435 December 24, 2025 — Orange Park, FL — Photophobia

From my very first exposure to blue led car lights - it feels like my eyes are being stabbed. Very painful. It's been years now and I am constantly trying to avert the lights in oncoming traffic @ night. I've also been parked and a car with these lights pulls up in the parking space in front of me and the stabbing feeling is immediate. I didn't realize til I heard this on a podcast that it wasn't just happening to me.

A.436 December 24, 2025 — Rockford, IL — Astigmatism

I was making a left turn and I was blinded to the point by some new pick up truck that I couldn't see the highway divider curb thing so I hit a curb the day after I got my alignment done on my car,

Other times they are so bright and on these big trucks pointing directly into my eyes wasn't able to see the lines on the road for a split second before the truck would pass me

A.437 December 24, 2025 — St. Paul, MN — Other

I have hyper sensitivity to light due to small fiber nerve damage in my brain. This nerve damage was caused by a toxic reaction to taking a fluoroquinolone drug in response to a sinus infection 9 yrs ago. LED lights are exceptionally difficult to look at since then. I am able to use filters on my iPhone and computer devices...but I cannot filter out the LED headlight glare that is becoming more and more pronounced at night. More cars are using them, and car companies are often intensifying the brightness in newer vehicles. As a solution, I have had to significantly cut back on night time driving as a result. LED light glare has dramatically altered my life. It has limited my social life and inhibited my ability to assist elderly parents and family members during evening hours. It's a handicap and debilitating.

A.438 December 24, 2025 — Surrey, BC — Other

My personal experience is negative with these lights; anxiety and agitation and eye strain , particularly when I'm in a place where there are a lot of them, so shopping in big stores or malls is out of the question. Driving at night is dangerous due to the blinding effect on oncoming Led headlights, particularly those on new cars and trucks. If I do ever need to drive in the dark, I use high beams when being approached by LED headlights, necessary just to vaguely gage where I am on the road. This is very stressful but I don't know what to do about it. I've tried anti glare glasses and they're useless against these very powerful headlights. I have a LED flashlight and that's about all I can stand to have around me. Please take this issue seriously, it's impacting our brains and eyes. Many others I've spoken to are experiencing the same issue. Unceasing blessings to you all this Christmas and in 2026, Barbara

A.439 December 24, 2025 — Toronto, ON — Other

One vital thing that is very relevant is the problem of Age related Macular Degeneration of (AMD) the eyes. The focal centre at the back of the eye, which is most closely packed with cones to maximize definition, begins to get damaged by the higher energy blue end of the spectrum. In areas around the centre are less cones (which give you colour) along with rods which are sensitive only to the light regardless of colour. So the areas (side vision) are lower resolution to start with, which is why any distraction requires your eye to swing around to get a clear picture. As the focal point begins to die away, one experiences dark floaters in the eye and later permanent black spots, ultimately you go blind. Birds and many insects have eyes that can see the blue-ultraviolet light, which eventually destroys their vision, but they have very short lives compared to us so it doesn't matter. There should be a research study started on the rate of AMD compared to the the use of LEDs in the environment of the victim. I am one of those victims.

A.440 December 25, 2025 — Motueka, New Zealand — None

1. Night time Driving - These led lights from on-coming vehicles have on several occasions almost caused my husband and myself to go off the road from their blinding effect, especially when they hit our eyes when driving around a corner, we are unable to see where we are going. Led car lights a terrible, terrible thing to have on vehicless for night driving. 2. Also, we have these lights in our shop because they donot come in any other form. They drain our energy and thinking ability. They are hazardous and should be remodelled to have all the spectrums of light, not just the blue light. We deal with sick people every day. These led lights are not conducive for our health nor the health of our customers & staff member, whom is light sensitive and has had to use special red lenses over her glasses to function properly at work. I have seen an improvement her use of the red glass attachments over her glasses...Please change the law for the sake of Human and Road safety.

A.441 December 25, 2025 — Oil City, PA — Migraine

A couple of year's ago, incandescent lightbulbs were banned in PA and the state sent out a box of light bulbs to every resident. I went through my house and replaced all of my lightbulbs with their LED lightbulbs. I liked them because they seemed to last longer and I felt possibly make my electric bill cheaper. But, after over a year of using them, I started noticing terrible migraine headaches, especially in the early morning hours when I was trying to do some reading. I also then started noticing a decline in my vision, which was odd because I had received a clean bill of health from my eye doctor in Colorado and a report of 20/20 vision. I found it increasingly difficult to drive at night due to the blaring headlights, and had basically stopped driving after dark altogether. But now, I was having a strange issue with my eyes. A sudden blurring sensation that would stop when I left the room of the LED or when I closed my eyes. Then, one morning, I felt my eye suddenly drifting and my vision instantly blurred. It was like my eye had just lost all muscle strength and drifted from its position! I grabbed and cupped my eye with my hand and ran to the bathroom to figure out what was going on! Once I got there, it seemed to return to normal. But, I began to wonder if it was the LED lightbulbs. I consulted a physician who was a friend about the situation. He assured me that he had not seen any research that LEDs were dangerous for eyesight. But, I didn't believe him. I instinctively took out all of the LED lightbulbs from my house. I found only one incandescent lightbulb left and put that into my lamp. I thought I'd be better off with no light at all. Then, I began weeks of self therapy staring at candles at night and giving my eyes the rest they were needing from all LED bulbs. My eyesight returned to normal. Eventually, friends and neighbors supplied me with incandescent lightbulbs thinking that I was just their weird hippy friend that they were trying to accommodate. I haven't had any trouble with my eye sight since the switch back to incandescent. My friend, however... the doctor? Well, he since received news that he's going blind. He's had to cease his practice of medicine altogether. I told him to get rid of the LEDs but he won't listen. He, unfortunately, is one of these people that trusts everything the medical industry and government tells him and he's paying for it with his eyesight. Terrible! They should all be ashamed of themselves!

A.442 December 25, 2025 — Truxton, NY — Electromagnetic Sensitivity

I have gotten headaches from florescent lights since first grade 60 years ago. I was finally given the correct diagnosis for my condition this year: Post Trauma Vision Syndrome. I tested as having both brain injury and Lyme disease contributing to my condition. Most of my adult life I was able to manage my condition by controlling the lighting in my environment. I have primarily been self-

employed because of my need to control the lighting in my work environment. Then, a couple years ago, the only type of light bulb I could tolerate, incandecent, became outlawed. I bought I large supply when I learned this was about to happen, but now I cannot visit the homes of most of my friends and relatives without becoming ill. I could not tolerate the lighting at the local fire hall where we held funeral dinners for each of my parents. I cannot stay in stores very long due to the lighting. Medical facility lighting makes me ill. I am now more severely disabled by my condition because the wider world does not make space for the needs of people like me any longer. When school buses or emergency vehicles with strobe lighting pass by my vehicle I have to look away to not become overwhelmed by that most obnoxious form of light, I should be paying great attention to those vehicles, but that would be dangerous for all involved. Looking away is the best I can do. If I am in a building when strobe lighting is used I will close and cover my eyes, but I can't do that when driving. I work with children with neuro-developmental injuries, This is an issue for them as well and they have to sit in classrooms whose lighting does not meet their needs, just like I had to back in elementary school.

A.443 December 26, 2025 — Chicago, IL — Electromagnetic Sensitivity

Unfortunately I had to go out today for the holiday and coming back in the dark was I don't even know what words to use how horrendous it was with these bright f****** lights the situation has not changed and it's not ending I was in complete mental distress nobody cares enough to even cover these damn lights it's like riding through a celestial bomb where a whole bunch of them go off all at once it feels like a brick is thrown in my face over and over again this is reality now this is the nightmare we live every single day it's actually real and sick

A.444 December 26, 2025 — Lake Placid, FL — Astigmatism

Astigmatism is only one of the issues with LED lights, but that is excruciating to be blinded by vehicle lights as well as the street lights, business lights, and home porch lights. This light is also killing the trees that are bombarded with the lights (I am a scientist…the artificial lights are damaging trees, wildlife, insects (in addition to all the other detrimental things affecting them (herbicides, pesticides, etc.)).

A.445 December 26, 2025 — Louisburg, NC — None

I literally cannot drive at night anymore. I'm on back roads in rural NC and these are running me off the road because they are so blinding. Just because car manufacturers can make them this bright, doesn't mean they should.

A.446 December 27, 2025 — Chicago, IL — Photophobia

Photosensitive epilepsy, bright LED lights on the street lights, head lights , Lincoln Park zoo lights, Costco, Whole Foods, blinding, making me have to wear Ray-Bans sunglasses at night. It's painful to have to look at a phone, I can't watch TV, can't go to movies, if I'm in a store that has LED lights and I feel like I have to puke. I

A.447 December 27, 2025 — Sanford, ME — Migraine

LEDs give me a headache. I've had to quit driving at night for fear of an accident. Those darn lights are glaring, blinding and unnecessary! They should be against the law.

A.448 December 28, 2025 — Hollis, ME — Astigmatism

For me, encountering high-intensity LED headlights is not a minor nuisance; it is a physical assault. The sensation is immediate and visceral—like a dagger stabbing through my eyes and directly into my brain. This pain triggers an involuntary fight or flight response, forcing me to look away or squint just to cope. The effect is cumulative; each passing car compounds the pain, rapidly triggering a headache that makes my eyes even more sensitive to the next beam.

This physiological reaction creates a critical safety failure. Because I am blinded by the glare, I lose the ability to scan the woods for deer or even track the lane lines in front of me. I have found myself slamming on my brakes in the middle of the road because I simply cannot see where I am going, terrified I might drift into oncoming traffic or get rear-ended. The reality of this danger hit home recently when I nearly struck a pedestrian. I was so overwhelmed by the wall of oncoming light that I

was completely blind to a person crossing the street until I heard a horn and saw them in my rearview mirror. These lights are erasing the world around me and endangering lives.

A.449 December 28, 2025 — Rigby, ID — Epilepsy

Bright lights with new vehicles prohibits my ability to even use my mirrors at night, they are useless. This takes away situational awareness and makes the roads extremely dangerous. I can not believe that these lights are legal to begin with.

Health wise these have triggered a seizure with a passenger of mine a few years ago. They didn't know that they had epilepsy until this moment. These lights are completely unnecessary and cause extreme danger on the road.

A.450 December 29, 2025 — Chester, MD — Migraine

I get ocular migraines from the led lights at lifetime club

A.451 December 30, 2025 — Great Falls, Canada — Other

mental disconnect with reality resulting in a fatal shooting

Reports received in 2026

January 2026

A.452 January 1, 2026 — Hartselle, AL — Migraine

Astigmatism & Vestibular Migraine

A.453 January 2, 2026 — Highland Park, NJ — Astigmatism

LED headlights have made night driving for me an absolutely unbearable experience. I always just assumed my eyesight was getting worse, but then after driving at night while visiting Guatemala, I realized - this is a unique issue to the USA. My eyesight has not changed, the cars here have. Driving at night is straining, exhausting, and stressful beyond words, like it never was before 2016 or so. Please understand that this is such a common experience and issue, and so frustrating to so many millions of people, that the easiest way for the government to do something that makes people like whoever is in charge is to ban these dangerous, stupid lights. I will probably soften my view on the entire Trump administration if it acted on literally this issue alone.

A.454 January 3, 2026 — O'Brien, OR — Other

Everyday I am exposed multiple times to headlights clearly above the legal lumen limit. Even in daytime I am forced to look at the passenger side shoulder many times. Besides being a danger and a supreme aggravation, it is likely illegal and NOBODY is doing anything about this. I was considering pointing a 6328 laser above their eyes but found out I could get in serious legal trouble for that. But not them, free to endanger my vision and my life every damn day.

A.455 January 4, 2026 — Oslo, Norway — Migraine

migrene,flashing eyes and bad consentration

A.456 January 5, 2026 — Burlington, WI — Other

possible cancer

A.457 January 6, 2026 — Boston, MA — None

When driving home from work at 5 PM on a Tuesday I was on a curve going downhill when a couple cars with blinding LED headlights approached. I couldn't see the road and my car hit the curb damaging the front wheel of my car.

I have been afraid to drive in the dark for years, not because I can't see the road. I can see the road until a car with blinding LED headlights approaches. Not feeling safe to drive after dark has impacted my work, social and family life.

A.458 January 6, 2026 — Suquamish, WA — Other

I used a LED headlamp on a regular basis for 30 years. I started getting headaches and having problems with my vision. I slowly started to lose my sight and while the doctors couldn't tell me for sure it was caused by using the LED headlamp but I believe it was. I did not make the connection between using the headlamp and getting headaches and vision problems until it was too late.

A.459 January 7, 2026 — Auburn, WA — Astigmatism

Because of the glare and starburst effect of LED super bright headlights, it has become increasingly difficult to drive at night and my eyes test at 20-20 in one eye and 20-10 in the other. These headlights cause an incredible amount of avoidable danger to all drivers. Please regulate the brightness ASAP.

A.460 January 7, 2026 — Commerce, MI — Other

With cataracts beginning to develop, and the associated halos in my vision, over-bright LED headlights create more significant visual problems for me at night. I am particularly aware of problems seeing construction barriers, traffic lane dividers, pylons and other warning elements with oncoming headlights blinding my view. The intense light and glare also make it hard to see past for individuals walking or riding bikes on the shoulder.

A.461 January 7, 2026 — Longview, TX — Migraine

Ocular Migranes

A.462 January 7, 2026 — Manhattan, KS — Other

It’s really hard to drive safely during the evening hours in a small car with halogen headlights and my eyesight is being compromised whenever newer vehicles are within 50 feet of my line of sight or my mirrors. And where I live, everyone is in much larger vehicles so there’s no reprieve. And more often than not, the brights are on and that makes it even more difficult. This needs to change and soon

A.463 January 8, 2026 — Centennial, CO — None

I have perfect vision, and every time a vehicle with LED headlights comes towards me, I am blinded, with a dramatic loss of night adapted vision. This is a huge safety hazard, as the dazzling light obscures the presence of hazards or pedestrians that are unfortunate enough to be caught behind it.

A.464 January 8, 2026 — Chicago, IL — Photophobia

OMG it's now 2026 and STILL NO CHANGE. Today driving almost every DAM car hit me in the face like a brick with their dam bright solar flares and it caused immense stress and PAIN in my eyes !!!! Why are our lawmakers acting like they can do NOTHING!!!! They don't need to "research" or investigate. Walk outside and just look down the road dammit!!! Day in and out we put up with something forced on us and can't go out anymore!!!! WTF????

A.465 January 8, 2026 — Durham, NC — Astigmatism

Several years ago I decided to stop driving at night entirely, because the glare from the oncoming LED headlights made it impossible for me to see well enough to be a safe driver. So now, during the winter months, I have a very reduced social life. No Holiday parties or dinners out, unless I can ride with someone else. I'm 70 and retired, but if these LED headlights had been a factor when I was working, I don't know how I would have managed if I had a night job. Now I know that most of the women my age, and some of the men, also cannot drive at night anymore. If any of my friends need help at night, I cannot get there to help them. I'm also sure that they damage my vision because after being exposed to them I cannot see clearly for a while. Also, I have read much about how they are very bad for our eyes. Please, please can't we ban them for the health and safety of every one of us?

A.466 January 8, 2026 — Fort Worth, TX — Astigmatism

Disrupted and impaired night vision and additional sensitivities, with all types of emergency vehicles flashing their 'caution' lights. They should all be banned from use, as they have been weaponized against the general population.

Over time these cause degenerative health effects and should be classified as high-frequency weapons.

Simpler, lower intensity, health-frequency tuned soft lights are still visible at night as well as daytime with their flashing and motion across lightbars.

Reform NOW!

A.467 January 8, 2026 — Frederick, CO — Migraine

On the day of the incident I had a line of cars with bright , LED headlights driving towards me. I looked to the right as they passed to limit the effect of the brightness but the last vehicle was a pickup. As it went over a bump I received the full brightness of the its LED headlights and couldnt see for a second despite looking to the right already. The brightness and color temperature of the LED bulbs make it difficult to see at times. The cool color temperature of the bulbs then spoils my night vision after the car passes and takes a few seconds to recover. I find myself closing one eye as a vehicle with LEDs headlights, or LED bar lights, passes so I can still see afterwards at night.

A.468 January 8, 2026 — Littleton, CO — Astigmatism

Yesterday I was on my local road at night with an F150 behind me. I could tell by the headlight pattern. The issue was the brightness leading to blinding intense LED light that overtook my visual field as the driver ahead of the F150. I felt unsafe due to the glare even moving my eyes off angle. I pulled over to let him pass as I couldn't drive safely with him behind me.

A.469 January 8, 2026 — Midwest City, OK — None

I avoid driving at night if possible because of the blinding effects of oncoming traffic. While oncoming traffic passes me, I have no choice but to go straight and hope nothing is in front of me. This never used to be the case. Large and tall vehicles like trucks are especially egregious. If behind me, they illuminate the interior of my car (VW Golf) as well as the interior lights. We need new regulations limiting GLARE, not just total light output. The glare from LEDs is far higher than traditional lighting sources. There are several methods/equations for measuring/calculating glare. Pick one, and use it.

A.470 January 8, 2026 — Rye, NH — Astigmatism

In rainy New England the increase in glare from bright lights on cars and billboards is making it very dangerous to drive at night. Some of the new cars and aftermarket bulbs are brighter and more blinding on low beams than high beams used to be. When it is raining or snowing, the problem is compounded and the risk factor is many times higher than it used to be. In winter when there are snow banks or ice sometimes pedestrians need to walk on the side of the road. At night you can't even see them until the last second due to the glare of oncoming headlights.

A.471 January 9, 2026 — Glen Burnie, MD — Astigmatism

Navigating the road at night with astigmatism feels less like driving and more like navigating a chaotic light show. Every oncoming pair of modern LED headlights doesn't just glow... it explodes into a blinding "starburst" of jagged white lines that stretch across my entire field of vision. These new bulbs are piercingly bright, and because my eyes can't focus the light correctly, each one creates a massive glare that washes out the lane markers and hides the car behind it. It's a constant cycle of squinting against the sharp, blue-white needles of light and waiting for my vision to recover, only to be hit by the next ultra-bright sensor-activated high beam.

A.472 January 9, 2026 — Sedona, AZ — Other

LED lights are extremely detrimental to my health - and not just the health of my eyes but my mental and neurological health as well. They are insidious and ubiquitous, and this is what makes them so dangerous. They assault those of us who are vulnerable to them in overhead lighting and light bulbs, screens of every variety, decorative twinkle lights, and car headlights, just to name a few.

Exposure to LED lights causes me intensely painful headaches, severe eye pain and blurred vision, ocular migraines/migraines with aura, and worst of all, complete mental shutdown. My brain literally stops working, and I feel like a zombie the rest of day or longer. Screens become too painful to look at, and I can't think or function. There is nothing I can do to mitigate these effects other than rest and abstain from further LED-induced damage.

As more and more stores and public spaces switch to LED lights there are fewer and fewer places I can go. My local library recently installed LED lights and I can no longer stand to be there for more than ten to fifteen minutes before the debilitating effects take hold. When I job hunt I have to physically check the lighting before even applying, as I cannot work anywhere with LEDs. Needless to say, this severely limits my options in an already poor job market. If the proliferation of LED lights remain unchecked I fear I will end up a virtual shut-in.

I recently purchased a new iPad, released mid 2025, and to my dismay discovered I could not bear to look at it, as the screen was LED and caused immense eye pain, blurred vision, and headaches. I had to return it. My older 2015 iPad, with its LCD display, has never once caused me such problems. Technology is inescapable these days, but what are we supposed to do when the only option, LEDs, is unbearable? I will continue to use my old, safer technology as long as I am able, but I honestly don't know what I will do when it no longer works. LED screens severely impact my quality of life and my ability to function in society.

I have astigmatism, and while my night vision has never been great I can no longer drive at night due to LED headlights blinding me and destroying what little vision I had. I just don't feel safe, and don't want to risk my life or the lives of anyone else on the road.

Trying to locate incandescent and halogen light bulbs is ridiculously difficult and increasingly expensive, but I have no other choice. I ration their usage to preserve the life of the bulbs. And despite their small size LED twinkle lights are especially painful - looking at them feels like being stabbed in the eye. And the headache they cause lingers for hours afterward.

It's obvious the human cost has no bearing on corporate and governmental policies compared to monetary profits, but I beg anyone reading this to please, please put a stop LED lighting before it can continue to destroy the health of people who've done nothing but be born with sensitive eyes, brains, and nervous systems.

A.473 January 10, 2026 — Oklahoma City, OK — None

Everyday I walk and ride bikes in my neighborhood and the local area, and everyday there are headlights so bright that I can't see anything around me. I have almost ridden into parked cars, tripped on the curb, and narrowly missed avoiding other vehicles because LED headlights are so bright that nothing else is visible.

A.474 January 10, 2026 — Siloam Springs, AR — Other

LED's are slowly making me blind.

A.475 January 11, 2026 — Gettysburg, PA — Photophobia

Horrid, life threatening. Can no longer drive at night. Aggressive tailgating drivers with much larger vehicles cast equally obscenely bright and painful lights into rearview mirrors. It is unbelievable that our elected officials would allow this! To my knowledge foreign countries have regulations but the USA does not. How could a young teen safely learn to drive?

A.476 January 13, 2026 — Cupertino, CA — None

Today, I went outside for a walk. I couldn't even look in the direction of my apartment parking lot because a car was parked with its headlights on. They were painfully bright, enough that even looking towards the car parked next to it was still painful. Green afterimages remained in my sight for minutes afterwards.

A.477 January 14, 2026 — Ketchikan, AK — Photophobia

The city surrounded my home with 4000 kelvins street lights in front and back of house . I immediately felt them when they came on. it was like a shock to the body!! Since 2021, everything from vision, CNS, hypertension, cognitive issues, immune system, fatigue, insomnia, PAIN!!!!! tremors and absent seizures. all documented by over 9 Doctors LED LIGHTS NEED TO BE BANNED They have ruined so many aspects of my life.

A.478 January 14, 2026 — Leonardtown, MD — None

I grew up having perfect vision. 20/20 all my life, never needed glasses of any kind. As soon as I learned how to drive, I loved driving at night. I never experienced any problems with glare from the halogen headlights except in cases when a driver's high beams were on at the wrong time, and the fix was simple: flash your brights and the other driver could correct their error.

But since the implementation of LED headlights that began when I was in my 20s, I have struggled to drive at night. The LEDs are blinding regardless of whether the beams are high or low, properly positioned and aimed or not, and there is no way for a driver to correct it. I've implemented the use of blue-blocking driving glasses, which barely take the edge off, and ultimately do not solve the problem. I find myself squinting and holding my hand up in front of me to block the glare of not only the headlights of oncoming traffic but also those flooding my side view and rear view mirrors.

Even still, my night vision is ruined and I can barely see my surroundings, if I can see them at all, over the blinding glare.

Now, in my 30s, with all new cars being fitted with LED headlights and these newer cars comprising more than half the cars on the road, I am no longer able to drive at night at all. Not in my 60s, not in my 50s, but in my 30s.

My vision remains otherwise excellent. As an avid hiker, I am fond of night hikes in the woods near my house, and I can see in their enveloping darkness with great clarity using no artificial light whatsoever to illuminate my path.

But the blinding glare from LED lights feels like a stab to my retinas. The high intensity, highly focused, blue-rich beams completely obliterate my night vision, not just for the duration of the acute glare but for many moments afterward. This renders driving at night completely unsafe. Even the intense brightness of some LED taillights is too much for me.

This limits not only my quality of life via my ability to participate in social activities after dark, it also limits my potential work opportunities, especially in the dark months of the winter. Even in the daylight on on rainy days, when everyone's headlights are on, the lights are blinding and impair drivers' ability to see, which exacerbates the dangers already present on wet roads.

I won't get much into the impacts of the growing prevalence of LED external light fixtures in residential areas, but these pose similar harms not only to drivers but to pedestrians as well. They disturb the sleep of people in their homes and imperil the local wildlife.

LED lighting poses a significant and totally unnecessary public safety hazard in the name of saving a few bucks a year on electricity. Many are totally disabled by it. These lights require a complete overhaul and ideally a total ban as a light source for anything except low-powered indicator lights.

Return to us our halogens, incandescents and sodium lamps that we may once again enjoy the safety and the warm, peaceful glow that once accompanied our nights.

A.479 January 14, 2026 — Visalia, CA — Other

Blue light at night should be banned - especially in public spaces. LED streetlights and billboards (and headlights) are so blindingly bright, I cannot go outside at night anymore.

A.480 January 17, 2026 — Temecula, CA — Other

I almost drove in to a drench because the car in front of me had a full LED light and it burned my eyes

A.481 January 19, 2026 — Jacksonville, TX — Astigmatism

I am unable to drive at night due the significant brightness of LEDs.

A.482 January 20, 2026 — Anytown, USA — None

HID LAMPS SHOULD ALSO BE ADDRESSED BASED ON WATTAGES OVER 35.

A.483 January 21, 2026 — Orlando, FL — Autism

Headaches!!!!!! Inability to see. INCREASED danger to everyone else!! I hate this

A.484 January 23, 2026 — Syracuse, UT — Epilepsy

I'm forced to have led halogen and so forth lights in my home and Art Studio. I absolutely need incandescent lighting for my epilepsy. It is like living in the old days where I have to only do things with daylight coming in. I have to turn off lights constantly. If I need the lights on which is often I end up with seizure symptoms or blatant seizures. Which by the way kills off brain cells every time you have them. I am desperate for incandescent lighting again. It's bad enough I can't go out in public places for very long if my hormones are unbalanced if I've not eaten drank or slept in a perfect state. I would like my home to be a safe Zone and be able to have incandescent lighting which is not too much to ask. This is for medical purposes and I should not be denied this it is limited my life consistently and impacted it greatly

A.485 January 24, 2026 — Vista, CA — Electromagnetic Sensitivity

The brightness of LED headlights started giving me great discomfort the moment they were introduced on cars. Initially, there were only a few cars that had them so the effect on me was minimal. Now, 80% of cars have them and they are way too bright.

This year has been the worst it has ever been. My eyes literally hurt when confronted by LED headlights. I have heard that LED headlights damage the retinal pigment, the DNA in the eye which then causes premature macular degeneration. I can totally see how this could happen.

Making things worse is the fact that many cars have auto headlights and they are automatically turning the brights on in the city! This shocked me because I have driven cars for 40 years and probably only needed my brights 2% or less of the time I was driving. These auto headlights do not always turn off in the presence of other cars.

Another issue is LED headlights on during the day. That is right, they are on during the day and are way too bright. I can stand in direct sunlight and my eyes are fine, but when confronted with LED's, I experience immediate discomfort.

Buildings are now using them in parking lots as well and they are intolerably bright. Making matters even worse is that emergency service vehicles have these lights as well and they are ridiculously bright.

The brightness is so alarming on cars that I get temporarily blinded by their headlights. This creates a safety issue.

A.486 January 27, 2026 — National City, CA — Migraine

Brights and LED headlights have been triggering my horrific migraines while driving. It is terrifying. Not only are the migraines painful and debilitating and disorienting, but my vision becomes impaired when migraines are triggered. It's happened several times while I've been driving at night, and this is so dangerous. I don't understand why lawmakers haven't stepped in to stop this. LED lights are way too strong for use in cars. At the very least, there needs to be strong filters so that drivers, riders, and pedestrians are not being blinded by the brightness.

A.487 January 27, 2026 — Shippenville, PA — Migraine

While at home this evening I was working on my HP Spectre laptop which is plugged into a 2006 Gateway LCD monitor. The indicator light for the caps lock hit me about 20 times in a 30 minute span while I was trying to cover the light. It caused immediate pain and a migraine with auras. This also caused a cognitive decline and overwhelming feeling.

February 2026

A.488 February 1, 2026 — Hazel Park, MI — Migraine

Headaches from constant led light exposure. Resolved when bulbs are removed

A.489 February 1, 2026 — Twentynine Palms, CA — Other

Pain and blinded for white L ED headlights

A.490 February 2, 2026 — Dallas, TX — Other

Over the last five years, I've noticed a dramatic and worsening increase in the brightness and glare of LED headlights on newer cars and trucks. Each new vehicle generation seems more intense than the last. The light is not just brighter, it's harsher, whiter, and more blinding, especially at night.

Driving after dark has become increasingly difficult and, at times, unsafe. On back roads or two-lane country roads, approaching vehicles with these LED headlights can completely overwhelm my vision, particularly when coming around curves. When large trucks follow closely behind, the reflected glare can be so intense that I've been forced to slow down or even pull over to safely let them pass. I have been driving for decades and never experienced anything like this prior to the widespread adoption of modern LED headlights. This issue has progressed rapidly in recent years and feels largely unregulated. In my experience, these lights now pose a genuine safety hazard and need clearer standards and enforcement.

A.491 February 5, 2026 — Bonney, WI — Electromagnetic Sensitivity

My bathroom light flickers and it makes my eyes hurt. Lights have bothered me for years and I have had trouble sleeping for years and taken medication but no help. I'm convinced that LED's are my problem but I'm having trouble getting replacements. I feel stuck.

A.492 February 6, 2026 — Vista, CA — Other

LED headlights are blindingly bright and cause accidents and indoor LED lights cause mood and depression like issues.

A.493 February 10, 2026 — Kershaw County, SC — Autism

The light is blinding bright. It shines in my home bothering my autistic daughter. It also spooks my livestock.

A.494 February 12, 2026 — Sebastopol, CA — None

LED lights flicker and make me have a hard time focusing and calming my nervous system. LED lights in cars make me feel unsafe to drive at night because they are so blinding.

A.495 February 13, 2026 — Honeygrove, TX — Electromagnetic Sensitivity

Early in the morning 615, I go to the local donut store and I turn on the corner and a company truck has its brights on, and it affected my eyesight and I'm hurting right now with my eyes. Liberty sanitation of Bonham Texas

A.496 February 14, 2026 — Inverness, FL — Other

I must be very sensitive to brightness of LEDs because they make me feel like my brain mentally can't deal with the light. I get very irritated, sad, and mad all at once. God made light and dark for a reason. We can't rest our brains because our brains can't shut down with this type of light. PLEASE HELP ALL OF US.. BLESS THIS WEBSITE!!

A.497 February 14, 2026 — Stanley, NC — Other

Me, my 6 y/o son, and 2 y/o daughter were hit by a car while walking in a crosswalk leaving their school Christmas program. The streetlights had recently been replaced by purple LEDs, reducing visibility. There are documented complaints filed with the municipality regarding these lights prior to this incident. The bright headlights from vehicles leaving the performance contributed significantly to the conditions that caused the driver to fail to see the crosswalk and us in it. The multitude of bright lights also caused us not to see him coming around the curve. My son suffered a traumatic brain injury, almost died, and was airlifted to Levine's Children's Hospital, where he spent 18 days recovering, learning to sit, eat, talk, and walk again. Grateful to God for his miraculous healing. It's time to do something about these lights. Children are dying. Pedestrians are getting hit every single day. This matters, and it's so fixable!

A.498 February 15, 2026 — Flourtown, PA — None

Every time I drive at night, I am blinded by oncoming car headlights! It seems that it has become a competition for auto manufacturers to have the brightest headlights. There seems to be no concern for oncoming drivers. I often find my eyes lids fluttering as I try to maintain my situational

awareness. It is TOO MUCH! I am sure accidents are happening nightly as a result of drivers being blinded.

A.499 February 17, 2026 — Asheville, NC — None

I make a morning commute at 6:00 every morning. The absurdly bright headlights of other cars make that commute a massive pain. I dread every car coming around every corner. I can't look away, I can't do anything other than brace myself and just accept that I won't be able to see for a couple seconds. It's very dangerous when I'm out on the highway or on roads I'm unfamiliar with, on top of being extremely uncomfortable. Make bright LED headlights with uncontrolled spread illegal!

A.500 February 18, 2026 — Nashville, TN — None

I would write down the plates but I can't even see the car apart from the fact that the lights are very strong being low they use them high in the city until I saw police with very blinding lights but most people have even higher lights wherever they are while some respect most don't do it and it really hurts the sight it's very annoying and dangerous while the police don't do anything they are just like npc until I have to put my hand so that it doesn't hurt my eyes even if I'm walking or cycling they hurt it's frustrating

A.501 February 28, 2026 — Davis, CA — Autism

I was struck in the eyes by white LED strobe lights by two recumbent bicycle headlights that caused to me to suffer pain and panic. The LED strobe lights must be permanently banned.

March 2026

A.502 March 2, 2026 — Lodi, WI — Other

No night sky.

A.503 March 3, 2026 — Amherst, NY — Photophobia

Difficult driving at night, difficult walking the neighborhood where LED lights have been changed. I've also submitted for the village of Williamsville, which I reside, but Amherst is the town. And does provide services for the village.

A.504 March 3, 2026 — San Francisco, CA — None

Eye damaged by an insanely Bright LED on a Semi Truck while driving at night. It was a dark field with no illumination when suddenly the truck either crested a hill or turned on its lights while not on before. It was a life-altering injury. LED light should not be used for illumination. It is destroying our collective eyes and brains. We are all suffering because of it. Quality of life diminished greatly because of the forced mass adoption of this horrible "technology". Go back to Incandescence.

A.505 March 3, 2026 — Village of Williamsville, NY — Photophobia

My ability to be able to enjoy walking my neighborhood or being able not to put blackouts on my windows. If in when LED lights are installed on my part of the village parts of the village have already been converted. I suffer from depression and anxiety in adhd. Extremely a light sensitive.

A.506 March 4, 2026 — Chicago, IL — Other

I get out late and need to take lake shore drive home. Cars run up to about 80 miles an hour which makes these LEDS a blinding disaster for me in my little sedan. BAN LED LIGHTS. THEY ARE HARMFUL!!!!!

A.507 March 5, 2026 — Murrieta, CA — None

I drive an hour home from work every night. During my hour long commute I am bombarded by bright LED headlights of other cars, regardless if they are oncoming or behind me. One incident particularly stands out, where I was waiting in a turning lane and truck with the highest and brightest headlights pulls up behind me. I was blinded just looking through my side view mirror and I couldn't see forward because the lights were also in my rearview mirror. The lights were so bright they lit up the entire inside of my car. Everywhere I looked was like an intense strobe light shining directly into my eyes. By the time I got home I could feel the effects of the lights. I'm worried my vision is

becoming more damaged with each night I drive home. This isn't good. Please do something about this or people will go blind.

A.508 March 9, 2026 — Kingston, Jamaica — Other

Disruption of melatonin.

A.509 March 9, 2026 — Wooster, OH — Astigmatism

Temporary eye damage, taking my focus away from the road.

A.510 March 12, 2026 — Tualatin, OR — None

Driving at night is dangerous! These new LED headlights in cars are blinding. At the very least I am coming home with a headache every day because my retinas are being fried. I am shocked more people aren't getting into car accidents. This has to be extremely hazardous driving conditions.

A.511 March 14, 2026 — Tampa, HI — Electromagnetic Sensitivity

[No narrative accompanied this report as received.]

A.512 March 31, 2026 — Dunkirk, NY — None

driving through a 60 mile stretch of 2 lane road in NC the road was wet and the lights were so bright i could not see the road in front of me. when i got home i upgraded my headlights to brighter led's so i could see the road. extended distance lights encourages speeding

A.513 March 31, 2026 — Holland, NY — Other

The law for the intensity of allowed brightness is ambiguous. It simply states "brilliance". There should be a lumens value where we may measure how intense the headlights are. It would be easy to ticket offenders. The same thing can be for the law on automobile noise.

April 2026

A.514 April 1, 2026 — Japan — (no category given)

I am Japanes. I wrote an article in english about the damage caused by LEDs.In Japan,LEDs are about to be made mandatory, and nobody is going to help me. Please read it. I will send you my website adress. https://note.com/treeleaves/n/na23539ed16cc

A.515 April 3, 2026 — Brunswick, ME — Astigmatism

No specific incident. Vehicle headlight brightness has been an annoyance for the past few years. It is near impossible to drive at night these days, and even during the day to dodge the laser beams of current headlights. This is a huge safety issue, and most people are likely not even aware of the problem their vehicles are causing.

A.516 April 7, 2026 — Asheboro, NC — Migraine

Since late 2022, LED visible radiation has made my life a living hell. I suffer from migraine disease—a physiological condition that is as real as Type 1 diabetes or severe allergies. It is not "psychological," though I have been gaslit by neighbors (who are medical professionals) telling me exactly that. The chronic pain and environmental stress caused by these lights have been so severe that I have had to seek professional therapy to cope with the impact on my life and health.

In early 2023, my neighbor installed an unshielded LED floodlight as bright as a stadium spotlight. It shines directly into my property, illuminating it so brightly that I can no longer enjoy the night sky—one of the primary reasons I moved to these mountains. Once the sun sets, I am forced against my will to go inside and close specially designed blackout blinds. Because there is no lighting ordinance in Asheboro to protect disabled people like me, I am effectively a prisoner in my own home.

This is a systemic issue. I can no longer drive home from work on the highways without a debilitating headache because of the unfiltered, "whiter-than-white" LED lights recently installed on cellphone towers. I am never fully present anymore; I am constantly "scouting" my environment for triggers.

There are over 40 million Americans with light sensitivity. We are being assaulted by cheap, bare-bulbed LEDs that are poorly filtered. Mandating that government and infrastructure lighting be

yellow-spectrum, high-quality, and shielded would make the world accessible again. We exist, and we should be heard.

Note: I give my full permission for the Soft Lights Foundation or government agencies to contact me for further documentation, medical records, or evidence regarding these claims.

A.517 April 10, 2026 — Charlotte, NC — Electromagnetic Sensitivity

Blinded and head pain by headlight light directly in my face . Scared I was getting stroke like or seizure. I'm sure it did something g.

A.518 April 10, 2026 — Fairfield, PA — Other

I am in a historic, small rural town in PA. I have been fighting tirelessly for 6 months to insist on warm (2200K), fully shielded in order to light only public spaces and not private ones, taking in the nature of each area of the Borough's lighting need and only as bright as the need is, IES/ANSI/DarkSky approved LED lights for our small town, that has had a history of the Council letting the power company, MetEd do whatever they wish. Last Autumn, a 4000K unshielded LED 2 laser beams of a light was suddenly installed across from our home. We and 5 other residences complained. This included someone who was undergoing thyroid cancer treatments. I was a wreck. We couldn't walk down our own steps because we couldn't see from the afterimages and the glare. We have metal awnings and all the room darkening blinds and curtains from the last round of terrible sodium vapors. The neighbor was told to put cardboard over their windows. I was told to move somewhere darker. I was also told to shoot the light out. All by a MetEd rep who is a hunting buddy of a council person and will be our last ditch effort with a can of spraypaint to try to "shield" the light, so I'm trying to leave that guy out of it. After 2 months of not sleeping, not wanting to leave the house because it was too dangerous because we were literally blinded every time, MetEd took down the light and put up a less abusive, but still really bad, sodium vapor. The cover fell off and it';s just a bare bulb and the neighbors and I are afraid to call MetEd lest the LED light come back. I have been back to at least 3 more Council meetings with lots of evidence backing me up and a petition rolling in too. They say they're behind us. I do not believe them. Every meeting is like the movie Groundhog Day. I was told to get a petition and a class action lawyer. Why do we need all that if the Council is "on our side" and the LED lights won't be coming back? Why a lawyer for something that hasn't happened yet? They only perked up when I said (again) that the lights had public nuisance legal problems. MetEd has now said they will install unshielded 3000K LED lights everywhere in town. I filed a formal complaint w/ the PUC, who unfortunately approved the new awful lights while I was away trying to do my real job. I have ADHD and PTSD, both of which have been horribly triggered and continue to be triggered because they just put these lights up with no warning. It's happened twice now, and I'm afraid they'll do it again. My husband is a disabled veteran. His problems were aggravated. The Borough Council and Mayor and MetEd reps were offered, for free, a representative from DarkSkyPA (Dark Sky International) to come and speak with them on lighting solutions. They have repeatedly passively refused. They cannot claim deniability. There's too long a paper trail. Due to my online petition, I found out there is a little girl on Main St. whose family moved here because there were no LEDs. She gets seizures from them. This is clearly an ADA issue for many of us and an emergency issue for her. I have photos of what the LED did to our home. I would love to share them and get any advice or help. Legal seems to be all the Council understands. Here is the link to my petition. https://c.org/2htgQdz9Vj One photo is on there. I would be grateful for any help you could give, especially any legal ADA citings like glare interfering with vision, etc.

A.519 April 10, 2026 — Monroe, NC — Migraine

Stadium ultra bright new tall lights in our development. So sick at night in my own development and home. Nothing blocks out the light totally. I've tried it all. Lack of sleep palpitations, headaches , light flashes in my eyes, wake up groggy, horrible. Can't go for walks at night, can leave shades up at night and artificial light from theses come thru the curtains and shades and makes me restless all night! I'm worried what they do to the body! I hate them!! Please have them banned and removed from here

A.520 April 12, 2026 — Boynton Beach, FL — Other

I had a bad car accident last week because a car's lights were so bright that I could not see the road. Why can't Karen manufactures help people that have difficulty driving at night? They are making the problem so much worse instead of better. I'm so disappointed.

A.521 April 14, 2026 — South Holland, IL — Other

I am filing a formal complaint about the rising use of overly bright, full-grille LED lighting on vehicles. These lights cause dangerous glare, obscure the road, and threaten driver safety. Last night in Chicago Heights, a vehicle with ultra-bright LEDs across its front grille temporarily prevented me from seeing the lane ahead. This is the third time in six months I've experienced dangerous glare from similar lighting. These lighting systems seem to breach roadway safety standards. Though often aftermarket, they are sold and used without enforcement. The lack of concern for driver safety and accountability from dealers and installers is troubling. • Investigate the legality and compliance of full-grille LED lights. • Enforce regulations on vehicle lighting brightness and beam patterns. • Advise dealerships and installers to avoid unsafe lighting equipment. • Alert drivers that aftermarket light bars and grille-wide LEDs causing glare are banned for road use. These ultra-bright lighting systems are not merely an annoyance — they are a growing public safety threat. I urge your office to take action before more drivers are put at risk. Thank you for your attention to this matter. I am willing to provide additional details if needed.

A.522 April 18, 2026 — Anytown, NY — Sjogren's

I have to wear glasses. i'm female with a sedan. blinded at night by the powerful lights even by sedans. sometimes i have to stop the car completely because i can't see which is dangerous. please regulate this.

A.523 April 18, 2026 — Fairfield, PA — Other

Hello. I submitted an LED incident report before and haven't heard back yet. I wanted to add something to the report. I am trying to prevent the installation of unshielded 3000K LED lights throughout our entire town. We had a 4000K "preview" light put up last Fall and taken down 2 months later due to numerous complaints. Our Borough Council, who in a newspaper article, said they were behind us 100% now said, in writing, that they will put up whatever lights MetEd (our power company) gives us, which are 3000K unshielded LED lights. The council says I should try my luck w/ the Pennsylvania Public Utility Commission, which I have made a formal complaint. The council is fully informed about the hazards of the lights, informed of alternative lighting, and have chosen to do nothing. We have an online petition. We have an in person petition. No one we have spoken to wants these lights. Please let us know what to do now. MetEd claims we can't make a complaint about a light they have not put up yet. We already saw their "prototype" and said no. The only difference in the light will be it's a little yellower. Here is our online petition that describes the problem. https://c.org/Mjk65dSscq

A.524 April 19, 2026 — Bellefontaine, OH — Other

Been trying to get Shields installed onto the street lights outside of my home for over 3 years now. I've had a lot of different health issues arise since these lights have been installed. Started out having dizziness, then was my thyroid, then my hormones, now my vision. I'm told I have vestibular migraines now. I am now seeing a functional medicine doctor, which has been quite the expense. Finally had a lighting company come out and "dim" one of the lights. I was told they couldn't dim it any lower. He also said he was going to send in a request for a shield to be installed (that was over two weeks ago). We still have no shield. I was also told by the lighting company that I may be responsible for paying for the shield, which would be around $400. Blackout curtains are a joke when it comes to these lights, as the light comes through any crack on all sides of the window (another expense). There has got to be something done about these lights. I would appreciate any help and advice from Soft Light Foundation.

May 2026

A.525 May 6, 2026 — Halifax, NS, Canada — Photophobia

My partner Jen has extreme photophobia that is basically ruining her life and employment. She can't even go into buildings because everything has been switched over to LEDs, she can't get employment barely. Can't use screens. It's becoming a nightmare for her. Just reaching out to see if you have some resources for maybe legal options or a phone number to talk to. She had to quit a job today because of it.

A.526 May 12, 2026 — High Point, NC — Other

My eyes are sensitive to the bright light at night. These new cars have twice as bright headlights as my high beams. So I just run with my high beams on all the time. I see cars, new cars, electric cars, sometimes with double headlights in the front, meaning four lights and they′re all bright. Why?

A.527 May 12, 2026 — Seattle, WA — Other

My vision suddenly changed. I was seeing bright flashing lights in particular blue and white colors. I could no longer read it closed captioning on the TV I could barely actually see the TV. It was terrifying. I walked away from the area where I was watching TV(Under a newly installed LED ceiling light in a fairly closed space/Breakfast nook in the kitchen. I had no idea what was happening to me, and I thought I was going to permanently lose my vision. Thankfully, I went into another room of the house and sat down and slowly my vision started to normalize. There were no LED lights in the room where my vision was restored. It was an incandescent light bulb inside a milk glass shade/Globe. I tried to think out what had just happened to me and I googled about LED lights and found out this has happened to other people as well. I do have dry macular degeneration(Which apparently can be a risk factor) But I had no idea What was happening to me and I felt like I was getting blind suddenly. Was terrifying. My vision is now back to normal and I will be removing all LED lights out of my home. I wanted to let you know this happened so you can address it.. Obviously, very dangerous to vision

A.528 May 14, 2026 — San Diego, CA — Migraine

I can no longer drive, go for walks or even look out of my windows at night because the LED headlights on newer cars blind me. While driving, I′ve had to pull over multiple times to wait for my vision to return to normal. My migraines have gotten more frequent and are triggered by bright LED headlights.

A.529 May 16, 2026 — Albany, NY — Astigmatism

I drive in a constant state of defense, placing away, raising an arm, adjusting mirrors in my subcompact sedan. I knew it was only a matter of time until this caused an accident. I am grateful it was behind a stopped car approaching a light, at a hilly diagonal 4 way intersection on a friday night, but it totaled my car and I fear ever driving again.

A.530 May 20, 2026 — Bellefontaine, OH — Migraine

Started having dizziness along with a bunch of other neurological issues in 2024. Am waiting to be seen by a rheumatologist to rule out sjogren′s syndrome , can′t get into them until July 2026. I′ve been seen by several doctors. This has caused me to have flare ups with my thyroid, vision problems, tingling and leg zaps down to my toes, blood pressure fluctuation, now am having severe headaches. I′ve tried several times to get whole house shields placed on the street lights trespassing into my home to no avail.

A.531 May 21, 2026 — Utica, KY — Photophobia

These lights are way too bright and impair my vision when driving at night to the point I can’t safely see. I have no issues with other types of headlights. If someone behind me has LED it’s very distracting shining in my car and they tend to follow too close behind close and I’m unable to use my rear view mirror or side mirrors due to the glare. It’s a growing problem.

A.532 May 27, 2026 — Chicago, IL — Photophobia

MULTIPLY THIS TIMES HUNDREDS OF TIMES EVERY DAY> OMG I AM LIVING A NIGHTMARE AND SMASHED IN THE FACE CONSTANTLY WITH THE BRIGHTNESS OF OVER EXCESSIVE HEADLIGHTS AND NOTHING BEING DONE!!!! STOP USING US TO HARM EACH OTHER AND IDIOT SELFISH DRIVERS DON′T CARE WHO THEY HARM!!! THIS IS A CRIME CONSTANTLY!!!!

June 2026

A.533 June 10, 2026 — Houston, TX — None

LED lights from the many trucks in TX blind me while driving in my standard vehicle. It makes driving at night miserable and painful.

A.534 June 11, 2026 — Newark, NJ — Electromagnetic Sensivity

Crazy ass bright police light, Newark PD. I swear, I saw Jesus Christ, go sick um Mark

A.535 June 12, 2026 — Chicago, IL — Epilepsy

Big box stores with LED lights make me sick. It is blinding bright and I can't shop. Costco, marshalls, TJ Maxx, grocery stores, LED lights are in most stores. The only way to shop in person is to wear sunglasses and a rollenz eye shield. The lights are flickering and too bright.

A.536 June 12, 2026 — Kalina Mala, Poland — None

It tires my eyes, I prefer longer-lasting bulbs because LEDs can withstand less (e.g. shocks or heat) and I'm a fanatic of vintage things.

A.537 June 16, 2026 — Oklahoma City, OK — Migraine

Tonight I was driving home after running some errands and there was an oncoming vehicle that had the brightest lights I have ever seen and it's hard not to look that way when the lights are that bright. I push my left turn signal and accidentally flashed my brights at the dude and he flashed me back and they were way brighter than before, so bright that it gave me a migraine and I'm still seeing little white dots after 20 minutes. I'm not sure why we need daytime lights for night time. What's the point? You're not supposed to have lights brighter than street lights on a car driving down any kind of road knowing that there are people out there with epilepsy and other things that can be caused by bright lights which by the way do a great amount of damage to your eyes. I hardly go out at night anymore simply because it's too risky with all the lights being so damn bright

A.538 June 17, 2026 — Madison, WI — Photophobia

My husband needed to be picked up from the mechanic this afternoon and it’s been raining here all day. I was otherwise having a great day and great week. The rain had thankfully stopped by the time I needed to drive. The cloudy weather meant more contrast with the LED headlights and running lights. I had to put my left hand up to block oncoming lights almost the whole way there and back, which feels very unsafe if one of those cars would cross the center line as I would not be able to see it behind my outstretched hand. My nervous system was shot by the time I got the three miles to the mechanic and was far worse by the time I got home. It’s taken two hours and a lorazepam for me to stop sobbing because I feel like I cannot function as a normal human due to the blinding oncoming lights. I just want to become a hermit, grow all my own food, and never have to drive or ride anywhere ever again. I don't know what else to do. I went from feeling great to hopeless and borderline suicidal in 8 minutes of drive time.

A.539 June 26, 2026 — Anytown, USA — Astigmatism

mostly teslas and new cars. Most of these lights are brighter than the sunset and cause lasting blindness after exposure. I constantly fear that one day I will be blinded and accidentally crash my car because of someone else's headlights.

A.540 June 30, 2026 — Goose Creek, SC — None

I have to drive through a pretty narrow and deserted road to get to my house and many times I have been completely blinded by cars driving in the opposite direction and once to the point where I have swerved off the road

July 2026

A.541 July 9, 2026 — Los Angeles, CA — Migraine

I routinely suffer from migraines, eye strain, and headaches due to the mandated LED and florescent bulbs. Incandescent bulbs never gave me a problem and thankfully I stockpiled them and still use them today throughout my home. But I am routinely impacted when at the office, at a friend's house, out in restaurants, stores, etc. The harsh lighting everywhere mandated now by absurd laws is a major problem.

A.542 July 12, 2026 — Sykesville, MD — Other

I have blue eyes and it makes it 10x more difficult to drive at night. I have to flip my rear view mirror up to reflect the light away from my eyes.

A.543 July 19, 2026 — Los Angeles, CA — None

So glad to find this website! In January (when it gets dark so early), I nearly hit a jaywalking pedestrian after being blinded by LED headlights. TWICE. In the first case, a woman walked her daughter from between two parked vehicles in the middle of the road as I was blinded by glare from an oncoming vehicle. In the second, a homeless man crossed against the light, and though I was green to go, I barely saw him because of the lights of the high-sitting SUV behind me. Had I hit either of these suddenly appearing jaywalkers, I might have lost everything—while the owner of the blinding vehicle (not to mention the auto manufacturing industry!) would have driven merrily away.

A.544 July 21, 2026 — Anytown, NA — Migraine

LEDs were invented as weapons to break up demonstrations. Incandescent lamps were invented to illuminate homes; they have a natural spectrum! Energy savings are nothing compared to the harm from LEDs! LEDs blind (that's why they were invented), cause vasospasm in the head, the head is tightened with a hoop, the human aura is irradiated, the pulse rises, dizziness, panic attacks occur! Please pay close attention to the problem people!

A.545 July 23, 2026 — Carroll, NE — Astigmatism

I simply cannot see. I am continuously blinded by these lights. I put my visor down to help block them. I do all the suggested things, that normal drivers do. It does not help. These lights are too intense. Not too mention, the common courtesy that was once taught for drivers, has become rare. Drivers are leaving these intense lights on without dimming appropriately, following with the brights on, and then there is the issue of the vehicles that have 4 and 6 lights on them. It is too much! There is a definite need for safety standards to be made here.

A.546 July 30, 2026 — Minneapolis, MN — Other

We are a 50 + year old multi sensory design research lab. Since there is no way to contact you on your site, you may find a conversation about LED design and research interesting. Peace, Steve Orfield

A.547 July 31, 2026 — Wappinger Falls, NY — None

The cars with the blinding LED lights are a real problem for me. I have to actually look away while driving and look at the road line to see where I'm going. It's an accident waiting to happen.

August 2026

A.548 August 2, 2026 — Crestline, CA — Other

My husband has a neurological condition and LED's lights are stealing our life from us, stealing our quality of life and freedom! We only feel safe at home where we have incandescent bulbs. Every environment outside of our house is hostile and it has a very negative impact on our physical health and mental health. The car headlights are blinding even during the day because of LED's. We rush our shopping to minimize the exposure. We can't go to certain stores and restaurants. We don't have a choice but to go to a grocery store with super ultra bright LED's, and we just wish we had another option. We wear specialty photosensitive glasses hoping to make our lives more livable in the LED nightmare, but even with the strongest glasses we still suffer the effects of these lights. We feel we can't go anywhere and experience life normally. Because the lighting is like an alien laser beam destroying our brain and well being and ability to function in society. We feel powerless and sick contemplating the injustice of this situation. I hope things can get back to normal because we have been losing our minds. Also people close to us don't understand the harm. Thank you Mark Baker and team for everything you are doing!

A.549 August 3, 2026 — Anytown, TX — Astigmatism

Got blinded while driving. As in big black spot I could not see for two minutes or so

A.550 August 4, 2026 — Camarillo, CA — None

Lack of sleep

A.551 August 9, 2026 — Chicago, IL — Other

It's now 2026 August and STILL NOT ENOUGH being done. I like you am BLINDED DAILY as soon as I step outside. No more able to drive, walk or just be outside!!!! Freedoms lost and the other day I used an LED yet the driver who blinded me sped around to follow and trap me in my motel room!!!! When I called him a hypocrite and that he blinded me he yelled I DON"T CARE !!!!!! Violence is what they want as if we don't have enough problems. What this boils down to is the DRIVER of the car COULD do something and cover or TURN THEM OFF and why they are on in the DAY MY GOD how stupid Americans are!!!!! Very sick and sad to blind kids who don't know better not to look and babies. Horrible nothing done still. Our police are trying and I'm making presentation of common sense to help. We shouldn't sacrifice our vision!!! When police go blind all hell will break loose!!!

A.552 August 11, 2026 — Auburn Hills, MI — Migraine

Because of the blinding LED lights on vehicles, I am considering not driving at night any longer. They temporarily blind me, so I have to look away at the side of the road as they pass by. This is extremely dangerous as our city also have a sever deer overpopulation and they run out onto the road at night. I also suffer from migraine headaches and have experienced an increase when exposed to more LED lights. With these health and safety issues in mind, it is logical to switch back to incandescent lighting. Especially since Bill Gates said the climate crisis is over!

A.553 August 19, 2026 — Albuquerque, NM — Astigmatism

Its very scary for me to drive at.night.The br8ght l8ght blind me and I struggle to see the lines on the road after incoming traffic blinds me. The lights make auras around them and it causes a lot of strain. My eyes hurt afterwards from having to focus so hard I just don't drive at night anymore. I also hurt in a movie theater so I don't go to the movies either. The screen is so bright I also see auras and the flashing colors hurt my eyes and I need to look away. Last movie I went to 7 years ago I left my family at the theater watching the movie and took an uber home so I don't go to movies either. I did find a few overpriced incandescent bulbs for my house and that is what I use at home. Computer work is also hard for me. I heep the screen very dim and since I retired I put the laptop away in the shed and life is better not having to look at the screen every day

A.554 August 19, 2026 — Blue Bell, PA — Other

DO NOT FEEL WELL AROUND LED LIGHTS. NAUSEOUS. FIND THE LIGHT UNSETTLING.

A.555 August 19, 2026 — Columbus, IN — Migraine

I'm an FCC-licensed Extra-Class Amateur Radio Operator. LEDs in my home interfere with radio reception, including both "ham" radio and local commercial broadcast radio stations. LEDs in my neighbor's yard lights emit broadband signals all across the VHF spectrum that make it impossible to hear any but the strongest radio signals in the 2-meter band. Besides violating FCC Part 15 rules & regulations, these "low voltage" yard lights, these lights are emitting radio signals that create health hazards.

A.556 August 19, 2026 — Kitchener, ON, Canada — Other

Blinding during night driving

A.557 August 19, 2026 — Lake Forest, CA — Other

Other was chosen as health issue because so many things have happened to me since my state has outlawed incandescent lighting. My emr symptoms are terrible (headaches, brain fog, body pain, chronic fatigue) My vision in which was fabulous my entire life has turned upside down. I developed rapid growing behind lens cataracts in both eyes. After getting them replaced in two years I developed secondary cataract. Both issues needing expensive surgeries and my eye sight never to return as normal. My entire household has suffered eye vision decline. The driving at night with a city of led lights is difficult. The shopping at markets has become a horrible event. We deserve to be able to use non Led / blue wave lighting in our homes and cities.

A.558 August 19, 2026 — Lancaster, PA — Other

Extreme discomfort from the glare of these LED lights, intense eye blinding.

A.559 August 19, 2026 — Las Cruces, NM — Other

LED's are very disruptive to humans, animals, birds and our environment. They are not compatible with our eyes, are damaging and very difficult to be around. They are especially hazardous in vehicle headlights because they temporarily blind the driver encountering them on a highway. No doubt, they have already caused numerous accidents. This spectrum of light can trigger migraines, seizures and other health incidents in more vulnerable people, especially those with underlying conditions that are aggravated by LED lights. They are disorienting to our wildlife and the opposite of the calm environment produced by incandescent lights. Please stand up for us all! Ban hazardous LED's and incorporate beneficial INCANDESCENT LIGHTS again. The health and wellbeing of people, our fellow travelers and environment, should be the #1 priority of those we elect to serve us.

A.560 August 19, 2026 — Modesto, CA — None

We've been noticing this for a while especially at night...the LED headlights are so bright it blurs your vision & even causes the area to not be visible. It's worse at night but even those that leave their headlights on during the day there's still an impact on your vision when LED lights are coming at you...walking or driving.

A.561 August 19, 2026 — Netherlands — Other

Am an airline captain, whereby, among other, my vision forms a very important aspect of safety. LEDs do impact my health negatively, we are nowadays exposed to numerous sources of LEDs (lighting in buildings, lights in aircraft, street lights, car headlights, smart phones, tablets, etc etc) LED=new asbestos. As always, also with LEDs, governments do nothing for health, but let businesses reap major profits first, amd then, years later come with the same story "ooh, we did not realize it was harmful". Another "safe & effective" lie, as with the harmful Cojona experimental gene therapy mRNA injections.

A.562 August 19, 2026 — San Antonio, TX — Migraine

The LED lighting in my office causes me to get migraines. Because of this, I have to keep my office light off, and use a table lamp. Today we had a meeting in the conference room, and the overhead lights remained on. I began to get an aura (that's how I know a migraine is coming) and had to get my sunglasses to wear for the duration of the meeting. I am highly sensitive to LED lights and it affect me even when driving and the oncoming vehicles have LED lights. Because of this I have stopped driving after dark.

A.563 August 19, 2026 — Sonoma County, CA — Other

The LED lights at work make me feel tired with difficulty concentrating after a few hours. The other work site does not have LED lighting so I am able to compare. I turned down an offer for more hours at work only because of the way the lighting there at the site with LED makes me feel too drained by end of work day.

A.564 August 19, 2026 — Wilmington, DE — Other

Left pupil doesn't react and because of this LED light FLOOD S into my eye blinding me. Light SO BRIGHT it can cause an ACCIDENT!!!

A.565 August 22, 2026 — Austin, TX — Other

Two children were riding bicycles, one with an extremely bright light mounted on their handlebars. I was driving towards them, the child without a headlamp was riding in the middle of the road and I could not see them. I only saw the child in the middle of the road a the last second and barely was able to swerve towards the curve after passing a parked car. Thankfully I did not hit the child or the parked car. The child's bicycle light was excessively bright and blinding.

A.566 August 24, 2026 — Palos Park, IL — Other

I am a twenty one year old male with vertigo. Because of this I try my best to stay away from harsh sounds and lights as they very often trigger violent dizziness and extreme nausea. With the increase

of newer cars all having harsh bright white led headlights I cannot escape the blinding and vertigo causing cars on the road. So today I drove to work at approximately 4:30 am CST. A newer audi driving behind me happens through a bumpy section of the road where I then receive what feels like fifteen, one second bursts of blinding light come through both side mirrors and rearview the mirror instantly causing a bout of vertigo making me dizzy and forcing me to dangerously finish my final two turns into work and go about my day unable to eat or drink due to the nausea and not operate certain machinery because of the dizziness.

A.567 August 25, 2026 — Boca Raton, FL — None

I have noticed over the last few Years that every time I go into a big box store whether it be a grocery store like Publix or target Costco or HomeGoods. I do not feel well after being under the lights in the store. I never noticed this in the past, but I definitely feel that over the last several years. Brain fog and just generally not feeling well until I leave the store. I never had this in the past

A.568 August 25, 2026 — Camden, NJ — None

Between the new LED lights on vehicles and the lights on EMS vehicles which are brighter than on older vehicles, it has become increasingly difficult to see at night with all the extra glare coming in my general direction when coming on the opposite side of traffic. The glare makes the eye sensitive enough to blind you for seconds and when caught off guard with vehicles coming in or out of traffic, it can be a danger to not only wildlife but also pedestrians and cyclists on the road.

A.569 August 27, 2026 — Aiken, SC — Astigmatism

People driving and parking with the LED lights is perceived as the most awful amount of light to my eyes. Making it hard for me to park or drive opposite of them.

A.570 August 28, 2026 — San Diego, CA — None

The new LED car lights are blinding.. makes it very hard to drive at night.. please come up with a better solution

A.571 August 29, 2026 — Paris, TN — Astigmatism

I have a hard time seeing at night as is so when a car with LED or HID headlights come towards me it′s the worst feeling that I could get into an accident.

A.572 August 31, 2026 — Davis, CA — Autism

I went into a CVS Pharmacy. At the counter, they had a computer screen with an attachment on the bottom that seemed to be a laser that was projecting a big green X on the countertop. But it was flickering. Within seconds, my heart was pounding and I had to take a knee on the ground. We figured out that I could place my hand over the laser to block the light so that I could make my order, but I was left stressed out for hours afterwards.

September 2026

A.573 September 2, 2026 — Davis, CA — Autism

I encountered LED RRFB strobe lights in the City in three separate events less than an hour apart. Each time, I went into fight or flight mode. But the third time, I felt close to hyperventilating and was shouting profanity in my car. It too me hours to calm down afterwards.

A.574 September 9, 2026 — Blasdell, NY — Migraine

I have been working at my company for almost 3 years. I have NEVER been diagnosed or had migraines or migraine aura until this year. We moved to a new building with LED lights on the ceiling. They are directly above my head approximately 7ft for 8 hrs 5 days a week. I have migraines and migraine aura, nausea, eye strain, trouble sleeping and dizziness. It ruines my day after work. Some days are spent sitting in a dark room by myself. I am unsociable and irritatable. Then I have to go back again the next day to deal with it again. It has greatly impeded my work. Its depressing. These lights are in a defense manufacturer who makes very important parts for the government. They should NOT be there. Please do something about this. Thank you

A.575 September 10, 2026 — Dallas, TX — Astigmatism

Developed astigmatism

A.576 September 11, 2026 — Yakima, WA — Astigmatism

I dread having to drive at night. In the city the glare from these ultra bright lights hurts and is blinding but I also have to drive down a dark highway on my way home and in the moments that I'm met with these LED lights I am often blinded for long stretches of road only having a handful if feet to see in front of me. That's even if I can bare to look at the road with out my eyes hurting.

A.577 September 17, 2026 — Wellington, CO — Other

I drive to work early morning (when it's dark). 55-65 mph area. My eyes are light sensitive. Down a 2 lane county highway. LED headlights with blue / white color are very disorienting. Especially pickup trucks and Semi trucks. The height of their headlights are close- to - equal to my height & line of site while driving. Causing me to having to constantly look down, to my right for the solid, white line. In most instances I am unable to differentiate if the oncoming driver has their bright lights on. In addition, there are hills. So an oncoming driver's headlights have variations. Sometimes not so blinding, then very much so. Even in town, when driving at night it's intrusive and usually miserable with LED headlights oncoming & from behind. Often I will pull my driver's side, side mirror inward to avoid the light in my eyes. This was never an issue before LED headlights came to be in vehices.

A.578 September 19, 2026 — Port Angeles, WA — Migraine

I have to take a rescue medication to go outside at night due to led spotlights, headlights, signs, street lamps, stop lights, and flashlights since they all trigger severe migraines that leave me bedridden without rescue meds and taking the meds too frequently is bad for your health so i avoid going out after dusk.

A.579 September 24, 2026 — Anytown, IA — Astigmatism

The plague of super bright white LED lighting has made driving much more difficult leading to me needing to wear yellow tinted clip on lenses over my glasses to take some of the sting out of them. Today as I was driving to work and an oncoming vehicle with blinding white LED headlamps was impairing my vision enough that I did not see the deer that ran out in front of me until I hit it, likely totaling my vehicle. I have been driving this vehicle for 10 years and never once had a problem spotting deer in the ditches even with oncoming incandescent bulbs.

A.580 September 25, 2026 — Mammoth Lakes, CA — Autism

I was a passenger in a vehicle driving east on Meridian Blvd. when we encountered two traffic signs with 6 LED strobe lights flashing at about once per second. Four of the LEDs were "white" and created significant glare. The overwhelming intensity and number of LED strobes caused me to involuntarily close my eyes because of the pain, and utter profanity as I felt the fight-or-flight urge. I remember that one of the signs was a speed limit sign, but the sensory overload of the LED strobes made it so I don't even remember what the second sign was for.

A.581 September 27, 2026 — Linden, NJ — Other

I was stuck in bumper to bumper traffic at 8pm. We were going 3mph for over an hour. I had a truck behind me with bright LED lights. They were shining in my side view and rear view mirrors, into the interior of my car and I could see a full outline of my vehicle on the truck in front of me. The interior of my car was like daylight. I could see my hand perfectly when I held it up to block the glare coming from the side view mirror. Once I was out of the traffic I could barely see and had a hard time referencing distance and it messed with my depth perception. I almost got into an accident.

A.582 September 27, 2026 — Pullman, WA — Astigmatism

Every morning I have to drive to work at 4:30 am. And EVERY morning I am blinded by other vehicles LED lights to the point that I have to actively hold up my arm to block on coming light to shield my eyes. If I do not physically block the light from my eyes, then the residual glare takes five to ten minutes to clear from my vision. I have nearly been forced off the roads by glaring LED in on coming cars making it impossible for me to see the road. Im constantly worried one of these mornings I will wreck my car from being blinded. 2026 is the worst year I have dealt with this issue so

far. And every year it gets worse. I also suffer from chronic migraines and these LED lights are tourcher for photo-sensitivity symptoms.

A.583 September 29, 2026 — Torrance, CA — Autism

I was driving in LA on 405 South near the 101 Freeway interchange today at about 7:00 PM (Sunday, Sept. 27th, 2026) and I saw one of your portable changeable message signs warning to expect delays or something (due to the construction on the 405).

This particular sign had 4 bright flashing yellow circle lights below and above it to catch drivers attention (see attached cartoon). These signs used to have a more reasonable flashing lights that cycle every half second or so. I'm scared that these strobing ones will become the norm. These high frequency strobe lights cause my nervous system to become overwhelmed and I'm temporarily in a state of confusion / near paralysis. This is extremely dangerous for me and other drivers on the road.

October 2026

A.584 October 1, 2026 — Denver, CO — Electromagnetic Sensitivity

headlights send me spiraling. sets me off

A.585 October 1, 2026 — Houston, TX — None

I drive to work at a factory every day around 4:00 AM. Several cars turn off onto the same exit to get to that factory, and all the bright lights make it very difficult to focus and see.

Specifically today, three or four different cars behind me while I was navigating to the correct entrance had LEDs that strobed either due to maybe flashing or through the change in angle on the LEDs based on road jostling. I nearly hit the curb. Thankfully I'm okay, but these sorts of incidents happen at least once a week.

A.586 October 1, 2026 — St. Leonards-on-Sea, United Kingdom — Photophobia

I live on the seafront and there is a cycle path and very bright street lights. When cyclists ride in the evening with led light , I am blinded ftom a long distance away , I can’t see anything but the light and it hurts my eyes and I have to shield them. This time I stopped the cyclist, who was a young man to try to explain to him what how his light was affecting me and other pedestrians. He insisted it was for safety snd that his light was pointing at the ground in any event. When I disagreed with him he said I wasn’t listening. I said it’s not been dark the lights are so bright. He said I wasn’t listening even through the opposite was true. Accused me of being rude and cycled off. He also had a flashing red led on the back of his bike. My health is really being affected by all these lights. I can no longer enjoy an evening walk and I feel ill from these lights. Please ban them.

A.587 October 4, 2026 — Burlington, VT — None

I can not walk outside after dusk without LED lights from cars blinding me when I walk on the sidewalk. I have to wear sunglasses when there no sun out. I have to cover my eyes. I've litrally walked into other people before because I CAN'T SEE due to LED headlights blinding me.

A.588 October 4, 2026 — Flagler Beach, FL — None

I cannot drive when the horible led lights from the street or head lights from cars. I avoid going into Walmart because of the horrible lighting all over inside and out. Headaches, eye soreness, not to mention irritability etc...

A.589 October 6, 2026 — Prineville, OR — Migraine

Me and my mom were driving back from a different town at night when this truck passed us, we thought he had his brights on because they were so blindingly bright, they were brighter then our brights, so my mom flashed him with hers but they weren't. Someone else's lights normally should not be brighter then someone else's high beams. Since she did that he did it back with his actual brights and I could not see for a while after that, and it really hurt too. my mom had to close her eyes while driving so she didn't get blinded. Another time I was with my dad, it was night and this other car was was coming up from pretty far away, I wouldn't know exactly but they weren't even that close to us yet but their lights were so bright we couldn't see infront of us. It's so stupid because why are we

being blinded from that far away? Anyways, there was a deer in front of us that we couldn't see up until last minute. Luckily my dad was smart and was going super slow but if we had been going any faster with those lights blinding us from that far away, that would've not only been unfortunate to the deer but damage to our front end as well, maybe would've even led to a wreck. And I'm tired of hurting every time I go somewhere at night.

A.590 October 6, 2026 — San Francisco, CA — Astigmatism

The cool, very piercing bright lights on newer cars, especially Tesla, is making it harder to drive at night. They are blinding and then I see spots after they pass. It is now almost constant. I would really like the lumens to be lowered or more regulated. While the cars driving with those bright lights can see well, it blinds everyone around them.

A.591 October 11, 2026 — Poteau, OK — Other

8/27/2026 around 9pm, I crashed a limousine due to oncoming headlights blinding me on a 2 lane county bridge, from the front bumper to the rear bumper, causing me to scrape the bridge, and totaling the vehicle. It scraped the entire side of the limousine. My commercial vehicle insurance company labeled my accident as "At Fault", because there was no contact with the other vehicle. Now when I replace the limousine, I'm confident my premiums will go up significantly.

A.592 October 13, 2026 — Chicago, IL — Migraine

LEDs on streetlights in general but specifically in my local park are giving me headaches and ruining my experience at night.

A.593 October 14, 2026 — Temperance, MI — Astigmatism

My adult son is autistic. We have a large neighborhood and we go biking and walking at night because the roads have less traffic so it's safer and peaceful. LED lighting is now ruining this experience for us. As neighbors are installing LED lights that are as bright as stadium lights without pointing them down or using shields, as well as the cars with their blinding LED headlights increasing in number each day, we are getting blinded and actually have to pull over until we can see again. Then another car or 2 drive by, and another neighbor puts in 5 lights they don't need, and we're pulling over again. There used to be some roads where people still had the nice warm golden lights and our eyes could catch a break, but that is going away. We bike to a school where we park and walk laps. A house in the neighborhood across the street put up a porch light that actually lights up the entire school parking lot! We now have to put our hands up or close our eyes during some of our walk. Then we go home and I usually have a headache and am still seeing spots when I go to bed. Now our neighbors behind us and in front of us have put LED lights in without a shield or pointing down, and they're lighting up the entire length, front and back, of our ranch home. So if I don't want blinds closed and want to feel fresh air, I have to deal with their unnecessary blinding lights. Who ever would have thought that the simple act of biking, walking, looking out your window, night driving or sitting comfortably on your porch would be taken away with no regard to how it effects humans, retinas and wildlife. Unbelievably cruel. LED lights are certainly not progress. They're taking us a huge step down.

Appendix B — Public Comments on the Petition to Ban Blinding Headlights (Complete Record)

This appendix reproduces the public comments left on the petition described at Part VII.G: 4,991 comments, the earliest dated November 17, 2016 and the latest October 12, 2026. Each was written by a member of the public who signed the petition. The Foundation reproduces them because Part I states its reason for doing so: a signature total is a number, and what the signatories wrote is evidence.

What has been removed, and what has not. The petition platform records each signatory's name and postal code. Neither appears in this appendix. The Foundation has taken the view that the city and the state, or the city and the country, are as much as the Department needs in order to weigh a comment, and that nothing is added by naming the person who wrote it. Two comments contained an electronic mail address and three addressed another signatory by name; those are marked where they have been removed. Nothing else has been altered. Spelling, punctuation, capitalization and grammar are the commenter's own.

Order and numbering. The comments are in date order, earliest first, so that a comment left after this appendix is built can be added at the end without renumbering any comment the comment cites. Where several share a date they are ordered by place. The dates are given as the platform records them, converted to a uniform format.

Location. Where the signatory gave a city and a state, both are shown. Where no state was given, the city and the country are shown. One hundred and sixty-two signatories gave neither a city nor a state, and for those the country alone appears. The platform records signatories in forty-seven countries.

The Foundation reproduces each comment without adopting its contents. Many assert a causal relationship between light-emitting diode emission and a condition the commenter describes. Those are the commenters' statements of their own experience and belief, not findings, and the Foundation does not advance them as findings. Part VII.A.5 states the same limit for the reports at Appendix A and it applies here with equal force. Some comments argue with each other, some are addressed to no one in particular, and a few concern subjects outside this proceeding. They are reproduced as left.

Comments left in 2016

November 2016

B.1 November 17, 2016 — Aberdaron, WLS, United Kingdom

These lights are dangerous. Medical evidence says the automakers are exceeding safe limits. Why are they allowed to get away by killing people all for a marketing gimmick?

B.2 November 17, 2016 — Ann Arbor, MI

I am signing this because I have been an opponent of too-bright lights for a long time. NHTSA lied to me in writing that they would do something "soon" about the too-bright daytime running lights when first allowed in the 1990s. Some 17 years later "soon" still has not arrived. The entire issue of too-bright lights has been a disastrous failure by NHTSA.

B.3 November 17, 2016 — Bethlehem, PA

I have been terrorized by blinding lights of oncomimg vehicles. This has curtailed night driving for me.

B.4 November 17, 2016 — Bethlehem, PA

I agree that this is dangerous

B.5 November 17, 2016 — Burbank, CA

I'm signing because I daily get headaches from these blue headlights. My near-accident rate is also increased due to the blinding effect on my ability to focus at night.

B.6 November 17, 2016 — Canberra, Australia

I totally support this petition against the "lightmare epidemic" that has swept the world in recent years. Headlights, DRLs, fog lights and even reverse and brake lights have become WAY too bright, as regards both comfort and safety.

B.7 November 17, 2016 — ENG, United Kingdom

As a migrainer (and as such being very sensitive to these new kinds of overly intense and blue-rich white lights) and also flashing lights at high frequencies - I find these kinds of lights on both cars and bicycles not only trigger many multiple ill symptoms, but are also a major deterant to my ability to be able to drive or cycle on the road safely. Lighting on vehicles and bicycles has gone senseless - we don't need such intense and overly bright blue-rich white lights to light our way at night. LED Bike lights flashing at fast speeds are actually highly annoying and very uncomfortable. In short - These lights are a deterant to road safety, being able to see properly on the road at night and are a major source of disability glare. Research has shown that such lights don't increase road visability at all, but actually rather drastically reduce it. Because of blue-light scattering and reflection - they also provide less visability in rain, wet conditions and fog. If you have intense, blue-rich harsh light shining into your eyes whilst you're driving you won't be able to properly see or discriminate between that and other visual stimuli in your perepheral vision - and vice-versa. Let's stop the madness. See lightaware.org #BeLightAware

B.8 November 17, 2016 — Edinburgh, United Kingdom

This is an issue that concerns people across the world - and it is so unnecessary! I write as a non-driver living in the UK, who is regularly dazzled by the headlights and daytime running lamps of passing vehicles. If this affects me, as a pedestrian, it's obvious that the potential danger to and from drivers having their vision temporarily impaired is so much greater.

B.9 November 17, 2016 — Granger, IN

As an electrical engineer who has investigated in detail outdoor lighting issues, I see the current trend toward brighter automotive lights with higher blue content as innovators exploiting a dangerous regulatory loophole. LED technology offers plenty of solutions with lower blue light content at only a marginal increase in cost. Only through regulations will auto makers adopt these better LED technologies.

B.10 November 17, 2016 — Indianapolis, IN

Thank god, these lights are so stupid. The mercury argument is weak, the higher frequency light is blinding. This is the most no brainer, and I'm stunned that we continue to elect congressmen without education

B.11 November 17, 2016 — Kenilworth, ENG, United Kingdom

I have written to the British government 5 times., and every time they tell me its safer with light on

B.12 November 17, 2016 — Ley Hill, ENG, United Kingdom

Can't stand bright headlights

B.13 November 17, 2016 — London, ENG, United Kingdom

I've had to stop driving at night because of them, and that includes blinding brake lights too. As a working musician, they've ruined my working life, and I now think LEDs, over bright headlights and mandatory DRLs should be banned, or at least a sensible limit imposed on their output.

B.14 November 17, 2016 — New Canaan, CT

Cadillac in the 1960's used to have a sensor on the dash to dim lights to on coming traffic automatically. It would be a cheap fix.

B.15 November 17, 2016 — New York, NY

YES, Please put a ban on all headlights that are over 3200k. Higher temperature light is blinding in the dark and simply a hazard to drivers as well as damage to our eyes. LED lights, sodium vapor lights, should not be used for car headlights or brake lights. Also the tint of headlights (blue, pink, green, we have all seen them) should also be banned. When light of any intensity is reflected in rearview mirrors it is amplifed and even brighter, as what a mirror does to light. Super bright headlights become blinding and overwhelm the driver. I literally have to turn all of my mirrors down to avoid being blinded. Please act on this.

B.16 November 17, 2016 — Tempe, AZ

DRLs are a hazard due to the glare they cause.

B.17 November 17, 2016 — Tucson, AZ

I hate the blue headlights!!!!!!

B.18 November 17, 2016 — West Los Angeles, CA

I am a daily bicycle commuter.

B.19 November 17, 2016 — Worksop, ENG, United Kingdom

The sooner they ban these LED lights the btter

B.20 November 17, 2016 — santa clara, CA

These headlights are very dangerous for Motorcyclists and bicyclists since while blinded by these lights motorist do not see smaller vehicles. If you cannot see at night with normal head lights then you should not be driving at night.

B.21 November 18, 2016 — Brooklyn, NY

These LEDs are simply blinding, dangerous and not necessary.

B.22 November 18, 2016 — Corona, CA

All auto manufacturers are responsible to recall autos and modify lights that do not meet safe DMV requirements. It is getting worse.....

B.23 November 18, 2016 — Fairfax, VA

I have sensory processing issues. Many of these painfullt bright headlights blind me, and flashing turn signals cause me to stumble, sometimes into the street. These things are dangerous.

B.24 November 18, 2016 — Llanfrothen, WLS, United Kingdom

I am signing because I agree that headlights are so bright and blinding. They draw the eyes when you are driving and makes it almost impossible to see when walking and cycling.

B.25 November 18, 2016 — Petaluma, CA

I am signing because I can no longer drive at night because of the blue headlights.

B.26 November 18, 2016 — Richfield Springs, NY

There is absolutely no reason to have these lights except for someone wanting to make miney on a fad. get rid of them!!!!!

B.27 November 18, 2016 — San Francisco, CA

LED lights are especially blinding for the elderly as our eye gradually deteriorates.

B.28 November 18, 2016 — Stoney Creek, CA

I have had many problems with these types of lights, especially when a truck comes behind a car and the lights now blind everything in your mirrors and make it very hard to see. This is very disturbing that the auto industry has allowed this and who tested this.... I wonder

B.29 November 19, 2016 — Chico, CA

Please sign this

B.30 November 19, 2016 — Corvallis, OR

Blinding headlights and daytime lights are a menace to public safety and should be banned.

B.31 November 19, 2016 — Crystal, ME

LED and HID headlights are so blinding, I've actually had to come to a complete stop on the road until they are past me because I cannot find anywhere to set my vision that allows me to safely continue until they are past me. They obviously must be responsible for some devastating motor vehicle fatalities, and have necessitated my stopping night time driving.

B.32 November 19, 2016 — Fresno, CA

Very distracting and dangerous from all angles (oncoming, rear or side views), especially raised vehicles.

B.33 November 19, 2016 — Monrovia, CA

There are way too many vehicles with headlights that are blinding to other drivers.

B.34 November 19, 2016 — Sacramento, CA

I have been a bicyclist for 30 plus years, and cannot figure out why there is a need for even brighter lights when I thought the existing headlights on cars were good enough. If the number of accidents hasn't gone down this should be the most blatant of all messages to the manufacturing industry to re-assess the rationale behind a need for brighter lights.

B.35 November 19, 2016 — Santa Rosa, CA

I'm signing because these headlights have been blinding me for years. and no one would listen!

B.36 November 19, 2016 — Wheaton, IL

Particularly the LED headlights need to be better regulated or banned if they can't be made less blinding. You can always tell when there is a new Acura or Audi coming at you

B.37 November 19, 2016 — canyon country, CA

these lights are dangerous the low beam of today is brighter than the high beams of yesterday, and laws were written to dim high beams of yesterday and now the lowbeams are brighter

B.38 November 20, 2016 — Coldwater, Canada

Dangerous & blinding. Would have thought automotive companies would have tested them before making such a ludicrous decision!!!

B.39 November 20, 2016 — Los Gatos, CA

This is a pet peeve of mine. We used to distinguish between normal headlights and "brights", the latter being appropriate only when you found yourself alone on the road. Now many of the new cars have "normal headlights" the exceed what "brights" used to be. They are blinding to both oncoming traffic and to traffic in the lane ahead of you. Please create legislation that regulates this and keeps us all safe.

B.40 November 20, 2016 — Merced, CA

I'm a truck driver & am blinded all the time

B.41 November 20, 2016 — San Rafael, CA

I am sick of being blinded by the light of some new cars--these lights are a hazard on the road and need to be recalled or made easier on the eyes of on coming drivers.

B.42 November 21, 2016 — Clear Lake, WI

I would like to see all daytime headlights (except motorcycles) banned and replaced with the Amber daytime running lights.

B.43 November 21, 2016 — Fort Worth, TX

Scares the livin' daylights out of me ! For safety sakes, I try to pull over to the right and stop till the driver disappears from sight.

B.44 November 21, 2016 — Munfordville, KY

I have a hard time driving at night because of the blue LED blinding headlights.

B.45 November 21, 2016 — Rockport, MA

They are so bad, many people won't drive at night. (Me included) Please ban these blinding headlights. Terrible invention.

B.46 November 22, 2016 — Pasadena, CA

I recently took the written section of the Driver's License Exam in California. One question asked what you should do if blinded by headlights. The correct answer: look down and to the right! How safe is that???

B.47 November 22, 2016 — Stamford, NY

Seriously people - we need to stop this dangerous trend before it creeps into all new vehicles! Read, learn, and take action!

B.48 November 23, 2016 — Colwyn Bay, WLS, United Kingdom

day time running lights are extremely dangerous

B.49 November 23, 2016 — Greifensee, Switzerland

Automatic cornering lights should also be banned.

B.50 November 24, 2016 — Ash, ENG, United Kingdom

I'm signing because I'm fed up with having to dip my rear view mirror on bright sunny days because some idiot comes up behind with lights blazing. Also fed up with lazy drivers who sit in front of me at traffic lights with their foot on the brake instead of using the handbrake.

B.51 November 24, 2016 — Bethesda, MD

I couldn't figure out why I was suddenly being affected by these lights, especially at night. I thought it was just me--even though my vision hadn't changed--until I read all these comments. These lights are deadly dangerous.

B.52 November 24, 2016 — Tuam, Ireland

They give me nauseating migraine just to catch a glimpse, I can't go outside at night now because of LED car lights (and LED street lights -separate issue). Never mind that many drivers I know feel they are bullied off the roads by LED and HID headlights and break lights. It's so difficult to see what's around that particular oncoming car or what's coming behind it, be it another car, pedestrian, cyclist. They are absolutely lethal and how car manufacturers are allowed put them on cars I just don't understand. They use LED as a selling point yet they are extremely dangerous and manufacturers continue to promote them and increase their strength and intensity. It's unbelievable how this is allowed to happen.

B.53 November 24, 2016 — Valley Springs, CA

As a sufferer of frequent migraines, with bright lights being a major trigger, I stand behind this 100%. I am also the only licensed driver in a household of three, one of which often works nights, which means I cannot simply choose to not drive in the dark. These ultra-bright lights are definitely a hazard and should be banned.

B.54 November 24, 2016 — Weston-super-mare, ENG, United Kingdom

I am signing this because binding vehicle lights - whether from cars or bicycles - are an absolute hazard for road users. We urgently need to get back Due Diligence as well as good old-fashioned consideration for others who share the space with us.

B.55 November 24, 2016 — Woodbridge, VA

I believe it would serve driving safety and would save lives.

B.56 November 26, 2016 — Weston-super-mare, ENG, United Kingdom

These lights are horrific and very debilitating. As a cyclist, I regularly have to get off my bicycle as I lose my orientation due to a an oncomer's bright lights. This is ridiculous! What has happened to good old-fashioned consideration? And what about common sense? Vehicle lights - and lights in general - need to be adequate, not over-imposing! Regulations are urgently needed to stop this madness.....

B.57 November 27, 2016 — Irvine, SCT, United Kingdom

It's causing deaths

B.58 November 27, 2016 — San Rafael, CA

I'm signing because this has been a serious problem for me when driving at night.

B.59 November 29, 2016 — Louisville, OH

I have been increasingly blinded at night by new cars with projector headlights and know many others especially my age and older who say these cars are making driving at night hazardous enough to make them wonder if they will have to stop driving at night. These cars make more light than others do with their high beams on and it's dangerous.

B.60 November 30, 2016 — Bristol, ENG, United Kingdom

It is a miracle I have not been involved in an accident, which would have been through no fault of my own. Every day I am dazzled and blinded by these extremely dangerous headlights. It is unacceptable to have them in use on the road. These dangerous headlights must be removed immediately to save lives.

December 2016

B.61 December 4, 2016 — Plano, IL

Tired of the bright white/blue headlights all night, every night. I can not see because of them

B.62 December 4, 2016 — Yarmouth, Isle of Wight, ENG, United Kingdom

I'm signing because this year I was afflicted by pain in my right eye from an LED light outside my window. This week I am moving house at great financial and emotional expense. Too many people don't seem to understand the harm caused by LED lights.

B.63 December 5, 2016 — Collierville, TN

I cannot see at night! This is getting crazy. I'm 51 and over the past 2 years these lights have gotten brighter and they, the people who have them (after market) lights seem to gain joy out of getting behind your vehicle and blinding you ! This is a crime in my opinion. I've almost wrecked on several occasions and try and slow down so they will get the message but they get pissed off, honk their horn and pass (thank God) and seem to not understand! Do they not realize they are blinding the driver? Not to mention the oncoming lights such as these! These lights need to be banned immediately!

B.64 December 7, 2016 — Chicago, IL

Can we speed this up, I'm 29 and am loosing eyesight by the minute. How dumb are these people allowing this to happen? Fucking idiots, total argument against Darwinism, we're getting dumber

B.65 December 11, 2016 — Bon Air, AL

In German, would call people who use LED lights, slightly evolved monkeys. Blue light rays, high frequency rays are damaging. And as humans, we're drawn to look at them, so its for sure bad

B.66 December 11, 2016 — Burns, TN

I have to drive to work and see this bullshit every morning,

B.67 December 11, 2016 — Chicago, IL

I'm signing because I don't want one blinding ray hitting my eye, every night, for 362 nights for the next 20 years until I prematurely go blind. Shall we take all the odd farts in congress and shine bright lights in their eyes and just do it, for a full year, great test. Chicago is about to put these in

neighborhoods....mostly because Rahm Emmanuel is retard who runs a bankrupt city, yet throws dinner parties like he's celebrity. #Political Career should be over

B.68 December 11, 2016 — Chicago, IL

Politicians who vote for LED's because of lobbyist, should be stuck by lighting and fed to sharks.

B.69 December 11, 2016 — Chicago, IL

Because they're fucking stupid

B.70 December 11, 2016 — Chicago, IL

How has the goal changed from 200 to 500? joke?

B.71 December 11, 2016 — Idaho, CT

This is getting ridiculous

B.72 December 11, 2016 — Indianapolis, IN

How has this not passed yet? Come on 11 more signatures! And how have SNL not mocked LED lights yet either? Am I the only one that wants to drive around with a baseball bat and blow out every Nissan Truck's LED lights that blind people as they drive. Baby Boomers, trying to run the world, can't figure out how to not blind people. Just retire already!

B.73 December 11, 2016 — Indianapolis, IN

I have children, and driving is becoming more difficult, and I'm worried for their safety if I get blinded by these things and crash

B.74 December 11, 2016 — NYC, NY

We stare at computers all day admitting blue light, now we have them on cars as we drive home. May as well just shoot us now and gives us some poison while your at it. Thanks America, not

B.75 December 11, 2016 — Oakland, CA

Fuck you congress.

B.76 December 11, 2016 — Pipe Creek, TX

These are blinding!

B.77 December 11, 2016 — San Antonio, TX

America sucks

B.78 December 11, 2016 — Wichita, KS

I'm signing because its better than throwing the users of LED lights in the gas chamber

B.79 December 13, 2016 — Ashland, VA

They blind me and cause headaches! It is not only oncoming, when these headlights are behind me, they are just as blinding no matter how I adjust my mirrors! And do not think about replacing them with the proposed laser! Why cant we just go back to past headlights! They did not cost as much to replace either! The new headlights are a danger!

B.80 December 14, 2016 — Chicago, IL

Years ago I spoke with NHTSA regarding this very issue, including advising them that the already noted increase in fatalities was likely due to these unregulated lights. Now they care? When I talked to them they said "a lot of people will need to die" before they act at all on this issue. Fools and sociopaths. Read my articles below. NOTE that limiting light emitted to that of traffic signals is a very bad idea as our traffic signals are also blindingly glaring and those are the ones placed by IDOT (IL DOT). Dr. Coleman https://sliceiconic.com/2015/01/26/led-lights-dangerous-on-roadways-and-off/ https://sliceiconic.com/2016/03/29/blinding-headlights/

B.81 December 24, 2016 — Exton, PA

I have excellent vision, but since about 2-years ago, I have had hot pain when cars with those horribly bright lights are near. Driving at night now takes longer, because I simply pull off the road to wait until vehicles with such painfully bright lights pass me. How can drivers with these lights not know the dangers these lights pose?! If you are behind another vehicles, you NEVER need to have high beam lights on. I have been dreaming of a light up sign that says. Get off my bumper with high beams on! This is a huge danger and I refuse to have "high beam bullies" run me off the road! I am serious about my child's safety! The government is supposed to be for the people and of the people. Let's tell them that regulation of these terrible lights is necessary!

B.82 December 31, 2016 — Mechanicsburg, PA

I cant say enough against headlight use during the day. It is no wonder fatalities have increased when ignorant motorists make it painful to keep your eyes on the road. I refer to it as a visual equivalent of nails on a chalk board. I have unfortunately had to learn to drive looking out the passenger window. Stop . . . Please, stop.

Comments left in 2017

January 2017

B.83 January 4, 2017 — st joseph, MO

I was blinded by the LED headlights and ran off a two lane Highway. In Missouri the pickup trucks seem to be having a competition to see who has the brightest headlights.

B.84 January 10, 2017 — Jamaica, NY

It is very strange that the U.S. government, which did so much to legislate better vehicle safety over the years, nowadays seems to ignore one of the biggest driving hazards--those insanely bright LED and HID headlights!! For anyone driving at night, these lights are a nightmare to deal with. When these first came out, the designers thought they were helping things by brightening the driver's field of vision--mostly a superfluous concern because the older headlights were more than adequate for most driving conditions--and drivers had beams anyway for the darkest conditions, and could get fog lights too. But is is totally unnecessary--and actually harmful--to have these ultra bright lights ON ALL THE TIME. What has been totally neglected is the safety consequences for the other drivers that are forced to look into the lights!! The alleged benefits of increased brightness of the road ahead is negated by the blindness these lights are causing other drivers. Especially at night, driving on a highway or busy road has become hell--not only because of oncoming vehicles with these lights but because of vehicles in back of me. These lights shine right into my mirrors and I can't properly see because the reflection blinds me. I often drive with my left hand shielding my eyes and the other on the wheel!! These ultra-bright headlights are a definite and severe safety hazard and need to be banned--soon, once and for all.

B.85 January 12, 2017 — Pinedale, WY

Headlights are so bright now that even looking away toward the shoulder makes it almost impossible to see in oncoming traffic. I have to slow down almost to a stop until the car goes by before i can continue. it is ridiculous

B.86 January 14, 2017 — Indianapolis, IN

too hard on eyes

B.87 January 14, 2017 — Munfordville, KY

I am not bothered by normal headlights at night but the first time I saw LED headlights I thought I

B.88 January 16, 2017 — Hollywood, FL

I'm tired to seeing blinding headlights that put our lives at risk.

B.89 January 18, 2017 — Chicago, IL

These lights are a misery to other drivers. They are completely over the top too bright, glaring and painful to look at. Ban them! Please!

B.90 January 21, 2017 — Fullerton, CA

These headlights cause headaches for both me and my fiancée. We always have to darken the rearview mirror or change lanes when they′re behind us at night.

B.91 January 24, 2017 — Richfield Springs, NY

I have been blinded by the glare of LED headlights. Their intensity needs better regulation

February 2017

B.92 February 11, 2017 — University Place, WA

I don′t wanna go blind!

B.93 February 12, 2017 — Fairfax, WA

I thought it was against the law to drive with high beams on.

B.94 February 25, 2017 — Teddington, Middx, ENG, United Kingdom

Blinding White LED lights on vehicles are a lethal hazard and should be banned forthwith! :(

March 2017

B.95 March 22, 2017 — Blagdon, ENG, United Kingdom

I am signing because this is a world wide problem and we have to wake up and do something about it.

B.96 March 24, 2017 — Mentor, OH

I stopped driving at night, due to glare, missed out on many club meetings, had to leave xmas and thanksgiving visits before dark, affects my ability to drive all winter when sun sets early. Couldn′t see lady walking dog on side of road one night, this is definitely a health hazard for people of all ages. No need for these types of lamps. Please ban them, before they existed we managed without them for over one hundred years.

B.97 March 26, 2017 — Thingwall, ENG, United Kingdom

Glare from these blinding headlights make it difficult to focus on the road. They are painful to the eye and completely unnecessary.

B.98 March 26, 2017 — Wayne, PA

These annoying headlights are blinding. I have migraines and they make them 1000x worse!! Please get these headlights removed from the market!!

B.99 March 28, 2017 — Glasgow, SCT, United Kingdom

I′m signing this petition because these headlights are blinding and dangerous. I would like the UK government to ban them too and perhaps if this petition is successful the government of the U.K. will take some action too. Please sign, especially those with LUPUS who are light sensitive - see the article in NEWS AND VIEWS, Spring 2017.

April 2017

B.100 April 20, 2017 — Aberdaron, WLS, United Kingdom

These headlights are killing people

B.101 April 24, 2017 — Princeton Junction, NJ

This is one case where signing this petition (to me) is unquestionably the right thing to do!

May 2017

B.102 May 2, 2017 — Den Dolder NL, Netherlands

I sufer myself and find many siuations where I know to be unsafe because of this.

B.103 May 2, 2017 — Fetcham, ENG, United Kingdom

I am often blinded by bright headlights. It's putting me off driving at night.

B.104 May 3, 2017 — Canterbury, ENG, United Kingdom

I believe new legislation is required to control acceptable levels of vehicle lighting on today's roads. This includes all motor vehicles as well as cycles and other road users ,

B.105 May 3, 2017 — Downhead Park, ENG, United Kingdom

There is such a chronically diverse range of headlight colours, brilliance, degrees of glare and intensity on cars on the road today, they are becoming a danger to all road users. Therefore, it is imperative that these concerns are addressed and the manufacturers should not be able to dictate the terms, purely as some sales gimmick to attract potential buyers. Lights can and are, frequently, used aggressively, wilfully and to deliberately intimidate. There, almost, seems to be a quite bizarre mentality that makes and turns the brightness and intensity of car lights into some type of prestige and status. "My lights are bigger and brighter than yours, so get out of my way"!

B.106 May 3, 2017 — Somers, NY

Thank you for starting this petition! The bright white headlights are awful whether oncoming or in your rear view mirror.

B.107 May 3, 2017 — Somerset, NJ

They're blinding. And makes me drive slower because at times I can't see the road. Worse during the rain. Yeah good for the driver using it.. BAD & extremely dangerous for the defenseless on coming traffic. Headlights were just fine years ago when you can define an on coming vehicle instead of driving in fear at times. before these detracting and dangerous lights.

B.108 May 4, 2017 — Alhambra, CA

I cant stand driving and all you see coming or behind you blue tinted lights! These lights make it extremely hard to see the road at night

B.109 May 4, 2017 — Carson, CA

It's so hard to drive at night when you have these bright headlights behide you or even on the frwy the opposite traffic headlights...those brights lights make me turn my head or close my eyes...or i get such a glare i can't see and have to break to make sure im not gonna crash into the person in front of me!

B.110 May 4, 2017 — Chino Hills, CA

I'm tired of being blinded by LED Headlights. Please pass this ban.

B.111 May 4, 2017 — Fontana, CA

These are blinding and trigger my migraines. No lights should be so bright as to cause a person to feel tortured

B.112 May 4, 2017 — La Habra, CA

I'm tired of being blinded when I drive at night

B.113 May 4, 2017 — Lancaster, CA

These lights are dangerous and blinding

B.114 May 4, 2017 — Los Alamitos, CA

Thank you for starting this petition. My husband and I we find it hard to drive at night because of the new glaring headlights. It is an obstacle especially for aging eyes. We were wondering how this could be allowed. I stopped driving at night. This means no shopping. I wonder how many people like me are impacting the economy in such way because of these glaring headlights. Regular headlights do not bother me.

B.115 May 4, 2017 — Los Angeles, CA

The LED lights blind me, and are unsafe to other drivers

B.116 May 4, 2017 — Middletown, NJ

Those LED lights are blinding!!! They need to be outlawed!!!

B.117 May 4, 2017 — Santa Ana, CA

Rather than making night driving safer, brighter headlights encourage drivers to drive even faster! In California, the maximum speed limit is considered by many to be the minimum.

B.118 May 4, 2017 — Spring Hill, FL

They r blinding

B.119 May 4, 2017 — Torrance, CA

It's dangerous to blind on-coming cars

B.120 May 4, 2017 — WHITTIER, CA

The new LED headlights are to bright, especially when shining right into a rear-view mirror. I drive a sedan and always have to adjust my mirror when an SUV is behind me with the LED lights because the brightness is overwhelming. It also seems as is the brights are on when a car in on-coming traffic is driving towards me with LED lights. They need to figure out a way to make warm colored LEDs for car and not the bright white, bluish color.

B.121 May 4, 2017 — Whittier, CA

its to hard to see pedestrians so lets save lives!

B.122 May 5, 2017 — Chino, CA

These headlights make it so difficult to drive at night! They are blinding and dangerous. I do not feel safe with these lights on the road.

B.123 May 5, 2017 — Dunsmuir, CA

THE LIGHTS ARE BLINDING and a safety hazard!

B.124 May 5, 2017 — Fernley, NV

It is a dangerous trend.

B.125 May 5, 2017 — Kenilworth, ENG, United Kingdom

In the UK we have exactly the same problem. You have said it all above. I do ask the question what sort of driver, deliberately driver thinks it is safer to drive with lights on reducing visibility.

B.126 May 5, 2017 — Ketchum, ID

Bright headlights are very unsafe for other drivers. Especially where I live, it makes it hard to see other road hazards like wildlife.

B.127 May 5, 2017 — La Mesa, CA

The bright lights force me to turn my eyes away from an oncoming car or, if the car is behind me, I must turn my rear or side mirror away from the lights. Dangerous.

B.128 May 5, 2017 — Las Vegas, NV

Yes, these new LED headlights are a hazard; Especially the ones that have the blue/white toned ones.

B.129 May 5, 2017 — Los Angeles, CA

Yes! These after market headlamps are becoming brighter. There have been times where I'm unable to turn left because the previous oncoming car was so blinding it left spots in my eyes. When it rains the ground becomes a shiny mess, to the point the lines are nearly invisible. And the height standards for the headlamps need to also be accounted for, because if they point straight ahead like an arrow, even the cab of the car ahead is filled with blinding, distracting brightness, making the exterior and the crosswalks hard to view. I don't need to wear glasses, my vision is fine so even wearing glare resistant lenses are not an option.

B.130 May 5, 2017 — Los Angeles, CA
I'm signing because driving while temporarily blinded is dangerous.

B.131 May 5, 2017 — Malvern, PA
These headlights make it difficult to see but almost impossible when it is raining!!!

B.132 May 5, 2017 — Moreno Valley, CA
I commute 65-75 miles one way. I see a lot of cars with blinding headlights and I agree it's dangerous. It's hard to keep eyes on the road when there is so much glare.

B.133 May 5, 2017 — Moreno Valley, CA
I hate the led lights. They make night driving very unsafe.

B.134 May 5, 2017 — Pasadena, CA
As a migraine sufferer this is a HUGE issue for me.

B.135 May 5, 2017 — Rancho Palos Verdes, CA
Very dangerous lighting and causes accidents

B.136 May 5, 2017 — Sun Valley, CA
they are blinding!!

B.137 May 5, 2017 — Trowbridge, ENG, United Kingdom
Too bright and blinding. Also turn indicators set so close to day running lights you cant see them even though they should automatically dim.

B.138 May 5, 2017 — Vallejo, CA
FOOTCANDLES are the measurement of light that comes out of a headlight. Low beam/high beam intensity was established when the modern yellow light headlight was first invented. All new headlights outside these long-established standards are by definition: illegal. What part of "illegal" don't headlight manufacturers understand today? This petition is really unnecessary. Just ENFORCE THE LAW already.

B.139 May 5, 2017 — West Covina, CA
The headlights are too bright and can cause accidents. People use them to bully cars in traffic, also.

B.140 May 6, 2017 — Azusa, CA
It make sense. Typically it takes 30 minutes for eyes to be re-adjusted after being expose to bright light [simple test, how long does it take your eyes to be readjusted after walking into your house from a bright sunny day WITHOUT WEARING SUNGLASSES. There is still no standard for how strong those headlights can be (# of lumins). Although CA vehicle code requires the distance these lights can illuminate, but who's enforcing that? Pull a roller tape out from the police officers back pocket?

B.141 May 6, 2017 — Hendersonville, NC
They are like looking straight at the sun!!

B.142 May 6, 2017 — Murrieta, CA
Those lights blind me!!

B.143 May 6, 2017 — New York, NY
These lights are horrible, and they due cause accidents because drivers and pedestrians are blinded by them.

B.144 May 6, 2017 — Oakland, CA
Can't see in those headlamps! Blinding.

B.145 May 6, 2017 — Pasadena, CA
I've been complaining about this very issue for well over a decade.

B.146 May 6, 2017 — Quail Valley, CA

I can't see when people are driving towards me with those headlights. Then I'm blind for a good 10 seconds after they pass

B.147 May 6, 2017 — Upland, CA

THOSE LIGHTS ARE BLINDING!!! ALMOST GOT INTO SEVERAL ACCIDENTS BECAUSE I WAS BLINDED BY THOSE LED LIGHTS. I HAVE TO WEAR SUNGLASSES AT NIGHT NOW WHEN I DRIVE.

B.148 May 7, 2017 — East Elmhurst, NY

I don't drive but as a passenger, especially a front seat passenger, I find these lights to be blinding, almost hurting my eyes. I can't imagine what it's like to be driving into that glare!

B.149 May 7, 2017 — Evanston, IL

It's dangerous

B.150 May 7, 2017 — Oracle, AZ

These lights are dangerous to other drivers and a source of light pollution.

B.151 May 8, 2017 — Altadena, CA

i AM BOTHERED BY THOSE PAINFULLY BRIGHT ON-COMING HEAD LIGHTS. tHEY ARE A ROAD HAZARD. WHY HAVE THEY BEEN ALLOWED TO BE MANUFACTURED?

B.152 May 8, 2017 — Chino Hills, CA

These lights are dangerous, blinding and irritating.

B.153 May 8, 2017 — Delano, CA

I hope the government listens

B.154 May 8, 2017 — Long Beach, CA

I am tired of being blinded by these dangerously bright headlights.

B.155 May 8, 2017 — Long Beach, CA

The blinding headlights are nothing but a hazard... No way, they need to be that bright.

B.156 May 8, 2017 — Los Angeles, CA

I have a hard time seeing,on,the,road at dark with over bright headlights.

B.157 May 8, 2017 — Los Angeles, CA

The trend of drivers converting their headlights to HID & even just installing 5500K & higher Bulbs to Halogen type headlight housing can be very dangerous to other drivers. The Halogen housing has no filters and the light is spread out too widely over the entire lens causing road glare. Many of the newer cars have projector type housing which limits road glare & auto adjustments as long as it's under 5500K.

B.158 May 8, 2017 — Manhattan Beach, CA

To outlaw high intensity headlights

B.159 May 8, 2017 — Rancho Cucamonga, CA

These lights are too bright and are a hazard they are blinding with oncoming traffic, as well as traffic behind me

B.160 May 8, 2017 — Rancho Palos Verdes, CA

Those bright night lights are blinding and can cause a moment of blinding sight and could result in an accident

B.161 May 8, 2017 — St Augustine, FL

Blinding headlights at night are annoying and dangerous. Too much blue light is also dangerous. Check Harvard Medical School blue light...

B.162 May 8, 2017 — los angeles, CA

Jose Guzman

B.163 May 9, 2017 — Mission Viejo, CA

I'm signing because the HID & LED headlamps are dangerous and annoying. Studies say light above 3000k is bad for your eyes. High intensity headlamps USED to be illegal in California- What happened?

B.164 May 9, 2017 — Redondo beach, CA

I have been a victim of those blinding lights

B.165 May 10, 2017 — Stroudsburg, PA

My eyes are strained by looking into car lights at night.

B.166 May 21, 2017 — Pittsburgh, PA

I feel like my safety is being compromised when people use the extremely bright headlights, and I also living in Pennsylvania, where they have strict window tinting laws on passenger vehicles only, and those laws are unconstitutionally oppressing my safety as a passenger vehicle owner.

B.167 May 22, 2017 — Wethersfield, CT

I'd like to enjoy driving at night again. If I look away from the blinding headlights, I'm distracted. If I look at them, I'm blinded.

B.168 May 23, 2017 — Kendal, United Kingdom

They're dangerous - they are blindingly bright and destroy normal night vision for seconds after passing.

B.169 May 26, 2017 — Enumclaw, WA

I hate these. You cannot see anything with these behind you.

B.170 May 26, 2017 — Huntington Beach, CA

These headlights need to go. Headlights originally were shining forth a beam, now it has flood light appearance which blinds the heck out of you when oncoming

B.171 May 27, 2017 — Burbank, CA

I have been against these absolutely stupid lights since they first came out. I get black spots in my eyes from them as if a flashbulb went off. Not good for driving at all! Who was stupid enough to approve these?!

B.172 May 28, 2017 — Everett, WA

As a person who is hypersensitive to lights and knowing many others as well also affected, these are very dangerous and can cause side effects that last hours if not more, even to those who are not hypersensitive.

B.173 May 28, 2017 — Saint Robert, MO

I am blinded on the road by these types of headlights.

B.174 May 28, 2017 — West Sayville, NY

I cannot see when these super bright lights are approaching me! They should be illegal because at the very least it is distracting and forces me to look away. At that point I've lost track of oncoming traffic or a road hazard.

B.175 May 29, 2017 — Hollis, NY

Even for non-drivers the lights are visually painful as well as obscuring. I have problems in my eyes as it is and I do not need to have another issue with my eyes because of these lights that sometimes I think are high beams. Whoever thought these were 'SAFE' on the roads seriously had no clue. Get rid of them or tone them down. Thank you.

June 2017

B.176 June 4, 2017 — Crystal Lake, IL

I have been temporarily blinded by the led headlights

B.177 June 4, 2017 — market harborough, leicestershire., ENG, United Kingdom

I want to drive in safety like I used to be able to, particularly at night-time. I've had to give driving after dark!

B.178 June 6, 2017 — Coral Springs, FL

Thank you for starting this petition! These headlights annoy this sh*t out of me!..Everytime someone gets behind me driving with these bright LED lights, I feel like having a extremely bright light in back of my car to shine in their eyes so they know what they're submitting drivers to! Thank you for starting this..I hope we can get the DOT to look into this.

B.179 June 13, 2017 — Canberra, Australia

Same for me. It's like a catch 22. I am forced to view traffic situations indirectly, which is potentially dangerous. Never had a problem in 30 years of driving, and then almost suddenly this crazy escalation in glare virtually every on the road.

B.180 June 14, 2017 — Australia

Lights on vehicles, and elsewhere, have, generally speaking, become WAY too bright in recent years, as regards both comfort and safety. This is a worldwide phenomenon which is largely out of control and urgently needs to be addressed.

B.181 June 14, 2017 — Oakland, CA

Bright lights are an obvious safety issue with a simple solution. I rarely drive at night in places where there is moderate to heavy traffic because the lights make it difficult to see.

B.182 June 15, 2017 — Harrison, AR

As someone who has some severe migraines, I almost desperately want these high intensity lights off the roads. They make the roads more dangerous, not safer.

B.183 June 16, 2017 — Long Ashton, ENG, United Kingdom

I DRIVE AND TOTALLY AGREE WITH THIS PETITION.GOOD LUCK.

B.184 June 18, 2017 — Mount Pocono, PA

In addition, all LED emergency lights on law enforcement and first responder vehicles need to banned, especially roof mounted emergency lights. They blind motorist, pedestrians, cyclists, and emergency responders, including law enforcement officers. Federal and State laws require motorists to move over while approaching an emergency zone or traffic stop, but it cannot be safely performed if being blinded by LED emergency lights. Even first responders and law complain of being blinded by their own vehicle's LED emergency lights.

B.185 June 19, 2017 — Clear Lake, WI

Todays' halogen headlights are bright enough. LEDs and those blue Xexons should be BANNED! Along with foglights and all headlight type Daytime Running Lights (except motorcycles). Only the "Amber" DRLs should be allowed on cars, trucks, and buses, not headlights.

B.186 June 28, 2017 — Devon, ENG, United Kingdom

When driving towards cars with HID lights it is like driving towards a vehicle with main beam on. With these lights I have to look to the side of the road. DAMNED DANGEROUS!!! and uncalled for. If you need lights that bright to see further ahead, you are driving too fast, (I'm no slouch).

July 2017

B.187 July 2, 2017 — Flint, MI

These lights are bothersome when i drive at night. Some what blinding at times.

B.188 July 4, 2017 — Dunedin, New Zealand
Safer lighting is needed.

B.189 July 4, 2017 — Dunedin, New Zealand
Hazardous, harmful and unacceptable, especially when there are safer alternatives.

B.190 July 5, 2017 — Dunedin, New Zealand
It's just to hard to see when there's oncoming traffic abs then for your eye's to adjust after

B.191 July 5, 2017 — Italy
cause I do not like blinding headlights, it is dangerous and cause discomfort especially LED lighting

B.192 July 8, 2017 — Fairport, NY
My friends and I do not drive at night if it can be avoided. Ages. 35 to 55

B.193 July 10, 2017 — Fredericksburg, VA
No one should be blinded by someone else's headlights at night while trying to drive. When I go out anymore at night I have to wear tinted clipons over my glasses in order for me to be able to see properly. When it snows it rains it makes it much worse! We all need to be more safety conscience!

B.194 July 17, 2017 — Ilsan, South Korea
Ban Blinding Headlights and Save Lives!

B.195 July 18, 2017 — Shawnee, MO
I was in an accident where the blue headlights on one vehicle caused another driver to cross the median, sides wiping my car

B.196 July 19, 2017 — Los Angeles, CA
LED headlights are incredibly bright and can be blinding, including in sideview mirrors. LED taillights can also be hazardous.

B.197 July 20, 2017 — Somerdale, NJ
Yes, please ban these lights. Much too bright at night. Also they really are an irritant during the day. A bright light coming towards you when it is already sunny is quite the distraction and we don't need move distractions while driving. It is dangerous enough. That split second of distraction can cause an accident. Also a problem with cars behind you as well. Turn off the lights during the day, please.

B.198 July 26, 2017 — Horseheads, NY
It's not safe for us it necessary to have these blinding lights on cars....the roads are unsafe as it is.....stop the lights

B.199 July 26, 2017 — Rochester, NH
I can't drive at night anymore. The blinding lights in front of and behind distract and make it impossible to navigate my vehicle. My eyes are overwhelmed even if I try to look away.

B.200 July 26, 2017 — Stamford, NY
These abusive auto lights must be banned asap while we still have some peace of mind on our public highways. Please spread the word on these and donate to our just cause! Thanks again Donald.

B.201 July 30, 2017 — Beddau, WLS, United Kingdom
I suffer chronic migraines and bi polar which is severely affected by these lights.

August 2017

B.202 August 1, 2017 — Olathe, MO
I am so blinded and feel roadrage toward oncoming cars with bright lights behind or in front of me.

B.203 August 3, 2017 — San Angelo, TX
Hurts my eyes!

B.204 August 8, 2017 — Alamogordo, NM

The new daytime headlights are way too bright!!!! Correct beaming of headlights would make a big difference!

B.205 August 8, 2017 — Brooklyn, NY

Many times I've narrowly avoided going off the road or driving into oncoming traffic because I was blinded by blinding LED headlights. These lights are endangering everyone on the road and should be banned.

B.206 August 10, 2017 — Albany, NY

It dangerous to drive blinded. I turn all mirrors down/away when driving at night, and look away when passing.

B.207 August 10, 2017 — Albany, NY

Audi and Volkswagon headlights are especially nazi.

B.208 August 16, 2017 — Orderville, UT

The blue lights not only cause an instant headache but also induce vomiting and the bright leds cause temporary blindness.

B.209 August 17, 2017 — Ottawa, ON, Canada

It's true and very distracting. Needs to be regulated

B.210 August 18, 2017 — Corona, CA

Blinding tail lights on most new vehicles and big rigs can impair your vision even at a distance and are brighter than stop lights. News media should be involved in the subject. Auto manufacturers and departments responsible for driver safety do not seem to be driving and noticing the problem. Some service stations have blinding LED price sign that you cannot distinguish the numbers

B.211 August 19, 2017 — Danielsville, GA

I'm tired of being blinded on major highways and/or interstates.

B.212 August 20, 2017 — Australia

I'm hoping this will bring change across the world, because they too have arrived in Australia! First I thought it was high beams, but the sheer amount of cars with these glare emitting lights have increased significantly. It's completely unsafe, as a frequent driver at night, oncoming vehicles with these lights blind me, like a camera flash ... I have to squint and slow down my driving. If it's a car behind me, I fear changing lanes because my side view mirrors are completely useless as all I see is glaring white light and I can't see the other lanes. So unsafe! Also, the light emitting from them hurt my eyes. If my body is hurting from this, when previous halogen lights did not, then I know this is not right and not OK!

B.213 August 23, 2017 — Fairfax, WA

I am literally blinded by the light! Turn down those high beams. Seriously. If your eyesight is that bad, you shouldn't be driving at night!

B.214 August 25, 2017 — Virginia Beach, VA

I have autism, and am already extremely sensitive, especially to lights (some can give me migraines-bright LED xmas ones are a hazard if I get carried away with Christmas spirit and can't help but look). When someone has their brights on, even during the day, my eyes are still reeling for minutes after. With the new LED blue, purple, etc lights, I can't even look sideways without still being affected. I thought I was alone in how much this sensory overload hampers my good driving. I'm glad to not suffer in silence anymore about lights that took a serious problem for me and made it astronomical.

B.215 August 28, 2017 — Hempstead, NY

I can not say just how dangerous this is, especially for the pedestrian who wears glasses!!!

September 2017

B.216 September 6, 2017 — Bloomfield, NJ

I'm tired of being blinded on the road at night.

B.217 September 6, 2017 — Scottsdale, AZ

i believe in preservation of vision. the laser/tazer from the driverless cars have also blinded me. so did the strobes from the redflex defective photo radar cameras. flashblinding, glare or distraction of a driver or pilot, atlease from laser in arizona, is a class 5 felony.

B.218 September 6, 2017 — Scottsdale, AZ

the led's and rf bulbs are designed to blind, the smartmeters also have sonic and tazer capabilities, the driverless cars invading arizona run on lidar- laser and radar- designed to cause reflected eye injury and blindness.

B.219 September 21, 2017 — Sonoma, CA

I've had to put up a curtain behind my front seats to drive at night because these damn LED lights light up the inside of my car from behind like it's friggin' day light!!!! They need to be BANNED now!

B.220 September 25, 2017 — Dunedin, New Zealand

blue light is classified as a class 2a carcinogen in night shift workers. WHO. White LEDs are rich (30% or more) in blue light, shown to inhibit melatonin and disrupt circadian rhythms. Moonlight affects circadian rhythms in humans how much then will LED streetlights disrupt our biological clock?

B.221 September 26, 2017 — Miami Beach, FL

Very dangerous

B.222 September 26, 2017 — Morganton, NC

I'm absolutely tired of not being able to see the road as these types of lights pass, not to mention, tailgating issues. It causes headaches and spots in my vision, along with anyone else I have conversed with on the subject. We've seen fine for years with old halogens, and I say that's all we need! It's enough to deal with halogen high beams!

B.223 September 27, 2017 — Ludington, MI

This is problematic for me as well.

B.224 September 27, 2017 — New Hudson, MI

Stop the accidents!!!!

October 2017

B.225 October 3, 2017 — United States

I am regularly blinded while driving home at night, especially when I am on my motorcycle. The effect of multiple high intensity headlights from several oncoming cars behind one another is so painful that I have to look off the road to the right, which is almost as bad as driving with my eyes closed. I hope there is a remedy for this problem soon. Thanks

B.226 October 7, 2017 — Birkenhead, ENG, United Kingdom

I really struggle with the brightness of car headlights in the UK, they really make my eyes hurt to look at them. At the age of 37 I am not the only one of my age I know that find them ridiculously bright

B.227 October 18, 2017 — Palo Alto, CA

It is important for this campaign to ban not only the blue/white (LED) headlights but also the white ones with too much luminosity, and also the two lights below headlights that are white and almost as bright as headlights. There are also wreaths of lights around headlights and other candlepower embellishments that apparently appeal to people's egos. They (ego trippers and corporations seeking to indulge them) will fight back with other distracting lighting, including excessive tail lights.

The overall issue of cars being lit up in many distracting ways should be addressed from the beginning.

B.228 October 26, 2017 — Citrus Heights, CA

I have been in too many blinding situations that could have resulted in an accident or worse as of late. Seems allot more cars this year have them then before. I get anxiety close to the end of work knowing I will soon be in traffic. Nowadays it seems every other car has their high-beams on and pointed right in my face. I run a computer repair shop and i am looking at screens all day, so going into what feels like a police search light right in my face is beyond scary and just plain dangerous and disrespectful in too many ways. All HID lighting should be banned on cars in my opinion. If you have to literally put a lighting ballast to amplify power into your headlights then you are purposely trying to blind drivers is my belief. End rant :)

B.229 October 29, 2017 — New York, NY

Coming at you , behind you , if the police knew haw many tickets they can issue for this offense they would be right on it .....!!!!!!

B.230 October 29, 2017 — New York, NY

Is there anyway to go after the manufactures or stores hawking these....

November 2017

B.231 November 11, 2017 — Travelers Rest, SC

HID and LED lights, especially of the blue-ish colour temperature and a public safety hazard. They should be banned. Vehicles that are equipped with them should be required to have them removed, even if they are installed by the factory. why is there not already a standard in-place that restricts the brightness of these lights? HIS lights create a hazard by blinding drivers. They also can be a health hazard by causing damage to the eyes other drivers. Additionally, these lights promote aggressive behaviour and are often used as a weapon against other drivers.

B.232 November 13, 2017 — Grants Pass, OR

I find these lights blinding.

B.233 November 13, 2017 — Poplar Grove, IL

Extraneous lighting, especially in wavelengths shorter than 610 nanometers, has nothing but harmful effects, particularly biological and astronomical.

B.234 November 13, 2017 — Shingletown, CA

They blind me too.

B.235 November 14, 2017 — Soquel, CA

I can't see the road when these things are blaring in my mirrors !

B.236 November 16, 2017 — Columbus, OH

Hate them

B.237 November 16, 2017 — Galloway, OH

I work 50-60 hours a week driving on the road half of those hours are after the sun goes down and then my evening/night is constant blinding, headache, road rage sometimes, frustration and seeing dots for many seconds! It's getting ridiculous this should never ever be ok or legal to us regular citizens! Police I can understand more but when lately all I see is bright bright blinding headlights in front of me and behind me blinding from both directions at same time and also cora buses, fire trucks these are huge trucks 10 times bigger than my small short Toyota Camry! Please stop the use of these for regular civilians please! It's so irritating and so so so very very dangerous every single day after dark hits everyday! Please stop the use of led lights please I'm begging! I'm so scared I will wreck because I'm being blinded by almost every or every other vehicle in front and behind me all the time! This should be immediately taken out of regular vehicles seriously. I know they r nice and cool also last a lot longer yeah that's awesome but is this going to be awesome when it starts to impair drivers

on the road and start dying because they lost control not because drinking or drugs but because the person in front or behind lights are so bright they couldn't see the small dog running out in front of them or the child that ball just rolled out and they run out to get but because your blinding lights are in my eyes I can't see the kid in front of me or the rain combined with led lights make this dangerous situation 100 times worse! It's very dangerous please please stop this please I'm begging

B.238 November 17, 2017 — big flats, NY

LED lights hurt my eyes while driving and should be banned before they cause more accidents. They also cause migraines and should be banned from all lighting. I am personally affected by these lights.

B.239 November 21, 2017 — Tonbridge, ENG, United Kingdom

I hate these dazzling lights with their blue tinge. They may help those driving cars fitted with them to see better what is in front, but they blind the rest of us whether the lights are shining in our faces or into our rear-view mirrors.

B.240 November 22, 2017 — Brooklyn, NY

Driving without seeing is dangerous to me and you!

B.241 November 22, 2017 — Sydney Mines, Canada

These new headlights are blinding in the night time while driving.

B.242 November 23, 2017 — Beaverton, OR

LED street lights and headlights cause dangerous glare and brightness that make driving after dark dangerous. Additionally, individuals with migraine disorders find it difficult to impossible to drive safely at night.

B.243 November 24, 2017 — Bloomfield, NJ

I am TIRED of being BLINDEDby oncoming LED car headlights. It is difficult to see the road in front of me!

B.244 November 24, 2017 — Eau Claire, WI

Sorry to hear ... I signed, hopefully more will too

B.245 November 24, 2017 — Grand Rapids, MI

I agree they are unnecessarily too bright

B.246 November 27, 2017 — Tampa, FL

When I drive at night, I encounter many vehicles that have hid/blue-white headlights that are too bright and cause pain and temporary blindness. I have to hold up my hand to block some of the light. STOP THE PRODUCTION AND INSTALLATION OF THESE TYPES OF LIGHTS

B.247 November 29, 2017 — Vancouver, Canada

I totally agree !! I also started a Petition myself in Canada. I thoroughly read your posting Donald Berry. Thank you for doing this !! We need to keep supporting this and sharing it so that manufacturers stop making these headlights, it causes accidents , casualties and damages peoples eyes. We need this to spread North America wide. If you could please support mine, I in huge support of yours. Blessings to you for doing this !!

December 2017

B.248 December 3, 2017 — Kodak, TN

Night driving continues to get worse. People with fog lights and the brighter LED lights are ruining my eyes. I have friends who also complain. It is so hard to see with those lights coming right at you. I drove 3206 miles in Oct. and over the week had to do night driving. By the end of the trip which was a very long night drive of 8 hours home, my vision was so messed up. It′s been a couple months and driving at night is no fun. The reason for the original yellow cast on the lights was to avoid all of this eye damage we are experiencing. I am sick of it and really hope that something can be done. When I see a car approaching with 4 or 6 lights on the front of their vehicle and there is no fog, it makes me

want to put my headlights on bright so they can endure a little of what I am going through. I hope something will be done soon. Maybe the media needs to get involved to spread the word.

B.249 December 4, 2017 — AZ, United States

They trigger migraines.

B.250 December 4, 2017 — Baldwin, GA

I suffer from chronic daily migraines and I've all but stopped driving at night because of these headlights.

B.251 December 4, 2017 — Booneville, AR

These are blinding and dangerous and are a trigger people with migraine disease!

B.252 December 4, 2017 — Chester, SC

Blue lights causes me to have migranes, and that can be dangerous driving at night.

B.253 December 4, 2017 — Crossville, TN

LED lights are blinding and cause migraines for me and many wrecks! Fog lights are just as bad!

B.254 December 4, 2017 — DeKalb, IL

I get severe migraines and am very sensitive to light.

B.255 December 4, 2017 — Great Falls, MT

I have severe migraine disease and these lights trigger a flare up of my symptoms. It is difficult/dangerous to drive once the symptoms start.

B.256 December 4, 2017 — Hooks, TX

There are many times the brightness and glare blinds me, either being at a single lane two way traffic lanes or easily and most common method from behind. I've flashed the upcoming vehicle from opposite direction assuming their headlights were on "high beam" so they can turn down their headlights. However, I've been flashed back to let me know it is not their "high beam" lights, rather their normal "low beam" lights. I have taught myself to move positions in the seat while driving to avoid headlights from behind to strike me through the rear view mirror, even after have clicked on the rearview mirror's night glare adjustment button below the mirror. Furthermore, many times these LED headlights in vehicles, except older year vehicles (1970, 1980, 1990) have initiative the start of migraine headaches, which is the main reason I avoid or very seldom drive at night time.

B.257 December 4, 2017 — Joanna, SC

I understand that headlights are important for drivers to be able to see at night, and in the rain. However, extra bright lights make it harder for other drivers to be able to see, making the roads more dangerous for everyone. They can also be a trigger for migraines in some people. When a migraine is triggered, it often affects vision and reaction tome, and is frequently excruciating. Extra bright lights can cause accidents, which can result in serious injuries, or even death. Regular headlights should be sufficient for all drivers.

B.258 December 4, 2017 — Las Vegas, NV

I suffer from migraines and these lights give me an instant migraine.

B.259 December 4, 2017 — Lockbourne, OH

These lights are a hazard to others on the road.

B.260 December 4, 2017 — Los Angeles, CA

I suffer from photophobia and it triggers debilitating migraines that last for days! I also have to drive at night as a courier since my migraines prevent me from having a full-time job doing my regular work. In confronted with these blinding lights each night and have to wear special glasses in order to survive them! But even with the glasses on, the lights are still too bright. It's awful. Please do something about this problem. Thank you.

B.261 December 4, 2017 — Maynardville, TN

Because I have Multiple Sclerosis and since losing my sight then regaining that ability after the passing of an exacerbation years ago I have had a very difficult time driving at nighttime as well as at “twilight”. The lights used now are horrific and do cause me instant migraine if in face of them! Please call for discontinue use of these types of ultra bright lights even at lowest setting!

B.262 December 4, 2017 — Monaca, PA

I have migraines and blue light is a major trigger for them.

B.263 December 4, 2017 — pittston, PA

I suffer from migraines and driving home from work is difficult even eith night driving glasses.

B.264 December 5, 2017 — Coventry, RI

For the longest time, I thought it was just me. This problem affects all age groups. Sometimes I turn my eyes to the right to avoid oncoming 'spotlights.' When the bright lights are behind me, if I turn the side mirrors to just the right angle, the reflected light goes back to the person behind me and they back off. In slow-moving, bright traffic I use my left hand to shield my eyes. None of this should be necessary. Last evening, I flashed my hi-beams at a truck, and he turned on the light-bar rack that was on the roof of the cab. Is this a Mine-are-brighter-than-yours contest? There needs to be a limit to how many lights can be on a vehicle, and how bright those lights can be.

B.265 December 5, 2017 — Galena, KS

I get migraines easily and these headlights do not help.

B.266 December 5, 2017 — Ironton, OH

I want to help save more lives

B.267 December 5, 2017 — Patriot, OH

I would love to see them ban these new lights had some idiots run me off the road cause they seem to want to ride my bumper with these lights in my eyes and I couldn’t see my turn for them being so blinding!! I think the real reasons for them to have these lights they are also using them in poaching cases !!! ☒

B.268 December 5, 2017 — Portland, OR

These lights give me a migraine near immediately and blind drivers on the road. It's known blue light has negative effects for parts of the population.

B.269 December 6, 2017 — Buffalo, NY

You got to be kidding me!!It will most had 10 accidents because of this!!!!

B.270 December 6, 2017 — Garforth, ENG, United Kingdom

I find these high intensity lights dangerous and annoying. I believe they are on a par with main beam headlights of old. There is no need for them. On poorly lit roads there is main beam to use. I did a test on a lit motorway with no other traffic around and turned my lights OFF, I couldn't tell i'd turned them off. So in other words on lit roads there's no need for these eye ball melting headlights. These high intensity lights on today's cars are a marketing gimmick and a dangerous one at that. I believe people are driving around now, who don't have these high intensity lights fitted in their cars, with main beam on because they think it's ok to do so. Standards are dropping all the time, in fact, they've gone.

B.271 December 6, 2017 — Klamath Falls, OR

They have always caused issues for me and my husband

B.272 December 7, 2017 — Federal Way, WA

I tried everything i even put my high beems on them and its bad living in kent washington and federalway area. These drivers dont have respect at all i think it the older people who be driving at night in their 60s and above thinking they are young. They should have a age cut off limit on elderly

peopleover the age 50 and above shouldnt have a licsense period and people who uses their high beems should get a ticket no matter what and have their lic taken on the spot.

B.273 December 7, 2017 — University Place, WA

This is important because... https://m.facebook.com/Ban-LED-and-other-blinding-headlights-1246601765483383/?ref_component=mbasic_bookmark&ref_page=XMenuController&ref=opera_speed_dial

B.274 December 8, 2017 — United States

Recently I've had many cars flashing their brights at me in my bicycle. MY BICYCLE LIGHT IS DISTRACTING DRIVERS. Hilarious and unfortunate.

B.275 December 8, 2017 — des plaines, IL

Yes get rid of them

B.276 December 11, 2017 — Lake Station, IN

Its super annoying and is worsened if you wear glasses.

B.277 December 11, 2017 — Valparaiso, IN

This is important because many accidents could and have happened with blinding headlights. very annoying and very bright.

B.278 December 11, 2017 — Valparaiso, IN

this is very important to me because this is a dangerous to be driving with peoples car who have very bright lights. they are very annoying and and to bright and a detraction to all drivers. the should not be loud on the road. they need to change them to a normal light that's not detracting.

B.279 December 12, 2017 — Novi, MI

Have seen accident happen because of bright flashing lites on police car.

B.280 December 14, 2017 — Baglan, NPT, WLS, United Kingdom

These new LED headlights are horrendous for drivers with any kind of light sensitivity, and probably not great for anyone. I literally put my hand in front of my eyes when a car with these lights approach. Instinctive reflex to protect my eyes, highly dangerous when driving!

B.281 December 14, 2017 — Lexington, SC

These LED headlights on new vehicles and the aftermarket head lights also the LED strobes on emergency vehicles and utility vehicles are way to bright and blinding they do more harm than good. All mentioned above are a distraction to on coming drivers.

B.282 December 16, 2017 — Kalkaska, MI

I have personally had issue with blinding headlights from oncoming vehicles.

B.283 December 17, 2017 — Huntington, NY

It's an issue of safety. If it will save lives or simply make driving at night easier for people, then let's make that change.

B.284 December 17, 2017 — Los Angeles, CA

It is dangerous and really disturbs my eyes trying to drive.

B.285 December 17, 2017 — Madison, WI

i am carolyn justice and i am from boiling s.c. may GOD BLESS YA .from MEMAW. NOTsure of what i am looking at

B.286 December 19, 2017 — Romford, ENG, United Kingdom

I almost had an accident because of these headlights , they are blinding and you cannot see in front of you when a car is oncoming , please ban them

B.287 December 21, 2017 — Biggin Hill, Kent. England, British Indian Ocean Territory

Good luck, keep up the good work. https://www.causes.com/causes/793537-ban-drl-s-all-automatic-car-lights

B.288 December 22, 2017 — Chicago, IL

Thanks Auto Industry...you have ruined being outside at all. I despise your blinding headlights. Join our group to raise awareness and to ban these horrible LED lights. https://www.facebook.com/groups/155084901640186/

B.289 December 22, 2017 — Minneapolis, MN

I get migraines from these horrible lights. They make driving unsafe due to temporary blindness!

B.290 December 22, 2017 — N14 4XR, ENG, United Kingdom

There are more and more of these lights and I find them unbearable. I don't have a problem with the lights on older cars. The daytime lights become quite horrible if the driver omits to turn on the headlights when it gets dark and these tiny glaring lights become more intense. Something should be done to regulate car (and street) lights, which are now also being changed to LEDs and which cause bright spots on one's peripheral vision and provide light which does not spread causing dark areas. Something must be done about this. I know someone who had an accident caused by being dazzled by a car coming over a humped crossing towards her.

B.291 December 22, 2017 — Tacoma, WA

I've almost had accidents because of these intensely blinding headlights. They should be banned and removed from the market.

B.292 December 23, 2017 — Burnley, ENG, United Kingdom

I am dazzled by these blinding lights on a daily basis. I totally agree with Donald. There is also a new trend amongst cyclists to have similar blinding LED lamps that flash or strobe. These too are a source of distraction and increase the already dazzling amount light being aimed at drivers too regularly.

B.293 December 23, 2017 — Dorchester, ENG, United Kingdom

This needs to happen in Europe as well.

B.294 December 23, 2017 — Lansing, MI

These lights are insane! For glasses bearing people it’s creates an undeniable glare!

B.295 December 24, 2017 — Brent, United Kingdom

I have experienced being nearly blinded by these lights and realise they are a hazard

B.296 December 29, 2017 — Yangu, South Korea

What is the purpose of lighting ? If you think that lighting is for energy saving, it's better to turn off.

B.297 December 30, 2017 — Queens, NY

These lights are ridicoulusly dangerous. Great job consumer safety for the automobile industry. Great job. lol smh

B.298 December 31, 2017 — OH, United States

HID and other high intensity headlights need some serious regulating (such as Australia's Design Rules). Many auto mfgs now have HIDS stock in their new vehicles. They cause annoyance from vehicles behind you, which is not only dangerous, it is also a severe annoyance which can be dangerously distracting and lead to even more dangerous road rage. In addition to this they often appear brighter than "Hi-Beams" and are a very severe safety concern.

Comments left in 2018

January 2018

B.299 January 1, 2018 — Bowdon, ENG, United Kingdom

This is an example of light pollution which is a major threat to the environment.

B.300 January 1, 2018 — Seattle, WA

Being blinded by headlights is dangerous.

B.301 January 2, 2018 — Bklyn, NY

They are blinding to everyone sitting up front in a car. I don't want to die from something that can be prevented.

B.302 January 2, 2018 — Lawrence Township, NJ

These light hurt my eyes

B.303 January 2, 2018 — Longmont, CO

I am definitely having issues driving at night. The lights of many oncoming cars are so blinding i am actually taking strange and possible dangerous steps to be able to drive. Sometimes i put my left hand up or look mostly to the right. This really prevents me from seeing anything to the left. I also have to slow down because i cannot there see the lines on the road or if there are any issues ahead whete i might need to take preventive measures. Please ban these extremely bright lights.

B.304 January 2, 2018 — Washington, NJ

These lights cause accidents from their blinding glare.

B.305 January 2, 2018 — Westhaven-Moonstone, CA

These need to be outlawed

B.306 January 2, 2018 — langhorne, PA

Signing because headlight glare is becoming more of an issue with the addition of high intensity headlights.

B.307 January 3, 2018 — Liverpool, ENG, United Kingdom

i love astronomy and light pollution spoils it

B.308 January 3, 2018 — Malvern, PA

Can't tell the difference between oncoming brights and hi-intensity headlights anymore. They are definitely problematic.

B.309 January 4, 2018 — Cambridge, MN

Wayy to bright

B.310 January 6, 2018 — DOBBS FERRY, NY

I'm a total gearhead and love all things "car", and I have never understood why these lights are legal. They're totally blinding and potentially dangerous for everybody on the road except the person using them. Since when are halogen lights NOT good enough?

B.311 January 11, 2018 — United States

I have personally been blinded by these overly bright lights and I think that they should be discontinued.

B.312 January 12, 2018 — Smithfield, PA

I am blinded every morning on my way to work to a stop. I can see the vehicle coming 2 minutes before I can actually see the vehicle... who needs lights this bright??

B.313 January 15, 2018 — Hawthorne, NJ

I have been forced from my job by LED lighting and now struggle just to drive. I can see just fine with my halogen headlights, incandescent flashlight and incandescent lighting in my home but the LEDs give me an instant headache, brain fog and eye strain. Even Apple acknowledged the problem with LED lighting by giving a "Night Shift" mode to the iOS devices that tints the display to a warmer yellow tone. We have laws against distracted driving due to cell phones but they allow LED / HID / Focused Beam headlights, LED taillights, LED brakelights (especially the ones that pulse on emergency vehicles), LED light bars (sold for off-road use but still used on-road) and LED emergency vehicle lights that are even more blinding than the headlights! I used to enjoy driving at night and didn't mind working the night shift; then LED lighting ruined my life. Put SAFETY FIRST! Completely ban and outlaw LED lighting on vehicles and anywhere where drivers on roadways will be affected by them.

B.314 January 15, 2018 — Sunland, CA

These lights are extremely dangerous, especially when driving through tall hills

B.315 January 16, 2018 — Dededo, Guam

Also blinding when they're tail gating you

B.316 January 17, 2018 — Des Moines, WA

They sure impact my eyes badly. I have to put my hand up to block them when driving at night. Not good!

B.317 January 17, 2018 — Woodland Hills, CA

This must happen. Some models low beams (eg. Cadillac Escalade) are brighter than the high beams on most cars.

B.318 January 23, 2018 — AL, United States

They are extremely unsafe especially when tractor trailers have them. Most people that have them that I know laugh and think it's funny. It's dangerous.

B.319 January 23, 2018 — gaithersburg, MD

PLEASE BAN THESE BLINDING LIGHTS ON CARS! They are lethal!

B.320 January 23, 2018 — germantown, MD

It is extremely difficult to see at night while being bombarded with these headlights. The lighting used by crews doing road repairs is also blinding.

B.321 January 25, 2018 — Bloomfield, NJ

The situation is intolerable. Driving was once my expression of freedom but with the blinding headlights coming at me and if not coming at me, bouncing into my rear view mirror. I have to shift my eyes from the glare which makes me unable to see pedestrians. Street driving after dusk is more anxiety producing than highway and highway is terrible. It feels like people have thier brights on all the time at night.

B.322 January 25, 2018 — Chicago, IL

I find them difficult on the eyes, they are blinding and hurt sensitive eyes. Obnoxious!

B.323 January 28, 2018 — Falfurrias, TX

This has to be fixed-new car low beams are brighter than my high beams. Another great example of stupidity beating out logical safety.

B.324 January 28, 2018 — Portland, OR

I am so tired of putting up with having to decide if whatever I need to do after dark is worth a 2 day headache or puking! Especially since the city of portland Oregon in its infinite stupidity put up led streetlights. It's REALLY scary trying to drive here! You can't see pedestrians, the blinding effect of the headlights odds much worse, and to top it all off... The police cars and buses are the most

blinding... I've had to stop in the middle of the street because I can't see too even pull off to the side! How many young people have to start turning up with cataracts before something is done?!

B.325 January 30, 2018 — Gray Creek, Canada

LED and Zion lights were designed by technology to be brighter, BUT OUR EYE BALLS ARE STILL THE SAME.

February 2018

B.326 February 4, 2018 — Albany, MO

I've created a Facebook group called LED's:The Sun of Hell, because of this blinding, hellish light. I have done extensive research, the AMA recommends streetlights be shielded and below 3,000 Kelvins. Headlights cannot be shielded, and they are often twice the AMA recommendation regarding Kelvins. We are being subjected to criminally dangerous ignorance by city officials, building managers, and the automobile industry regarding these lights. The reason for them, energy savings, is also being negated by increasing the number of fixtures, even rural outbuilding are festooned with them, mounted horizontally to blind passing drivers.

B.327 February 5, 2018 — Bournemouth, ENG, United Kingdom

Headlights are too bright. They are becoming a safety hazard.

B.328 February 9, 2018 — Atlanta, GA

There seem to be more and more cars with these headlights on the road, so much so, that my eyes can't seem to get a break in between the glare of oncoming traffic. Even looking away doesn't seem to help so I have to put my hand up to shield my eyes or I will have spots in my field of vision for a few seconds. I am driving a car mind you and those few seconds could mean the world of difference. I choose not to text or talk on the phone while I am driving because I don't want to be distracted but these HID and LED headlights are creating just as much a distraction. Maybe the headlights pass the intensity (Lumens) test however there don't seem to be any regulations regarding wavelength of the headlamps. Maybe that is what needs to be updated? In the meantime, the HID and LED lamps need to be banned for the safety of all those on the road!!

B.329 February 15, 2018 — Fountaintown, IN

These lights are blinding me every time I drive at night. For anyone who have a difficult time driving at night, these only amplify the problem. These need to be banned immediately!!

B.330 February 19, 2018 — Makawao, HI

hideous blinding lights, last thing we need to have blarring in our eyes while driving!!!

B.331 February 21, 2018 — Onsted, MI

These lights are blinding, especially at night. I have to turn my mirrors down and have to shield my eyes to oncoming traffic. It is dangerous.

B.332 February 21, 2018 — swansea, MA

Worst LED lights ever ,like they need it ? My biggest fear is the road construction on those police cars (holy god) !!! I was totally blinded on the highway! Yikes I was pissed because it took me eyes FOREVER to be back to the normal sighting visions! Not a good move whoever created LED on vehicles! PLEASE BAN THEM !!!

B.333 February 25, 2018 — Glenolden, PA

I drive a school bus and these lights have blinded me where I have had to stop the bus for a couple seconds...AND THERE ARE CHILDREN ON THE BUS! Ban these lights. They are NOT needed. Very dangerous!

B.334 February 26, 2018 — Horseheads, NY

It wasn't stupid enough to allow the auto industry to place a turn signal next to a BLINDING headlight. Now there allowed to make those lights so bright you can't see in front of you when one of those vehicles is behind you. I kind of got used to the spots in front of my eyes for 30 seconds when

looking for a turn signal, but now with this intense brightness, the turn signal is a much smaller problem. If it's night and someone with these lights is behind you, it's best to pull over and let them go so you have the ability to see. I had someone with these lights behind me and I could not make out where my driveway was to make the turn! Is this what our society has come to? Like everything else in this country, to someone it's all about money! Don't we have safety organizations in place to stop dangerous situations?

March 2018

B.335 March 1, 2018 — Miami, FL

I want to see laws implemented that makes it Illegal for automobile manufacturers to put in auto lighting that blinds other drivers. It's completely unnecessary to have such bright headlights. I also would like to see legislation passed that makes it Illegal for individuals to install aftermarket headlights that are blinding, distracting and light up the inside of your car like several high powered spotlights. They are a safety issue for motorists and pedestrians alike.

B.336 March 2, 2018 — Pittsfield, MA

It's absolutely debilitating to so after these light hit your eyes! They are finding out more and more how harmful these lights are. Yet have not got to the long term effects yet. They need to be removed before it's too late for some.

B.337 March 2, 2018 — Pittsfield, MA

These headlights are a danger.

B.338 March 2, 2018 — Rhododendron, OR

too bright is dangerous and painfully glaring to oncoming traffic. ask yourself if my lights are bright enough to see the next county over are they too bright?

B.339 March 4, 2018 — Bellevue, MI

Unbelievably dangerous. I would like to see lumen limits place on all exterior lighting personally. It is one of the many ways we are wrecking our environment, creating personal health and safety issues, and behaving irresponsibly. I am shocked this isn't talked about more. Being blinded by glare is an undeniable traffic hazard that desperately needs to be addressed.

B.340 March 6, 2018 — Houston, TX

The auto industry says that half of all new car headlights have a poor rating. They include the effect on the oncoming driver. If these are not stopped, driving at night will be next to impossible if every car has them.

B.341 March 6, 2018 — Rising Sun, MD

I have noticed this problem has gotten worse over the past several years.

B.342 March 7, 2018 — Glasgow, SCT, United Kingdom

I am now blinded on a daily basis by these things particularly at roundabouts and have had "near things". German marques are the worst. I have contacted my MP and the issue is with the UN for some bizarre reason. Donald, have you considered raising an e-petition on the Government website?

B.343 March 7, 2018 — Glasgow, SCT, United Kingdom

I am now blinded on a daily basis on these things and have suffered some "near things", German marques are the worst. Apparently, the issue is with the UN for some bizarre reason.

B.344 March 10, 2018 — Forest Park, GA

I am sick and tired of being temporary blinded by oncoming traffic, and light glare from my rear-view and side mirrors. Driving at night has become an absolute nightmare because. It's extremely frustrating uncomfortable and hurts my eyes.

B.345 March 14, 2018 — Bloomfiled, NJ

I agree!

B.346 March 16, 2018 — Waikoloa, HI

I can no longer drive at night, these lights cause me to lose my ability to see the whole field of vision.

B.347 March 17, 2018 — Franklin, GA

They are blinding to people. They actually make my eyes hurt!

B.348 March 17, 2018 — San Diego, CA

Aside from night blindings, I regularly get blinded during the *daytime* in my home's parking garage.

B.349 March 18, 2018 — Greenfield, IN

These are blinding to other drivers. They cause oncoming drivers to lose full field of vision especially on dark country roads. It's looks like they are coming at you with brights on. If they are behind you, there is a very bright glare in side and review mirrors. These lights need to recalled. There is no way these have not caused accidents.

B.350 March 24, 2018 — Ardentinny, SCT, United Kingdom

I've had times when oncoming headlights have completely dazzled me and they are not on full beam as its inner city.It is especially bad on duel carriageways and puts you off driving at night .l hope something is done.Many people arent even aware that you can lower your dipped headlights a bit.Manufacturers must do something snd so must government legislation.

B.351 March 24, 2018 — Clay, NY

I find that I need to squint my eyes and turn away from on coming traffic. Basically, I'm taking my eyes off the road. After the vehicle passes, my vision isn't clear. This is very dangerous.

B.352 March 24, 2018 — London, UK, ENG, United Kingdom

In the UK there's a trend to using fog lamps all the time. This is actually illegal here, except when visibility is bad, but many drivers think it's cool to have them on. Or something.

B.353 March 24, 2018 — Santa Cruz, CA

LED headlights send out flickering radiating rays of light that expand outward from the headlights of oncoming vehicles and make it nearly impossible for me to see the road and the edges of the road or even the markings on the road or anything that might be in the road in front of me. These LED headlights are extremely hazardous.

B.354 March 25, 2018 — Brantwood, WI

The lights are blinding

B.355 March 25, 2018 — Mayville, WI

These are a hazzard.

B.356 March 26, 2018 — Carthage, MO

It takes a second to dim your headlamps. Be kind and dim your brights for an oncoming vehicle.

B.357 March 26, 2018 — Carthage, MO

This is a pet peeve of mine. It's dangerous and unkind to not dim your brights to an oncoming vehicle!!

B.358 March 28, 2018 — Austin, TX

I have been driving more at night recently and have been blinded by oncoming headlamps to the point where I've had to pull over and wait for the spots blocking my vision to fade.

April 2018

B.359 April 4, 2018 — La Grange, IL

These headlights are blinding!

B.360 April 6, 2018 — United States

New Toyota Corolla S model was so bright in my rear view mirror I pulled over to let him pass. Oncoming traffic flashed this car, wow align your headlights to point at the road, not at the horizon.

B.361 April 7, 2018 — Darien, IL

Hurts my eyes

B.362 April 16, 2018 — Deltona, FL

I'm really having an issues with Toyota vehicles and also even as far as new Silverado trucks. These headlights are blinding when behind you. In front isn't as bad because they will pass eventually. But behind if they are matching you speed you're better off just slowing down to let them pass because of the headache they cause.

B.363 April 16, 2018 — Deltona, FL

Yes it's like a swirling array of blue and orange colors being emitted from those headlights. RIP my eyes to toyota corollas. Just had a 2018 Camry yesterday do the same.

B.364 April 18, 2018 — North Haven, CT

This is one of my biggest pet peeves. These LED lights are just bad. On cars or houses or streetlights doesn't matter. They are brutal. I drive home from work sometimes later and they blind me. Our world is becoming way too bright, loud and dirty. Do something.

B.365 April 18, 2018 — West Jordan, UT

The glare bothers me too And I drive a lot in the night

B.366 April 25, 2018 — Fond du Lac, WI

I drive to work everyday at night. I am disgusted at the amount of people putting these LED aftermarket bulbs in their halogen housings. They're made for a little halogen filament, not a bank of LEDS. Ridiculous glare and light splash. DOT compliant OEM ones are fine. These are ridiculous.

B.367 April 26, 2018 — Alpharetta, GA

During the day I have to adjust my rear view mirror to night position due to so many bright daytime headlights which makes any car without them essentially invisible. They are so bright, I frequently see drivers forgetting to turn on their normal head lights at night. Daytime lights should NEVER be bright enough to be used for night driving. Having to block my side view mirror with my hand until a car with these ultra blinding lights passes is also very dangerous.

B.368 April 26, 2018 — Elgin, IL

The trend towards high intensity headlights and other high intensity LED light sources is dangerous to the health and well-being of human and other animal races. Our next generation may well be partially blind if something is not done soon. Blinding of our current and next generation will be detrimental of our economic and creative potential. These high intensity lights make our environment highly prone to accidents, they affect wild life that is struggling to cohabit with us and share our planet. It's becoming hard to drive at night and even during day times. We must bind together to stop this craziness from polluting our visual environment. In the last few recent years, headlights, tail lights, street lights, lights on police/emergency cruisers, tow trucks, public buses have all in my opinion intensified to the tune of 3 to 10x. Head lamps emit white light/beam direct to eyes vs. the old method of reflection and natural light bulbs that used to disperse beams better. I have personally reduced my night/evening driving only to bare necessity and also walking out with kids at night. Do sign this petition if you can sense the danger, want our elected officials to create and enforce polices against this disaster and are concerned about our rights and our general well-being.

May 2018

B.369 May 6, 2018 — United States

#savelives

B.370 May 13, 2018 — Smyrna, TN

People are being Rude and Obnoxious and are Absolutely Absurd.Its is Being Used as a Tool to be Overly Aggressive to Other Law Abiding Citizens that are Following State Laws.Re:Posted Speed Signs On Interstates and Residential areas. People are using the BRIGHT LIGHTS without a necessary cause or REASON , NO ITS NOT THE HEADLIGHTS,ITS THE PEOPLE THAT ARE GOING OUT OF THIER WAY TO PROVE WHAT AN ASS THEY CAN MAKE OF THEMSELVES TO WITH NO REPERCUSSION OR PUNISHMENT. DAREING ANYONE TO STOP THEM. THEY ACTUALLY ARE TAKING THE GREATEST PLEASURE IN OFFENDING EVERYONE POSSIBLE TO GET THIER JOLLYS.YES ITS MOST AMAZING.ARROGANCE AND IGNORANCE AT ITS PEAK.ITS A NORMAL WAY OF LIFE FOR FOOLISH ASSHOLES..IRRITATE AND AGGRAVATE.

B.371 May 14, 2018 — Bemidji, MN

I have a vehicle where I am constantly being flashed by oncoming traffic. The headlights were adjusted, there was nothing in the back to make the headlights point up towards the sky, so I decided to get out and in front of the car to see why this has been happening. It wasn′t so much the actual light beam, but rather the "stylish" LED crap that overtakes the headlamp assembly. There is no way to turn these things off. I flipped the switch to parking lamps and attempted to drive down my driveway with only the LED accent lighting and parking lamps on. The LED accent lights did absolutely nothing as far as illuminating the roadway in front of me. They are just a nuisance to oncoming traffic. I have been doing my own silent protest by keeping my high beams on when approaching vehicles with LED light strips. I covered my LED light strips so they are no longer visible. I am at the point of frustration now where I want to be a vigilante and hit all the LED light strips with bright orange or green plastidip or duct tape. These lights have got to go!

B.372 May 18, 2018 — Hayward, CA

Some LED and HID lights are more intense than high beams and they should be used accordingly on deserted highways. In towns, with lively traffic they shouldn′t be used.

B.373 May 22, 2018 — Mercer Island, WA

Thank you...

B.374 May 28, 2018 — Tacoma, WA

Write a reply...people are so rude! bright blinding lights were invented by assholes

B.375 May 28, 2018 — Tacoma, WA

Toyota, BMW, and many other cars should be recalled to smash the fuckin LED out of them!

June 2018

B.376 June 1, 2018 — Appleton, WI

Because these lights are terrible

B.377 June 1, 2018 — Atlanta, GA

These LED lights are literally ruining my life. The combination of LED streetlights and car headlights is literally unbearable to me. I can only go out at night if someone else drives and I wear an eye mask. I am so freaked out by these lights I don′t know how I will live the rest of my life if these don′t go away. These lights cannot possibly be healthy for humans or animals. PLEASE MAKE THEM ILLEGAL!

B.378 June 9, 2018 — Nashville, IL

Led lighting should only be for off road use.

B.379 June 13, 2018 — Gore, VA

I′m tired of becoming ″blind″

B.380 June 19, 2018 — Australia

Bright low beam headlights are dangerous

B.381 June 19, 2018 — Huntsville, AL

It's no coincidence blue light is harmful to us during the night and the gov't and dot has allowed the steady increase of these blinding blue lights on trucks and cars. I'm pretty sure even car manufacturers are installing them on their new models and now at least 1/4 of all cars and trucks have them. But it's not only headlights it's street lights store lights lights for your house I read somewhere it's a weapon! The blue light during the night does major damage to our circadian rhythm. I drive a truck, 75% of the time during the night, and it's causing problems with my sleep, my mood, and gives me bad headaches...

B.382 June 25, 2018 — Seattle, WA

Some of these lights are color temperature of 10,000K. If you care about #lightpollution please follow @IDA international Dark Sky association. If your in #Seattle please follow @darkskiesseattle to help raise awareness and collaborate for changes.

B.383 June 27, 2018 — Athens, GA

If only Donald Trump was annoyed by these lights too.

September 2018

B.384 September 18, 2018 — Patchway, ENG, United Kingdom

I've seen the effects on sufferers.

B.385 September 18, 2018 — Taunton, ENG, United Kingdom

I find the modern lights very distracting and the very small indicator strips are very hard to see

B.386 September 18, 2018 — United States

i hate these damn things

B.387 September 20, 2018 — Bath, ENG, United Kingdom

I'm pissed off being blinded by some person who has not got a clue about road manners. Cyclists have these now front and red to the rear aldo blinding worse when they are the flashing type.

B.388 September 21, 2018 — Rochester, NY

I can't drive at night with these crazy bright lights!

B.389 September 22, 2018 — Peabody, MA

These headlights are not only blinding and dangerous to drivers but are also hell for those of us with extreme light sensitivity.

B.390 September 29, 2018 — United States

The blinding headlights are not only an issue for oncoming vehicles, but also for the cars driving immediately in front of said vehicles. While many rear-view mirrors have anti-glare capabilities, side mirrors do not.

October 2018

B.391 October 1, 2018 — Clarkston, MI

I am signing this petition because the number of bright headlights on cars in my area is increasing rapidly. I have a serious medical condition that makes my eyes sensitive to bright lights and as a result I am prone to visual disturbances, auras. These lights are not just in at night but all day long. They strike from my side mirrors and cause me to see spots. On time I ran a red light because I had bright headlights coming at me and from behind me. I couldn't see for seconds. It was scary.

B.392 October 1, 2018 — La Crosse, WI

As a newspaper delivery person, I find myself constantly blinded by oncoming lights. In my job, it's important for me to see the road to assess hazards, and not be blinded.

B.393 October 9, 2018 — Schenectady, NY

These lights have blinded me nearly causing an accident several times They should be banned!

B.394 October 25, 2018 — Teaneck, NJ

I have noticed this as a true problem for myself and believe it is extremely dangerous.

B.395 October 28, 2018 — Hattiesburg, MS

I'm tired of being blinded while driving!

B.396 October 28, 2018 — Petal, MS

Brenda Wilkerson

B.397 October 31, 2018 — West Sacramento, CA

These light cause actual pain and eye damage.

November 2018

B.398 November 3, 2018 — Mebane, NC

I too have been blinded by these lights

B.399 November 5, 2018 — San Jose, CA

LED sucks. Xenon is much better if you want the look.

B.400 November 6, 2018 — DELTONA, FL

I have night blindeness and these completely block my vision

B.401 November 6, 2018 — Germantown, MD

I hurts my eyes!

B.402 November 7, 2018 — Clear Lake, WI

Xexon and LEDs headlights should be banned. Today's halogen headlights are bright enough. The AMBER daytime running lights should be the only DRLs allowed.

B.403 November 7, 2018 — Portland, OR

everything in our environment is becoming ugly. why does this have to be the new normal. headlights are intimidating, cruel, mean, blinding, ugly.

B.404 November 8, 2018 — Fredericksburg, VA

While I'm all for a person customizing their vehicles with aftermarket parts, I don't see the need for these overly bright lights as regular driving headlights. Especially as factory headlights. I have almost been in a handful of accidents because of these lights. In these instances, my children were often in the car with me.

B.405 November 8, 2018 — Kamloops, Canada

I'm signing this petition because I am FED UP CONSTANTLY BEING BLINDED by these blue-white LED HEADLIGHTS!!! They HURT my EYES, NEGATIVELY AFFECT MY DRIVING since I can't 'see' the road at night (and day) after having the horribly blinding 'camera flash' of an oncoming vehicle (esp. trucks, vans & buses) with unacceptably bright LED HEADLIGHTS!!!

B.406 November 9, 2018 — MT, United States

Bloody bright lights cause accidents .

B.407 November 9, 2018 — Santa Maria, CA

Saftey While Driving

B.408 November 9, 2018 — shirley, NY

THEY ARE SOOOOOOOOOO BLINDING, MAKE ME SICK AND ARE DANGEROUS AND DEADLY. IT IS HONESTLY HORRIBLE THEY ARE ALLOWING THESE ON CARS!!!! IMMORAL

B.409 November 10, 2018 — Ashland City, TN

I very nearly hit a pedestrian who was walking on the side of the road wearing black clothing, I didn't see him until the last second because of some jerk's brights blinding me!

B.410 November 10, 2018 — Bellevue, WA

I'm 68 years old and when driving at night, bright headlights cause me difficulty.

B.411 November 11, 2018 — Afghanistan

I can't stand these HID headlights. I've almost went off the road cause they glare so much. Both my cars have normal halogen lights so now every time someone with HIDs is coming up on me I blast them with my high beams since they're low beams are blinding me.

B.412 November 11, 2018 — Spring Hill, TN

The LED lights can be blinding and can make driving difficult.

B.413 November 13, 2018 — Philadelphia, PA

Three lights are blinding, especially in single lane roads. They're dangerous and unnecessary. Common sense laws need to be passed regarding these lights, sooner than later.

B.414 November 14, 2018 — Crossville, TN

I hate those lights. I have almost wrecked many times over bcuz of them.

B.415 November 16, 2018 — Baytown, TX

I drive every night on a narrow two lane road to get home from work. I know the common rule is to look down at the road lines whenever an incoming car is in sight with lights, but there's no point when the car has bright LED lights that completely white out my vision. There have been several instances where I, and several of my friends and family, have nearly driven off the road because we couldn't see anything other than the blinding light of LED headlights. What's worse is that they aren't using fog lights or anything, it's just the normal headlights. That needs to be banned immediately.

B.416 November 16, 2018 — El Paso, TX

I am only 20 years old but I seem to have a light sensitivity issue with bright LED lights popping out of nowhere in the dark. The bright lights hurt my head and when I walk at night I need to cover my face or direction of where the bright light is coming. I noticed it’s abnormal because it bothers me much more than other people my age. I have to wait until March to tell my eye doctor about this problem. Even wearing sunglasses have not helped me.

B.417 November 16, 2018 — San Antonio, TX

They should be for emergency vehicles only IMO. Too many nuisance drivers, with no regard for public safety, blinding other motorists. Enough is enough.

B.418 November 17, 2018 — Milwaukee, WI

It's hard to avoid objects and people or cars in front of me when I can't see because of someone's blinding bright headlights.

B.419 November 17, 2018 — Woodburn, OR

I signed for all of the same reasons as others. These LED headlights are dangerous! I don't believe the problem is the LED technology itself, but how it is constructed (i.e. color, lenses, etc). More safety checks are necessary before dumping such things into the marketplace. In some cases, I have been blinded by these headlights even at a location ~30 degrees to the side! How can this possibly be considered safe? I am disheartened as I see this petition drive was launched around a year ago. I would have expected at least several hundred-thousand signatures by now :(

B.420 November 22, 2018 — Niederwald, TX

I've nearly ran bbn off the road or into several cars due to these blinding lights!!!!

B.421 November 25, 2018 — Overland Park, KS

I'm being blinded by headlight glare in my side view mirrors from newer, whiter headlights. We need to limit the color temperature!

B.422 November 25, 2018 — Waltham, MA

I'm signing this petition because I find the glare from headlights of oncoming cars blinding and dangerous. I hate driving at night now and am concerned that I will get into an accident due to the brightness of the headlights. It feels like the lights are piercing my eyes and it looks like all cars have their high beams on.

B.423 November 26, 2018 — Richardson, TX

They are too bright; everyone knows that!

B.424 November 28, 2018 — Manchester, NH

I had a pick-up truck on my back bumper the other night. The truck had 3 lights on each side. It lit up the interior of my car so bright I could have read small print on any contract. These lights are a menace and need to be banned.

B.425 November 28, 2018 — McLean, VA

I wear screenvision/blue light reducing glasses when I drive at night, but I shouldn't have to do that. The lights are the problem, not my eyes.

B.426 November 28, 2018 — Morris plains, NJ

I am blinded at night by these glaring lights

B.427 November 29, 2018 — Burlington, United States

Even when people get behind you these things blind you, I'm not saying they should ban them for off-road use but on the road it shouldn't be allowed, what was wrong with the old headlights? They're so bright and every vehicle turning the glare changes direction and hits spots causing a glare to where drivers can't see, anyone can easily get blinded with the sun as it is and run off the road, into other vehicles and then who's fault is it if they couldn't see cause they were blinded? Still theirs.. After losing my grandfather in a vehicle accident many years ago, I feel people shouldn't lose their lives and the vehicle they worked so hard for over a silly blinding lightbulb.

B.428 November 30, 2018 — Whitehouse Station, NJ

Every state needs to reaim headlights during the annual vehicle inspection, if they don't have inspection institute one! Also the truck drivers with the 36" wide light bars on the front need to go. If you are the only one on the road light it up, when others are just in front of you shut em down.....at this point emissions take a back seat to being blinded.

December 2018

B.429 December 2, 2018 — Saratoga Springs, NY

Sick of these LED lights blinding me at night on the road. It doesn't matter if the vehicle is oncoming or behind you. Lights that bright are ridiculous and can cause accidents. Get rid of them.

B.430 December 3, 2018 — Green Bay, WI

How is paying $10 going to get this seen to 150 more people? I think this petition is a scam to make money!!! I have over 13,000 followers, on one of my google accounts - it does NOT cost $10, nor $5 or even $3 to "help" get this petition seen by more people! Besides, the issue is already illegal, just write to the secretary of the DOT! See my LONGER VERSION of my 'comment' bellow!

B.431 December 3, 2018 — Green Bay, WI

I have a few things to say about this *BLINDING HEADLIGHT* "petition"... 1) there are a number of different issues here. Not only are the BRIGHT lights SO WRONG, they are ALREADY

suppose to be under so many candle power set from the factory. THEY ARE ILLEGAL ALREADY! We do not need to "petition"!!! If the DOT did their job, they would have been changed already. 2) Lights that move, are illegal! They were banned back in the 50′s! Lights that move up or down are STUPID and the people who have them looks like they are flashing their brights at me/us when they 'float' up and down!!! Even the COPS have these on the Ford suvs! THEY ARE ILLEGAL! If the DOT did their job, they would have been changed already. YOU PEOPLE NEED TO WRITE TO THE DOT!!! Not start a petition! 3) There is another issue here that is not being covered; the use of MORE THAN TWO SETS of lights are ILLEGAL in the State of Wisconsin, and I think many other states, if not all of them!!! Look it up! The DOT standards are on the internet! LAW STATES, NO MORE THAN 4 FORWARD WHITES AT ANY GIVEN TIME can be used!!! These auto companies know this! But the foreign companies started making these stupid "eye brow" lights around the other head lights, and they make it even brighter! These are technically ROPE LIGHTS, that are also ILLEGAL!!! They sometimes have 15 LEDs in them! plus with the other 4 white lights make make 34 or more forward white lights!!!! When no one is allowed more than 4 at any given time on the road!!! 34 or 4? hmmm. WHITE TO THE DOT PEOPLE!!! Also,,, why the hell are the police not enforcing the laws we ALREADY HAVE IN PLACE??? Addition non-sense: REVERSE LIGHTS! Reverse lights on a motor vehicle are ONLY to be illuminated when the vehicle is IN REVERSE, AND ABOUT TO BACK UP!!! Not on for ANY amount of time when no one is in the car!!! WHY THE HELL ARE BACK UP LIGHTS ON WHEN PEOPLE ARE WALKING AWAY FROM THEIR CARS??? THIS IS STUPID AND CRAZY! How long has the average person sat waiting in parking lots, waiting for a car or truck to back out??? WRITE TO THE DOT! DO NOT MAKE PETITIONS! If you make a petition, the assholes (or ignorant dumb-asses) doing the wrong will think they are in the right to begin with, when in fact, THEY ARE IN THE WRONG, AND THESE AUTO MAKERS NEED TO BE FINED, AND MADE TO RE-CALL ALL OF THESE new cars and trucks that run with more than 4 lights (they use to program/design switches to make the 'fog' or other lights on the bottom go OFF when the brights were activated! That was because they KNEW only FOUR FORWARD WHITE LIGHTS were allowed at ANY given time! The "brights" are another set of illuminating elements or (LED) and thus making it 4 lights on the front of vehicle - to comply with DOT standards and federal LAW! But why are they ignoring the law??? THE LAWS DID NOT CHANGE! SO ANYONE DRIVING AROUND WITH 6 LIGHTS ON, OR MORE, ARE VIOLATING THE LAW! This petition is BS! I signed it at first because I thought more people need to know there is a problem and like me, THEY BLIND ME!!! I CAN NOT SEE PAST THEM STUPID CARS OR TRUCKS! But when i started getting e-mails asking me for money??? NO! $10 to get this out to 150 more people??? NO! THAT IS NOT RIGHT! NOT $5 EITHER! AND NOT $3!!! WAKE UP PEOPLE! JUST WRITE TO THE LADY IN THE DOT OFFICE; SHE IS THE ONES ALLOWING IT! LOOK IT UP!

B.432 December 3, 2018 — Green Bay, WI

It′s actually against the law to have more than 4 (four) lights on at any time while driving.

B.433 December 3, 2018 — Green Bay, WI

It′s actually against the law to have more then FOUR (4) forward white lights one at ANY given on the road. They need to be reported then. EVEN MULTI-BEAM LIGHTS are ILLEGAL! And these multi-bean LED lights are NO exception and are ILLEGAL to use. Write to the DOT, tell them to enforce the LAW.

B.434 December 3, 2018 — Green Bay, WI

It′s actually against the law to have more then FOUR (4) forward white lights one at ANY given on the road. They need to be reported then. EVEN MULTI-BEAM LIGHTS are ILLEGAL! And these multi-bean LED lights are NO exception and are ILLEGAL to use. Write to the DOT, tell them to enforce the LAW.

B.435 December 3, 2018 — Green Bay, WI

same here

B.436 December 3, 2018 — Green Bay, WI

same thoughts exactly!!!

B.437 December 3, 2018 — Green Bay, WI

For whatever reason my comment was not posted, so entering it again: 1) there are a number of different issues here. Not only are the BRIGHT lights SO WRONG, they are ALREADY suppose to be under so many candle power set from the factory. THEY ARE ILLEGAL ALREADY! We do not need to "petition"!!! If the DOT did their job, they would have been changed already. 2) Lights that move, are illegal! They were banned back in the 50′s! Lights that move up or down are STUPID and the people who have them looks like they are flashing their brights at me/us when they 'float' up and down!!! Even the COPS have these on the Ford suvs! THEY ARE ILLEGAL! If the DOT did their job, they would have been changed already. YOU PEOPLE NEED TO WRITE TO THE DOT!!! Not start a petition! 3) There is another issue here that is not being covered; the use of MORE THAN TWO SETS of lights is ILLEGAL in the State of Wisconsin, and I think most every states, if not all of them!!! Look it up! The DOT standards are on the internet! LAW STATES, NO MORE THAN 4 FORWARD WHITE LIGHTS AT ANY GIVEN TIME can be used!!! These auto companies know this! But the foreign companies started making these stupid "eye brow" lights around the other head lights, and they make it even brighter! These are technically ROPE LIGHTS, that are also ILLEGAL!!! They sometimes have 15 LEDs in them! plus with the other 4 white lights make make 34 or more forward white lights!!!! When no one is allowed more than 4 at any given time on the road!!! 34 or 4? hmmm. WRITE TO THE DOT PEOPLE!!! Also,,, why the hell are the police not enforcing the laws we ALREADY HAVE IN PLACE??? 4) Additional non-sense: REVERSE LIGHTS! Reverse lights on a motor vehicle are ONLY to be illuminated when the vehicle is IN REVERSE, AND ABOUT TO BACK UP!!! Not on for ANY amount of time when no one is in the car!!! WHY THE HELL ARE BACK UP LIGHTS ON WHEN PEOPLE ARE WALKING AWAY FROM THEIR CARS??? THIS IS STUPID AND CRAZY! How long has the average person sat waiting in parking lots, waiting for a car or truck to back out??? WRITE TO THE DOT! DO NOT MAKE PETITIONS! If you make a petition, the assholes (or ignorant dumb-asses) doing the wrong will think they are in the right to begin with, when in fact, THEY ARE IN THE WRONG, AND THESE AUTO MAKERS NEED TO BE FINED, AND MADE TO RE-CALL ALL OF THESE new cars and trucks that run with more than 4 lights. AND for the other issues! They use to program/design switches to make the 'fog' or other lights on the bottom go OFF when the brights were activated! That was because they KNEW only FOUR FORWARD LIGHTS were allowed at ANY given time! The "brights" are another set of illuminating elements or (LED) and thus making it 4 lights on the front of vehicle - to comply with DOT standards and federal LAW! But why are they ignoring the law??? THE LAWS DID NOT CHANGE! SO ANYONE DRIVING AROUND WITH 6 LIGHTS ON, OR MORE, ARE VIOLATING THE LAW! This petition is BS! I signed it at first because I thought more people need to know there is a problem and like me, THEY BLIND ME!!! I CAN NOT SEE PAST THEM STUPID CARS OR TRUCKS! But when i started getting e-mails asking me for money??? NO! $10 to get this out to 150 more people??? NO! THAT IS NOT RIGHT! NOT $5 EITHER! AND NOT $3!!! WAKE UP PEOPLE! JUST WRITE TO THE LADY IN THE DOT OFFICE; SHE IS THE ONES ALLOWING IT! LOOK IT UP!

B.438 December 6, 2018 — Desborough, ENG, United Kingdom

It's really bad now

B.439 December 6, 2018 — Houston, TX

We used red lights in the Army for night operations. They don't over stimulate your eyes and allow quicker recovery when going back to darkness. This has been known for a very long time. I dont understand why our government ever allowed these super bright lights to become such a menace...

B.440 December 6, 2018 — Mascouche, Québec, Canada, Canada

Les lumières des voitures me donne beaucoup de migraines , depuis que j'ai cesser de conduire lorsqu'il fait noir je n'ai plus de migraines. C'est très aveuglant et donc très dangereux de conduire en étant aveugler, car les voitures en sens inverse nous aveugle , il est impossible de voir une bêtes ou un piéton qui serait sur la voie.

B.441 December 7, 2018 — San Jose, CA

LED headlights and taillights are a catastrophe. It's unbelievable that our government is allowing this. How are we supposed to even drive anymore?

B.442 December 8, 2018 — Emporia, KS

I live in a fairly rural area where many of the roads are narrow, lack white lines and have little to no shoulder. Wildlife in the road is also a big concern. These lights make it impossible for oncoming drivers to see the edge of the road or hazzards on the shoulders.

B.443 December 8, 2018 — West Mifflin, PA

Because I am blinded to the point of getting in an accident at least 4 times every morning and every night. I don't want to die!

B.444 December 8, 2018 — elkton, MD

Some jerk tailgating me for over ten minutes caused nightblindness in my one eye that couldn't avoid the glare. And I legit cannot properly see the road or its markers when passing other cars with this, and they seem to only be growing in population...

B.445 December 9, 2018 — Ellwood City, PA

Lights are to bright and cause others to be blinded

B.446 December 9, 2018 — Gray, ME

A police officer had a car pulled over on the side of the road with blue led lights signaling. I slowed down to go around but thought the officer was in the vehicle. I was HORRIFIED as I drove past to suddenly be able to see that the officer was actually outside his vehicle and that I was unable to see him until I had come alongside him. The blue leds did not illuminate the area. They bathed the area in blue color. This distorted what I was able to see. I worry for everyone's safety with the use of led.

B.447 December 9, 2018 — Lomita, CA

I am a car and motorcycle enthusiast I fitted off road Halogen lights to my vehicles for decades I remember getting tickets for using my lamps on a highway Never blinding others Late night Dark conditions Still the officers hidding behind a tree will find the excuse to issue a citation Well Today we get 500% more glaring and blinding lamps on the road and those are used as regular headlamps Those blind and glare to extreme lévels Needless to say a corrupted DOT has allowed those lamps to be used on cars putting safety on the side I do not see policemen ticketing drivers BMI ding others with their Zenón and LED lamps because the DOT has allowed them to be used on highways and the police follows this corrupted decision by the DOT We need impeach the officials from the DOT and send them to jail for having put aside safety in the place for money given to them by car manufacturers We need action Impeach the DOT

B.448 December 9, 2018 — North Haven, CT

It's so hard to drive at night with these glaring lights. Unnecessary evil.

B.449 December 9, 2018 — Six Lakes, United States

Those headlights are blinding to oncoming traffic!

B.450 December 9, 2018 — Tampa, FL

They are too bright and dangerous

B.451 December 9, 2018 — bastrop, TX

When I come upon headlamps and police cars that have blinking lights, these days those colored lights blind me for several seconds .. seriously impairing my ability to safely navigate for a ways down the road. It's frightening. There is serious enough risk in recovery time That it might as well have been distracted driving cell phone use. The eyes are rendered useless in these events. Why are the safety patrols using blinding lights⁉⁉

B.452 December 10, 2018 — Hudson, MA

These headlights are extremely dangerous and uncessary. I can see the road just fine at night with mt regular lights.

B.453 December 10, 2018 — MA, United States

because my eyesight and anxiety are bad enough already, and i don't need your jackassery to fuck the road up for me

B.454 December 11, 2018 — Edgerton, KS

It's dangerouse to be blinded while driving

B.455 December 11, 2018 — Fairfax, VA

I sometimes literally end up seeing spots after a car on the other side of the highway blinds me.

B.456 December 11, 2018 — Las Vegas, NV

These headlights are causing me to be blinded so often it's a wonder I haven't gotten in An accident yet. It's a matter of time. . This is ridiculous they are a danger to everyone on the street except the people who have them.

B.457 December 12, 2018 — Austin, TX

I've never had problems with oncoming lights until recently. To me these new headlights are more of a problem than the older lights on high beam. Please ban these lights and create standards that work for the driver and their fellow drivers.

B.458 December 12, 2018 — Circleville, OH

Cataracts make night driving difficult. Bright lights cause halos and are distracting.

B.459 December 12, 2018 — Los Angeles, CA

I'm terrified to drive in the evening because of this!!!

B.460 December 12, 2018 — Newfane, NY

General Motors, pickups are blinding, GM is the worst must be cheaper headlight setup as gm will blind u to save .50¢

B.461 December 12, 2018 — Seattle, WA

Bright LED headlights actually make it harder to see at night because of the glare. Please take measures to lower the intensity of these headlights!

B.462 December 12, 2018 — Trout Lake, WA

I live out in a rural area. At night, when an oncoming vehicle has HID/LED headlamps, about 90% of the time, I'm blinded to the point of barely being able to see the white line. Much less a deer, raccoon, or rare pedestrian.

B.463 December 12, 2018 — United States

As everything else concerning safety is regulated on a vehicle , it is baffling why headlights are not! Some of these lights are more blinding to on coming traffic Than high beams.

B.464 December 12, 2018 — Wytheville, VA

I hate those headlights

B.465 December 13, 2018 — Bellevue, OH

Those lights are blinding and dangerous at night! I have eye problems and because of those lights, I can't drive at night. Please ban them!

B.466 December 14, 2018 — Des Moines, WA

People don't see the bigger picture here. They think if they have brighter headlights it makes everyone safer. That couldn't be further from the truth. When you blind oncoming traffic with your blinding headlights it makes it harder for them to see pedestrians crossing, makes it harder to see potholes in the road, makes it harder to see curbs. Many things! And what ever happened to properly aimed headlights? Is it even possible to aim LED's? Most of the time they look like they are aimed both high and low. This is very dangerous!

B.467 December 14, 2018 — Des Moines, WA

That is exactly the point I try to make to people.

B.468 December 14, 2018 — Des Moines, WA

I was trying to turn into a business parking lot recently and ran over a curb because i got blinded by laser headlights. I was so pissed!

B.469 December 14, 2018 — Des Moines, WA

I'd like to follow them to where they park their vehicle, and then spray black paint over their shitty lights! But I don't want to go to jail because of them being assholes!

B.470 December 14, 2018 — Des Moines, WA

I got "attacked" a couple nights ago by a Jeep coming toward me with 6 headlights, and they were all blinding LED's. They had the 2 blinding headlights, plus 2 blinding foglights, PLUS a light on each side of the windshield that hung out above their rear view mirrors, and those ones were seriously blinding because of their high mount, and total disregard for proper aim! I bet those are illegal for street use anyway. Why don't cops pull those shitheads over and cite them? and those rectangular all-LED light bars, aren't they only for off road use? I keep getting blinded by those, too!

B.471 December 16, 2018 — Rockville, VA

This truly is a serious threat to our society. While new types of lighting help in certain situations, the end result is causing more harm than good. We need a more gentle spectrum that accomplishes safer driving for all. Go NHTSA and save us. Please fulfill your mission for all of us esp. Our new drivers, our children.

B.472 December 16, 2018 — bauxite, AR

Hate the bright lights

B.473 December 17, 2018 — Azusa, CA

I find it unbelievable that we allow these horrific blinding headlights to create a peril to drivers. Please ban them.

B.474 December 17, 2018 — Doncaster, ENG, United Kingdom

It's completely true. Everyone is saying it.

B.475 December 18, 2018 — Greenville, PA

I have complex migraines that are triggered by light. Driving at night has been made unbearable due to these headlights. During a 7 hour road trip recently I was so afraid I would wreck. There were hundreds of times on that journey that I simply couldn't see.

B.476 December 18, 2018 — Manchester, NH

I had the same thing happen to me a few weeks ago. At first I thought I had at least two vehicles behind me. The 6 headlights (3 on each side) also had the smaller bulbs surrounding them. The smaller bulbs alone put out more candlelight power than my high beams. In all, I would not be surprised it I had 6 large bulbs and at least a dozen smaller bulbs in my rear view and side view mirrors. I was totally blinded and had to pull off to the side to let the idiot pass me.

B.477 December 18, 2018 — Manchester, NH

I think it is funny that not too long ago you could get a ticket for having your high beams on when approaching oncoming traffic. Now, one of those bulbs is 10X brighter than the old high beams. And they have a lot of those bulbs on some of the trucks.

B.478 December 18, 2018 — Manchester, NH

Makes you wonder how the auto industry got these okay'd? How much did they have to pay someone off to get these made legal?

B.479 December 18, 2018 — Troy, NY

I'm signing because if nothing happens and the only choice left is to be forced into having the bright lights, we all lose.

B.480 December 18, 2018 — londonderry, NH

these lights are way too bright.

B.481 December 19, 2018 — Houston, TX

I'm tired of being blinded and almost wrecking every night from work. I can't take it anymore.

B.482 December 19, 2018 — mansfield, OH

they are dangerous. My car sits pretty low and when trucks or jeeps are coming toward me I can not see.

B.483 December 20, 2018 — Belchertown, MA

I'm signing because I'm tired of having pick up trucks behind me in my car blind me with their LED headlights. They are also blinding when coming at you on the opposite side of the road.

B.484 December 20, 2018 — Hamilton, Canada

These lights are irritating honestly arent high beams enough when you need bright lights to see the road. I have to wear sunglasses at times to be able to make it through my drive home from work. I've had spots in my vision and had to pull over. Seriously these lights gotta go I'm done with them they should never even became a thing.

B.485 December 20, 2018 — Milton Keynes, ENG, United Kingdom

On multiple occasions I have been close to either going off the road, or even hitting head on with another vehicles due to the ridiculous brightness of LED/HID headlights. For the safety of all road users they should be either banned or at least regulated.

B.486 December 20, 2018 — Portland, OR

Those lights are blinding

B.487 December 20, 2018 — Provo, UT

I hate the ultra bright headlights so much! They might help the driver possessing them to see better but the rest of us are blinded and at risk of injuring ourselves or others as a result.

B.488 December 20, 2018 — Scotch Plains, NJ

I am signing this petition because with car sales down and SUV sales up, these exorbitantly bright lights are increasingly difficult to avoid. I don't see how they make driving safer when approaching cars are blinded.

B.489 December 20, 2018 — Tacoma, WA

I'm sick of being Blinded by headlights. Blinded by a douche who's driving with his high beam lights!

B.490 December 20, 2018 — coos bay, OR

I prefer to be able to see when driving at night.

B.491 December 21, 2018 — Louisville, KY

I get blinded at night with these lights . i have sensitive eyes to bright lights and cannot drive at night because of these headlights

B.492 December 21, 2018 — Minnetonka, MN

Whether it's a vehicle coming towards you (blinding direct lights) or a large vehicle behind you (blinding through the rearview mirrors), these HID/LED/blueish lights pose a huge safety risk to other drivers. A few seconds without being able to see your surroundings on the road are enough to cause a major accident.

B.493 December 21, 2018 — Mission, TX

My epileptic partner can't even be in the passenger seat without getting a seizure cause of these stupid lights.

B.494 December 21, 2018 — Riverhead, NY

I wear glasses with an anti glare protection. They do not work with the new blinding headlights. The glare is blinding, the range of luminescence / beam is to far outward blinding oncoming traffic. Dangerous and disturbing during and after the lights hit my eyes.

B.495 December 22, 2018 — Ctr Barnstead, NH

We need these banned

B.496 December 22, 2018 — Millbury, MA

It's very difficult to see driving at night. I have children. Those lights should be banned!

B.497 December 22, 2018 — Port St. Lucie, FL

trump Is dumber than a head light, and even he had taken lives. that's all.

B.498 December 22, 2018 — United States

greg bond,it's to much light and distracting on the road!

B.499 December 22, 2018 — columbia, SC

I'm a driver

B.500 December 23, 2018 — HONDO, TX

I drive a winding hilly country road frequented by caravans of tire testers. If they have LED lights it is punishing and dangerous.

B.501 December 23, 2018 — Hudson, NH

They should not even be legal

B.502 December 23, 2018 — Memphis, TN

I have chronic migraines & driving at night has become impossible. Because these headlights trigger them instantly.

B.503 December 23, 2018 — Toronto, Canada

It's simply blinding.

B.504 December 25, 2018 — Rochester, MN

They're too damn bright!!!

B.505 December 26, 2018 — Chevy Chase, MD

I'm tired of being blinded in traffic. It's dangerous.

B.506 December 26, 2018 — Feasterville-Trevose, PA

Those lights should be banned.

B.507 December 26, 2018 — South Chatham, MA

I do not have any sensitivity to light, lack of vision, etc. and these lights are still extremely blinding. Who is to blame when these lights cause a fatal accident? This needs to stop.

B.508 December 26, 2018 — Woodbridge, VA

I'm being blinded at critical driving decision moments by cars with these lights. The blinding effect lasts after the car has passed putting us all in danger.

B.509 December 27, 2018 — Sebastian, FL

These headlights are hazardous! There should be light levels limits on vehicles.

B.510 December 28, 2018 — Cork, Ireland

This is an international epidemic affecting road users as a result of very poor design decisions by car manufacturers. Their drive towards making a car seemingly safer for a driver in fact is making those very cars a lethal danger to other road users, including other car drivers. Glare is lethal. Blinding, blue-white headlights are lethal. The trend towards ever brighter lights, front and rear, is lethal. Just because car manufacturers can make their car lights brighter doesn't mean they should. They are creating conditions that will kill increasing numbers of people in years to come.

B.511 December 28, 2018 — pittsburgh, PA

These lights blind me, not to mention Science shows us that blue spectrum light contributes to macular degeneration.

B.512 December 29, 2018 — Goirle, Netherlands

Yep! Always a problem, here too!

B.513 December 29, 2018 — Midland Park, NJ

It makes it very difficult for me to see! I can't wear sunglasses at night and it's truly hard to keep my eyes open with some cars.

B.514 December 29, 2018 — Woodland Hills, CA

Imagine you are driving along a winding canyon road, in the dark, no lights except the stars and the moon. You have very good vision, but you have the normal visual reactions of a person 65 years old. You have an excellent driving record. However, a car comes around a curve from the opposite direction, with headlights that send a blinding, searing light to your retinas, and completely wash out your visual field for 5 seconds or more. You know the curve up ahead, you are familiar with the road, and so you gently come to a stop (an abrupt stop could cause the car behind you to either swerve or push you over the side), and briefly wait to recover your vision. But maybe next time, or some other unsuspecting driver won't react so well, or won't have time, or just won't know the road well enough. These lights are murderers.

B.515 December 29, 2018 — s Fallsburg, NY

They are very bothersome.

B.516 December 30, 2018 — De Pinte, VOV, Belgium

because I trust Martin Cohen

B.517 December 30, 2018 — Oak Lawn, IL

Preserving vision and saving lives is important

B.518 December 30, 2018 — Plano, TX

I live in the country and drive on dark winding roads. Oncoming blinding LED headlights make it dangerously impossible to see anything for several seconds!

B.519 December 31, 2018 — East Greenbush, NY

I am often blinded by these lights and it seems to be getting worse. There seem to be more and more vehicles on the road like this. I consider it a road hazard.

B.520 December 31, 2018 — Winston, GA

The new headlights on cars and trucks are absolutely blinding to me when I'm trying to drive at night. I cannot believe these are even legal! I have seen trucks with additional LEDs added as a third front light that are SO BLINDING that have to shield my eyes from them, almost running off the road. When I was learning to drive many years ago, it was STANDARD practice as well as common courtesy to dim one's lights when approaching an oncoming car or when following behind another car. Now it seems the more obnoxiously bright one can be with their lights, the better?! This is NOT OK.

Comments left in 2019

January 2019

B.521 January 1, 2019 — Eureka, MT

These things are like staring into and aircraft landing light.

B.522 January 1, 2019 — Long Beach, NY

It hurts the eyes, it takes longer to adjust the eyes after looking at it through rear view mirror.

B.523 January 2, 2019 — Roxbury, MA

When a car with those bright bluish lights is heading straight towards me on a winding country road, everything else becomes completely invisible. I no longer will drive those roads at night, until those lights are outlawed.

B.524 January 3, 2019 — Dearborn, MI

I'm getting tired of getting blinded by these headlights. They may work for the drivers of these vehicles but are dangerous to oncoming cars. They need to be banned!

B.525 January 3, 2019 — Indianapolis, IN

Those damn bright lights are gonna kill someone one day

B.526 January 4, 2019 — Indianapolis, IN

just signed it they are so damn dangerous last week I was on a 2 lane road about 9 pm and some asswipe coming from the other way blinded me so bad i had to stop the car and wait for him to pass i flashed my high beams at him from over 100 feet away because they looked like they were on then he flashed his and omg thats when i damn near went in to a ditch it took about 30 seconds after he passed for my eyes to go back to normal

B.527 January 5, 2019 — Eau Claire, WI

Those lights blind me !!

B.528 January 5, 2019 — West Hurley, NY

I'm signing because I have a similar problem being blinded by headlights!

B.529 January 6, 2019 — Adena, OH

I have nearly been in accidents because of being blinded to the point where I can't see the road!

B.530 January 8, 2019 — Harrisonburg, VA

I am unable to see when they are coming. I have gone off the road because I have lost the road in the light. They also cause pain

B.531 January 10, 2019 — Portland, OR

These are a danger to public safety.

B.532 January 10, 2019 — San Jose, CA

More cities are switching to LED street lights to increase energy efficiency. There is absolutely NO REASON—other than pointless vanity—why people in our cities need LED or HID headlights on their vehicles. It doesn't help that auto manufacturers are abetting this unnecessary and dangerous trend by fitting their vehicles with HID headlights that are too bright, even when meeting current code. And though blue-white headlights are illegal in my state of California, after-market conversion kits are available on the internet. These lights are a menace and a safety hazard, and are not needed in brightly-lit cities.

B.533 January 11, 2019 — madisonville, TN

I have been complaining for a couple years about these lights. I can't believe they are legal. I literally have to shut my eyes when passing a car with HID/LED lights. I have almost ended up in the ditch from being blinded. They are straining to the eyes. I have perfect vision, I'm 27, and in good health. Tired of people with them saying we shouldn't be driving at night if we can't handle it.

B.534 January 13, 2019 — Honoraville, AL

I suffer chronic migraines and they definitely trigger them, but they also cause eye pain and difficulty seeing at night.

B.535 January 14, 2019 — Asheville, NC

For the record, it is not a senior's problem with a brightness of these halogen headlights!... It is a common sense problem! I'm in my forties and I've had terrible frustration at these headlights for years now. I am a former professional truck driver of many years and I have to say, the worst are tractor trailers with these headlights as they set up higher than regular cars and are terribly blinding when they drive behind you, let alone the problems oncoming. Note to the National Highway Traffic Safety Administration, it doesn't take a study to realize that the lights are blinding, just common sense! .... stop your studying and start saving drivers by Banning these VERY DANGEROUS headlights!

B.536 January 15, 2019 — Ann Arbor, MI

The increase in the brightness of headlights produces frequent situations in which even the "low beams" from many cars are dangerously bright and distracting, often making lane-marking marks and pavement boundaries harder to discern.

B.537 January 15, 2019 — Columbus, IN

I'm glad you can see into the future and all, but I'd like to see where I'm going too.

B.538 January 16, 2019 — MESA, AZ

I have almost run into cars several times when trying to change lanes, due to being blinded by LED lights on vehicles behind me!! If windows tinted too dark is illegal, this should be a no-brainer!!!!!!

B.539 January 18, 2019 — College Station, TX

Countless near misses from LEDs and hids in the wrong housings on these jacked up trucks.

B.540 January 19, 2019 — Pinckney, MI

I drive a long way to work and I am encountering more and more vehicles with these types of lights. I cannot believe they are allowed. It appears engineers only considered one side if this equation! I have recently seen pick-up trucks with basically two headlights on each side of the vehicle! Enough already!

B.541 January 20, 2019 — Cutchogue, NY

Every night i drive and have to divert my eyes from the blinding effects of these lights on the road ahead or reflected in my mirrors from behind. I can see the shadow of my own car infront of me from the illumination of these bright lights. It is very unsafe. It affects my ability to see clearly. These lights need to be outlawed and replaced with safer lights.

B.542 January 20, 2019 — United States

I have a hard time driving at night because of all the glare and feel like everyone has their brights on. My husband feels the same.

B.543 January 20, 2019 — Wasilla, AK

These are blinding and very dangerous. I drive a school bus and these lights produce intense glare to the point of no one being able to see children at bus stops. It's just a matter of time until tragedy occurs.

B.544 January 21, 2019 — Ashland, KY

I've been a truck driver for almost 37 years people driving today don't know what a dimmer switch is or how to adjust there lites or if the car come with driving / fog lights in the bumper they run them constantly to out of adjustment

B.545 January 21, 2019 — Austin, TX

Let's Make Blinding Lights Against The Law & punishable by PISTOL WHIPPING AND ARREST!!! This problem has become a "cancer" because as young generations begin driving, they think these

blinding lights are "normal" because this is all they know. New generations of drivers don't know any different. My Opthamologist STOPPED driving at night because it was damaging to her eyes!!! The above article is Spot-On when it says, " ... A visual field so polluted by distracting glare that the brain has a hard time keeping focused on the important subjects like pedestrians in a crosswalk." Brighter is NOT SAFER. The time to Act is NOW.

B.546 January 21, 2019 — Edina, MN

I have been blinded many times by LED headlights especially at night. Very dangerous!

B.547 January 21, 2019 — Hanover, NJ

Patrice Barry

B.548 January 21, 2019 — Pine, CO

The blue-rich glare from these high kelvin lights are a safety hazard. We must change this dangerous trend!

B.549 January 21, 2019 — Seattle, WA

What we really see in a city like seattle with pedestrians and people on bikes is other drivers can’t see them because they are in the glare-zone-of these awful unsafe high-lumen-High-Kelvin lights. #VisionZero

B.550 January 21, 2019 — United States

These lights are as bright as high-beams used to be and catching one in the face as a driver crests a hill can be totally disorienting!

B.551 January 21, 2019 — W. Hempstead, NY

PLEASE THIS IS INSANE VVITH THESE LIGHTS!!

B.552 January 21, 2019 — Waretown, NJ

I’m afraid to drive at night because of these lights

B.553 January 22, 2019 — Burnley, ENG, United Kingdom

It is vertually impossible to see when blinded by these headlights

B.554 January 22, 2019 — Cypress, TX

Me too!

B.555 January 22, 2019 — Northville, MI

I CANNOT SEE

B.556 January 22, 2019 — Pāhoa, HI

I signed it because I’m not a selfish idiot and neither are you ! BAN THEM!!

B.557 January 22, 2019 — St. Petersburg, FL

It's dangerous and I'm tired of being blinded at night.

B.558 January 22, 2019 — Stretford, ENG, United Kingdom

They do blind you as they approach and you lose your night vision for a moment.

B.559 January 22, 2019 — United States

I agree

B.560 January 22, 2019 — United States

I'm blinded every night by oncoming drivers of newer vehicles with LED headlamps. So Bright that i signal the oncoming driver to turn off his high beamsonly to have the driver toggle his high beams and absolutely blind me. To the point that i have to pull off the road way because i can't see. It scares me. Even on low beam LED headlights are disruptive to other drivers ability to see. In fact Even when a driver behind you has LED lamps it reflects off of rearview and side mirrors to the degree that its

blinding. As the driver of a compact and miss size car is like to add that the problem of blinding headlights seems worse too me when the oncoming vehicle with LED lights are larger trucks.

B.561 January 23, 2019 — DALLAS, TX

I thought I was the only person that notice this.

B.562 January 23, 2019 — Levittown, NY

I feel the headlights are very blinding and dangerous to everyone on the roads

B.563 January 23, 2019 — Pahoa, HI

People need to have good vision at night, and intense light is not a good way to do that.

B.564 January 23, 2019 — San Juan, PR

I am signing this petition because I am tired of being blinded by the lights of oncoming vehicles while I drive at night. I can't use the visors to shield my eyes since they won't go lower. I thought car designers were placing high beams higher up on SUVs and 4x4s. Please make changes so driving at night is safer for those who are blinded by these lights. If these lights also harm the environment then please ban these lights.

B.565 January 24, 2019 — Binghamton, NY

It's very dangerous. The blinding glare from oncoming vehicles with these new headlights are a concern to me and many other drivers I've talked with. Thanks.

B.566 January 24, 2019 — Chicago, IL

These lights are blinding and dangerous. I can't imagine driving at night when every car has them. Let's use some common sense and put people first.

B.567 January 24, 2019 — Macclesfield, ENG, United Kingdom

It stops me driving at night

B.568 January 24, 2019 — Nutley, NJ

These headlights are blinding when driving at night and it’s unsafe for drivers either in front of you or opposite side traffic

B.569 January 24, 2019 — University Place, WA

#banblindingheadlights #banledheadlights #banhidheadlights #banlaserheadlights #recallcarswithblindingheadlights #banledlightbars

B.570 January 24, 2019 — Yonkers, NY

These lights are worse than someone having their bright lights on. Make these lights illegal and take them off the road now.

B.571 January 25, 2019 — Buchanan, TN

I suffer from night blindness and have to pull over so my eyes can readjust.

B.572 January 25, 2019 — Seymour, TN

I'm tired of being blinded with bright lights also!

B.573 January 26, 2019 — Bowling Green, MO

DRLs were never intended to be a safety device.

B.574 January 26, 2019 — Chesapeake, VA

Those bright white LED lights in new cars are so blinding that it makes it hard to see the lines of the road. It has nothing to do with drivers with bad vision. I have 20/13 vision, and have a really hard time seeing what’s in front of me when someone’s regular headlight beam are brighter than most high beam.

B.575 January 26, 2019 — Portland, OR

I have to reposition my rear view and side view mirrors when one of these cars with blinding headlight lamps is behind me. I have perfect vision and light sensitivity and this is a very dangerous and irresponsible design of these vehicles. It is as dangerous to other drivers as cars with poor braking systems. I demand these headlight lamps be recalled, fixed, and banned from future use in any country.

B.576 January 26, 2019 — Tacoma, WA

Ban the fuck out of the blinding muthafuckas!

B.577 January 26, 2019 — Tuckahoe, NY

I almost swerve off the road each day from people shining their not-high-beams at me. I am sick and tired of putting the lives of that many people at risk for something so trivial.

B.578 January 26, 2019 — United States

I have experienced temporary blindness several times due to excessively bright headlights...

B.579 January 27, 2019 — Orléans, Canada

These lights will also create accidents

B.580 January 27, 2019 — Tacoma, WA

I'm signing because those lights OBVIOUSLY should be illegal, they are TOO bright and it is difficult to drive at night when someone is behind you or passing you with these lights.

B.581 January 28, 2019 — CINNCINATI, OH

Sonja Darling you get blinded by the bright led lights it makes you not be able to see at night

B.582 January 28, 2019 — Cincinnati, OH

I have been blinded to the point I run off the road more times than I can count. They are dangerous, and honestly dont understand how lights so distracting made it to production. They should have been axed long before that.

B.583 January 28, 2019 — Galax, VA

People such as myself that have what is known as night blindness is a struggle in itself trying to drive at nighttime, add rain in that mix it's twice as hard to see your side of the road. So when you meet the blinding lights of oncoming traffic (even on dim) some of the later model vehicles with LED headlights, I personally have to concentrate to the right side of the road or I totally lose vision. I have a 2017 Ford vehicle and upon meeting oncoming traffic they constantly blink their lights at me thinking my lights are on bright when in fact they're on dim, I know if I flash them I'll blind them so I try not to do it unless they continue to do so at me.

B.584 January 28, 2019 — Saint Peters, United States

Debra Schnyder

B.585 January 28, 2019 — San Antonio, TX

LED lights are blinding! I swear people were driving around with their brights on. These lights can't possibly be good for eye sight.

B.586 January 28, 2019 — Tacoma, WA

https://m.facebook.com/groups/304594800386308?view=info&refid=18&ref=bookmarks

B.587 January 28, 2019 — Warerville, OH

Twice in the past week I was almost involved in accidents due to these lights. One because a car behind me had them and their glare off my side mirrors made it difficult to see the road in front of me. Another time another driver drove off the road and I almost hit him. When I stopped to help he told me the headlights of a Lincoln caused him to crash.

B.588 January 29, 2019 — Hawk Point, MO

When these cars are coming at you it is almost impossible to see through the lights and you are temporarily driving blind

B.589 January 29, 2019 — TX, United States

I was almost in an accident when making a left hand turn because the car across from me at the stop light had such BLINDING lights (not adjusted, not facing the road, but straight ahead so as to be dangerous) that I temporarily couldn't see the road. When the lights are on oncoming traffic, they are horribly dangerous. I am not alone in my complaint with this. The drivers with the ultra-bright lights can see fine, but it is inconsiderate and downright dangerous to other drivers who have to share the road. These lights are worse than a car having their "high beams" on.

B.590 January 29, 2019 — amelia, OH

I want to see at night not to be blinded by the light

B.591 January 30, 2019 — Phoenixville, PA

The new trend of blindingly bright headlights over the last few years is making it harder for other drivers to see at night.

B.592 January 30, 2019 — Rush, NY

These lights are blinding creating very dangerous situations! After being blinded by the light, it's hard to see the road, deer about to cross, etc.

B.593 January 31, 2019 — Riverside, CA

We recently traveled and drove during the night, the blinding lights made it very dangerous, it was very difficult to see the upcoming traffic and the lines on the road

February 2019

B.594 February 1, 2019 — Houston, TX

My eyes are being damaged by these uneccesary blinding headlights

B.595 February 1, 2019 — Lancaster, TX

I'd like to get home safely without being blinded by overly bright headlights as I'm sure others would too.

B.596 February 1, 2019 — Philadelphia, PA

It is blinding! I have been thinking that people are just insensitive lately and must all the sudden be driving with their high beams then thinking something must be wrong with my eyesight since all of the sudden everything appears to be so blinding only to find out that it's not me that people are now driving with these high powered lights which are blindingly dangerous. The blue lights are the worst offenders. Please ban use of the blue lights and even the high powered yellow lights (I am not talking abought high beams) or find some way to make them safe for the public as this is becoming a real danger to society especially on highway driving at night. Furthermore the law should be targeted at the manufacturers of these, auto shops, and mechanics so that they will know not to sell or install these lights for the average person thereby reducing the chance someone will use them knowingly or unknowingly. Please address immediately!

B.597 February 1, 2019 — blauvelt, NY

The lights are blinding my vision

B.598 February 2, 2019 — London N89HN, ENG, United Kingdom

These bright headlights (and even tail lights too) make night driving a nightmare.

B.599 February 3, 2019 — Birmingham, AL

I have very light blue eyes and these headlights cause actual pain when they shine on my face at night. It makes driving at night dangerous.

B.600 February 3, 2019 — Broadstairs, ENG, United Kingdom

Led lights are too bright and a health and safety hazard

B.601 February 3, 2019 — Pescadero, CA

These headlights cause glare disability and temporarily blind drivers in oncoming traffic. Eliminate the blue-rich white headlights and use warmer temperature colors such as amber.

B.602 February 3, 2019 — Providence, RI

This really is a big safety issue, and these lights don't belong on the roads.

B.603 February 3, 2019 — Tacoma, WA

#banblindingheadlights

B.604 February 3, 2019 — West Babylon, NY

I drive from Suffolk County to Queens and back again every day to and from work, most of the time in the dark. The newer headlights are downright blinding in the rearview and side mirrors. To make matters worse, the city and counties have begun switching the amber streetlights to bright white blinding lights that hurt my eyes and make actually seeing the lines in the roadways (or lack thereof, especially on Queens Blvd and Union Turnpike) virtually impossible. Please reconsider a better alternative, as these bright white lights are blinding drivers and I'm just waiting for the accidents to happen. I really do not want to be one of them.

B.605 February 3, 2019 — selkirk, NY

I'm going to get in an accident if they don't ban these high intensity lights!

B.606 February 4, 2019 — cambridge, MA

The new headlights are endangering oncoming traffic. They are simply blinding.

B.607 February 4, 2019 — villas, NJ

These lights are blinding

B.608 February 5, 2019 — Michigan City, IN

I'm signing because these lights are terrible for drivers and the environment. We had to fight to get these lights turned away from our house when a new government building went up next door. Thankfully, we had a community rep that took action for us.

B.609 February 5, 2019 — Tijeras, NM

I literally cannot see when LED headlights coming toward me on a dark rural road.

B.610 February 6, 2019 — Lindenhurst, IL

These lights trigger my migraines making it dangerous for me to drive!

B.611 February 6, 2019 — Minneapolis, MN

I, too, often have trouble seeing at night with these very bright lights. I have thought people are driving with their him beams on

B.612 February 7, 2019 — Cross Roads, TX

It's damaging eyes and we can't see while we're driving there is nothing good about led hid headlights. We had it right for so many years. Why do they change it for no reason. We need to start a Class Action lawsuit against the Government, dot, and the automobile makers. We need to hire some good lawyers. That is the only way to get change. These terrible lights are not even close either. They are like 300 times to bright and I think the rays are too sharp too. So the entire style of the light is just Criminal. Sometimes I feel like getting a green laser and shining it right back at the on coming violator to teach them a lesson. I will never buy one of these new junky poorly designed cars. I drive a 2004 GMC Sierra and its just fine and the Lights are normal.

B.613 February 7, 2019 — Cross Roads, TX

We need to All Start a Big Class Action lawsuit. This is rediculous that this has happened. Some idiot that have no sense or cooth is the one that put these on all the cars. Actually it was obama. I

remember a speech of his saying he wanted all cars to go to LED's in the future. He is such an idiot. led technology and it's waves and rays are say to intense and sharp. It's criminal. It's assault.

B.614 February 7, 2019 — Cross Roads, TX

We need to All Start a Big Class Action lawsuit. This is rediculous that this has happened. Some idiot that have no sense or cooth is the one that put these on all the cars. Actually it was obama. I remember a speech of his saying he wanted all cars to go to LED's in the future. He is such an idiot. led technology and it's waves and rays are say to intense and sharp. It's criminal. It's assault.

B.615 February 7, 2019 — Cross Roads, TX

We need to All Start a Big Class Action lawsuit. This is rediculous that this has happened. Some idiot that have no sense or cooth is the one that put these on all the cars. Actually it was obama. I remember a speech of his saying he wanted all cars to go to LED's in the future. He is such an idiot. led technology and it's waves and rays are say to intense and sharp. It's criminal. It's assault.

B.616 February 7, 2019 — Cross Roads, TX

We need to All Start a Big Class Action lawsuit. This is rediculous that this has happened. Some idiot that have no sense or cooth is the one that put these on all the cars. Actually it was obama. I remember a speech of his saying he wanted all cars to go to LED's in the future. He is such an idiot. led technology and it's waves and rays are say to intense and sharp. It's criminal. It's assault.

B.617 February 7, 2019 — Cross Roads, TX

I have blue Eyes too and the rays are sharp and intense. I can actually feel them hit me. I think it pretty much equally affects people with green and brown eyes too. We need to protest at Capitol hill also we all need to start a Class Action Lawsuit.

B.618 February 7, 2019 — Cross Roads, TX

yes even the tail lights and blinkers are WAY too BRIGHT. It's the type of ray it used. the LED's are just bad and probably invented by Satan or obama.

B.619 February 7, 2019 — Cross Roads, TX

It's Criminal. These lights are not even close. It's like someone was going out of their way to make everything LED HID. That is a bad technology all together and a dangerous one. It's assault.

B.620 February 7, 2019 — Cross Roads, TX

Me too. It's insane. I think it's so rediculous that some one did it on purpose to hurt people. I do remember obama in a speech about 6 years ago saying that he wanted all cars to go to LED HID lights. He's such an idiot.

B.621 February 7, 2019 — Cross Roads, TX

Thank Obama for it. He preached and ordered all car makers and truck makers to have LED HID lights. LEDs are the same tech used to make those green lazer pens that are illegal to shine. Except they just make it White, Yellow or Bluish White and they aim it in a cone instead of one line. Its' the exact same thing though. This is Illegal what the government is doing to the People.

B.622 February 7, 2019 — Cross Roads, TX

They can even cause permanent or more serious damage which we don't really like talking about. This is probably the worst problem that has ever happened in USA history probably worse than slavery because that really only affected like 5 % of the population.

B.623 February 7, 2019 — Cross Roads, TX

It actually hurts. The Trucks have lights that are like 1000 lasers. It hurts my eyes and is affecting them. Can we forward this to Donald Trump to make an Executive order and fix this rediculous obama crime he's done on everyone.

B.624 February 7, 2019 — Cross Roads, TX

democrats did this and they have no common sense and they hate people. Litterally this is an obama policy.

B.625 February 7, 2019 — Cross Roads, TX

I used to love driving at night. Now it's just rediculous and there is nothing that can be done other than the government needs to step up big time and fix this terrible problem that obama and his minions caused. This is criminal and they did it on purpose. everyone already knew that led sucks even on flash lights. Those whitish blue flash lights that they were pushing at cheap stores (I never bought one Cause I have good taste and can tell when something is junk but others bought them and would take them camping) Everyone knew those flashlights were garbage.

B.626 February 7, 2019 — Cross Roads, TX

LEDs HIDs are GARBAGE!!!!!

B.627 February 7, 2019 — Cross Roads, TX

They are WAY WORSE. They use laser technology. Oh no I said the magic word to a millennial "technology" now all the millennials wil coming running saying how awesome and hip they are. That is the problem. millennials don't complain about the things that matter. They love and accept any kind of new electronic even if it's garbage.

B.628 February 7, 2019 — Philadelphia, PA

Led headlights screams "I'm a douchebag"

B.629 February 7, 2019 — San Jose, CA

headlights are bad

B.630 February 8, 2019 — Tacoma, WA

We are getting closer and closer to that magic number 5000 signatures! I wonder what happens when it hits 5000.

B.631 February 9, 2019 — East Troy, WI

As a chronic sufferer in general, I couldn't tell you how many times I've been given migraines after being blinded by LED headlights.

B.632 February 9, 2019 — Fairbanks, AK

These blinding lights killed and will kill thousands and hundred thousands of people. We need to stop this madness.

B.633 February 9, 2019 — United States

They, re annoying and dangerous

B.634 February 9, 2019 — Vancouver, WA

I have personally experienced dangerous blinding, inability to safely stay on my side of the road, and even turned off of road too quickly and ended up in a culvert due to the intensity of the overly bright LED and/or HID headlights.

B.635 February 11, 2019 — Fall River, MA

I'm signing this petition because blinding headlights cause epileptic seizures. And rather the car is fully equipped, or motified by owner. They are causing serious harm to those who have epilepsy.

B.636 February 11, 2019 — San Francisco, CA

I've literally had to come to a complete stop because light from oncoming cars was so bright I couldn't see the road. They're a menace!

B.637 February 11, 2019 — San Francisco, CA

As a bicyclist, I agree that LED lights should only be so bright as traffic signals on automobiles so not to blind other drivers and others on the road. However, I rely on LED lights on my bicycle to be seen. I do not believe my bicycle lights go beyond the brightness of traffic signals.

B.638 February 13, 2019 — Saint Louis, MO

I'm sick of the blinding lights. No reason for them!!

B.639 February 14, 2019 — Tacoma, WA
We are getting so close to 5000 signatures I can taste it! Come on, people, sign that petition! Share that petition! Ban Blinding Headlights!

B.640 February 15, 2019 — Mansfield, OH
Lights are blinding

B.641 February 15, 2019 — Tacoma, WA
https://m.facebook.com/groups/304594800386308?ref=bookmarks

B.642 February 15, 2019 — Vineyard Haven, MA
It's obvious. These lights are blinding.

B.643 February 16, 2019 — Carrog, WLS, United Kingdom
These lights are a danger on our roads, please ban them.

B.644 February 16, 2019 — erith, ENG, United Kingdom
I don't want to go to jail because of somebody else's bad design.

B.645 February 19, 2019 — Durant, OK
I hate these lights - they make driving dangerous.

B.646 February 19, 2019 — Tacoma, WA
#banblindingheadlights

B.647 February 19, 2019 — cleveland, TN
I suffer from migraines and these lights st night are a serious trigger when I am driving!

B.648 February 20, 2019 — Hensley, AR
It's an absolute FACT, the intensity from these headlights not only temporarily blind for some drivers but also migraines with visual aura. The light feels like a laser. As for the street lights, I describe the most common ones as glare bombs, no matter what "color" they are. They are excessively too bright, with a glare the most offensive attribute. I am a lighting professional that is confident with my justified reasons for signing this petition. The healthcare professionals - neurologists, optometrists along with the lighting manufacturers, designers need to have a conversation with the actual people who are affected.

B.649 February 20, 2019 — Hensley, AR
Thank you for signing!

B.650 February 20, 2019 — Hensley, AR
Thank you for signing!

B.651 February 20, 2019 — Hensley, AR
Thank you for signing!

B.652 February 20, 2019 — Hensley, AR
Thank you for signing!

B.653 February 20, 2019 — Hensley, AR
Thank you for signing Al

B.654 February 20, 2019 — Picayune, MS
Same problem can't drive at night anymore because of this.

B.655 February 20, 2019 — Pittsburgh, PA
Blinding headlights are a dangerous.

B.656 February 20, 2019 — Saint Louis, MO

I'm a migraine sufferer.

B.657 February 20, 2019 — Tacoma, WA

#banblindingheadlights

B.658 February 20, 2019 — Tacoma, WA

https://m.facebook.com/groups/304594800386308?ref=bookmarks

B.659 February 20, 2019 — Tacoma, WA

Thank you, Melissa

B.660 February 20, 2019 — Tacoma, WA

Ban the fuck out of them!

B.661 February 21, 2019 — Butler, PA

Blinded by the light of the headlights and the roadside signs that are being put up.

B.662 February 21, 2019 — Myrtle Beach, SC

And people with these headlights will say just look at the line on the road. Nah duh. I can't see the line when you have the sun on the front of your car

B.663 February 21, 2019 — Paia, HI

I have to turn my bright lights on when those cars approach me, so it's dangerous for those drivers as well. at times I cant see anything so I just follow the speeding traffic in front of me and somehow manage not to crash into anything. true story I'm not joking. I'm also driving less in the evenings because of it.

B.664 February 22, 2019 — BRONX, NY

save a life

B.665 February 22, 2019 — Charles Town, WV

The issues that are even larger than simply having OEM installed xenon or LED headlights is the positioning of the lights themselves. There is no federal standard for maximum headlight height, large vehicles should have a maximum height off the ground headlights are allowed to be designed into the vehicle. Additionally, the inexpensive aftermarket pieces that people are adding to their vehicle are absolutely ridiculous and the biggest part of this nationwide issue! For $50 someone can go on eBay or Amazon and buy a xenon light kit and install it into their non-factory equipped xenon headlight housings (which is 100%" illegal to do). This creates very bad scatter, glare and poor illumination, even for the driver. also, where I live, people drive around with off road light bars and spotlights turned on, even on city streets or one the highway, that is just uncalled for and ignorant.

B.666 February 22, 2019 — Fond du Lac, WI

I, too, get blinded by these lights. It actually HURTS my eyes. Perhaps these drivers can now see for miles ahead of them. However, everyone coming TOWARDS you can see nothing at all. Think about that.

B.667 February 22, 2019 — Orlando, FL

I'm tired of being blinded by headlights as I drive

B.668 February 22, 2019 — St Louis, SC

LED headlights are painful and dangerous!

B.669 February 22, 2019 — St. Cloud, FL

I can't drive at night now because it's I can't see with these bright headlights. It's not necessary.

B.670 February 24, 2019 — Davis, CA

I agree that these blinding lights are not necessary and are even dangerous! What happened to the times when people were considerate of others by dimming their "bright lights" when ANY oncoming

vehicle was visible? I also agree that the angle of truck lights are even more blinding especially if one is in a car that sits a bit lower. I plan to keep looking for options to make our opinions heard by car manufacturers, legislators and law enforcement!

B.671 February 25, 2019 — Australia

I've noticed that it's much more difficult driving at night than it used to be, and more dangerous. Modern headlights are too bright.

B.672 February 25, 2019 — Dayton, OH

I now have to turn my mirrors down so I'm not blinded by the cars behind me let alone the cars in front of me!

B.673 February 25, 2019 — Tacoma, WA

LED and HID headlights are hazardous!

B.674 February 27, 2019 — Algonac, MI

They are a big safety hazzard.

B.675 February 27, 2019 — Alice, TX

I believe these lights are unsafe and should be banned.

B.676 February 27, 2019 — Chicago, IL

I have an astigmatism & I suffer from migraines. The excessively bright headlights are painful & potentially dangerous for me.

B.677 February 27, 2019 — Romeoville, IL

They hide behind the apron strings of some loophole, but their 'right' to them ENDS when the safety of the public (let alone my family and myself) is involved.

B.678 February 27, 2019 — San Francisco, CA

Clearly I am not the only one who has experienced this distraction.

B.679 February 27, 2019 — santa fe, NM

it's a matter of saving lives

B.680 February 28, 2019 — Chicago, IL

Bright blue-white blinding lights in headlamps or streetlights is dangerous. This needs to end.

B.681 February 28, 2019 — Kenosha, WI

I'm on the roads at night a lot. Nine out of ten refuse to dim bright headlamps.

March 2019

B.682 March 1, 2019 — Rivalta di Torino, Italy

Alcuni dei nuovi fari a LED provocano abbagliamento e sono pericolosi

B.683 March 1, 2019 — Sarzana, Italy

Le luci led freddissimo sulle autovetture e autocarri abbagliano molto nel buio della notte causando una parziale impossibilità di guidare in sicurezza per qualche tempo.

B.684 March 1, 2019 — Tacoma, WA

people are even blinding me during daylight hours with Daytime running lamps that are laser bright! WTF? SERIOUSLY

B.685 March 3, 2019 — Oakville, WA

I'm tired of coming home from work and these new extra bright headlights completely blinding me and I have to slow down and even sometimes pull over to avoid wrecking.

B.686 March 4, 2019 — Medford, OR

The new lights are just too bright and should be banned for safety reason!

B.687 March 4, 2019 — United States

headlights now are blinding and causing dangerous driving

B.688 March 5, 2019 — Clarkston, MI

These lights are horrible and make it extremely difficult to see when driving.

B.689 March 5, 2019 — Clarkston, MI

I am signing because I have been temporarily blinded by these headlights both from oncoming traffic and from the glare caused in my rear-view mirror from a vehicle behind me.

B.690 March 5, 2019 — Wilmington, United States

These headlights are way too bright. They are blinding either behind you or especially coming toward you.....they are dangerous and a safety hazard. There should be a li.it on how bright they can be.....hey!! Like they used to be and we all could see just fine!!

B.691 March 6, 2019 — New Rochelle, NY

Totally agree 100% with this petition. I am literally BLINDED now at night - both as a pedestrian and a driver. I now HATE driving, and even walking around at night. The daytime running equivelants are also just as bad, ruining the “peace” and aesthetic of walking about in the day while not bringing any safety improvements. These ridicuolously bright blinding lights need to be reigned in - and quickly...

B.692 March 6, 2019 — New Rochelle, NY

“it was obama”.. LOL. amazing what you brainwashed republican trolls will do to inject your divisive hate speech everywhere. This is happening EVERYWHERE! pushed by the auto manufacturers and most countries outdated legal standards that only define light intensity as “wattage” and not “lumens”. Go look it up and take your divisive trolling elsewhere...

B.693 March 6, 2019 — San Diego, CA

These headlights are distracting, blinding, and painful!!!

B.694 March 6, 2019 — Sylacauga, AL

I have astigmatism and they blind my vision.

B.695 March 7, 2019 — La Grange, IL

This is crazy! Beam the lights properly on the road, not into outer space!

B.696 March 7, 2019 — Melbourne, FL

Feels like eternity when one is blinded by LED headlights, as ones car continues to move forward but the driver can’t see anything. The recovery time from the glare is too long. Even looking to the very edge of the white line away from the lights does not work. It’s scary. I just returned from a short drive home and was blinded by 4 SUVs that sit higher than my own SUV. I was so enraged, I figured I can’t be the only one who has trouble with LED light, that a quick google search revealed I am not alone. Please support banning LEDs that are brighter than traffic signal. Please also push to enforce proper height adjustments to headlights.

B.697 March 7, 2019 — Melbourne, FL

It’s a scary feeling when your car is moving forward at whatever speed but you, the driver, can’t see a thing because you have been blinded by LEDs of oncoming traffic, especially those of SUVs and other lifted trucks. Seconds feel like eternity when you are blinded.

B.698 March 7, 2019 — Thorpe Market, ENG, United Kingdom

Stop this dangerous practice

B.699 March 10, 2019 — Tacoma, WA

We're almost to 4900! We need 5000!

B.700 March 11, 2019 — Chillicothe, OH

I am signing this because 1. They are blinding and I would venture to say most people are driving with their highbeams on so they can see the road in front of them vs looking down at the ground, because the radius of the beam is so small on low-beam. 2. You might as well be driving with 2 flashlights on the front bumper for as useless as these lights are at night, other than people being blinded by them! Why would anyone need lights this bright while driving???? It's crazy!

B.701 March 11, 2019 — Enfield, ENG, United Kingdom

I'm badly affected by the effects of l.e.d lights when I drive at night not only on main roads but particularly when I have to drive through wooded areas where large cars use they're beams and redirect them too late.

B.702 March 11, 2019 — Maple Heights, OH

The new headlights are dangerous. It always appears as highness are on. The lights are blinding.

B.703 March 11, 2019 — Milwaukee, WI

These oncoming lights are TOO BRIGHT making it dangerous to drive at night.

B.704 March 11, 2019 — Oklahoma City, OK

Jennifer Sloan

B.705 March 11, 2019 — Worthing, ENG, United Kingdom

Literally just got blinded on my way home this evening by several cars on a dark Road. I had to pause driving because I genuinely couldn't see the road in front of me for the brightness. Made me so cross!! This has to stop!

B.706 March 12, 2019 — CAMPBELL HALL, NY

LED Light bars coming at a driver are way too much to overcome when driving. Also, emergency lighting on cop cars is way over the top and creates a hazard when approaching and potentially obscure the scene.

B.707 March 12, 2019 — Neenah, WI

I had a truck with what seemed like the whole front end was "lighted" so bright that I was totally blinded. Don't know if aftermarket lights were added, but I DO know his high beams were NOT on...at first, because he flashed them back at me (in a tiny Geo Metro!) when I flashed my brights at him. Somehow we both survived, but it was a polarizing moment. Since, other vehicle extremely bright lights in other settings have reinforced my belief that these bright lights are dangerous and in spite of "claims" they are carefully engineered and fall within the established standards, I can't believe they can. I have a Outback and a Silverado, both are newer and have pretty bright lights, but I have no complaint about those, and I HAVE experienced both approaching me at night - without being blinded. Car manufactures are claiming their new led lights illuminate a significant percentage better than the older ones, but they also want you to believe "brighter" doesn't blind oncoming drivers. Which I call "b.s." I'm done with my rant for now.

B.708 March 12, 2019 — Tacoma, WA

90 sigs to go!

B.709 March 13, 2019 — concord, NC

I have to wear special blue light blocking tinted glasses at night and I'm still getting blinded from front and back by drivers every night. I have had to completely stop my vehicle, because the driver coming at me wouldn't dim there bright HID lights or maybe they couldn't be dimmed. It's much worse for older people, I understand.

B.710 March 15, 2019 — Chicago, IL

I signed because I have a special love for my retinas and would like for them to last the rest of my life.

B.711 March 15, 2019 — Middletown, CT

I'm a teenage driver who drives a low car (Toyota Camry '05) and I cannot see when any car driving by has LED headlights. They are especially blinding on bigger cars since my head is right at the level of their headlights. I've taken to playing a game guessing whether it's a person with high beams on or LED lights since they're so similar. This blinding effect lasts long after the car has passed and is a danger to everyone. If I look at the edge of my line I cannot see if anything jumps out in front of my car, and it does little to help me see.

B.712 March 15, 2019 — Middletown, CT

* edge of my lane

B.713 March 17, 2019 — Los Angeles, CA

As a doctor of optometry, I fully endorse this petition.

B.714 March 18, 2019 — Soquel, CA

the lights are just too bright, like looking at a blue sun ray.

B.715 March 18, 2019 — Tacoma, WA

4997! Only need 3 more to hit 5000! When that happens, what happens? Will they be banned? Or will people still be allowed to drive around blinding everybody?

B.716 March 19, 2019 — Orlando, FL

I'm only in my 30's and these lights literally blind you in the road especially at night. I also see people turn them on in the day I have no clue why. Something should be done about this. God feels like a UFO when someone has those beem lights behind you.

B.717 March 19, 2019 — Secaucus, OH

It's so annoying seeing these sorts of headlights, it honestly terrifies me

B.718 March 19, 2019 — Tacoma, WA

OK, What was the point of telling us we need 5000 signatures if now the number is being raised to 7500? I'm guessing at 7500 they will say we need 10,000. Then it will say we need 15,000! What is the actual number we need to BAN BLINDING HEADLIGHTS? 100,000? 500,000? 1,000,000?

B.719 March 19, 2019 — Tacoma, WA

looks like change.org is ignoring our 5000. they raised the bar to 7500, which then will probably go higher and higher! Try this other petition! #banblindingheadlights https://petitions.moveon.org/p/l_azY_5L9e

B.720 March 19, 2019 — Tacoma, WA

#banblindingheadlights

B.721 March 20, 2019 — Mt. Morris, IL

I don't like those! They blind you at night

B.722 March 21, 2019 — Hampshire, IL

It is the best time for us to watch the news and we liked the anchors & weather person.

B.723 March 21, 2019 — Tacoma, WA

Lets get 25 million signatures! Then we will only need 75 million to reach the next goal!

B.724 March 23, 2019 — Anishinaabe Aki, MI

Holy shit get rid of these lights! They are dangerous.

B.725 March 23, 2019 — Anishinaabe Aki, MI

Light pollution. Obviuosly something created to harm the natural state of things. Not good for humans, our 4 legged friends, or any other species. I refuse to drive at night because of these toxic lights.

B.726 March 23, 2019 — Commerce charter Township, MI

Enough is Enough! Stop ˜the blinding headlights!!! Let's save some lives, especially when driving at night!!!!

B.727 March 23, 2019 — Macomb, MI

Driving at night is a nightmare with these lights. How many deaths will it take before they are banned?!

B.728 March 24, 2019 — McMinnville, TN

If it is illegal for us to drive with our bright headlights on and LED′s are brighter, why is it legal for LED′s? It′s just common sense folks.

B.729 March 25, 2019 — Bayville, United States

Because blinding headlight can danger

B.730 March 26, 2019 — Barrow upon Soar, ENG, United Kingdom

These high intensity headlights are dangerous, meaning oncoming drivers can be totally and painfully blinded for several seconds. Nighttime pedestrian injuries are increasing because of driverss being blinded.

B.731 March 26, 2019 — Forestville, NY

These lights are too bright. On coming traffic is blinded by such bright lights. Not necessary, and very dangerous.

B.732 March 26, 2019 — rochester hills, MI

Its hard to see the road when you have flood lights in your face.

B.733 March 27, 2019 — Australia

Night driving has become much more unpleasant and dangerous than it needs to be. I try to avoid it more than I used to, which makes me reluctant to go to events in down.

B.734 March 27, 2019 — Snover, United States

These lights signicantly decrease my ability to drive safely at night!

B.735 March 27, 2019 — Utica, MI

These lights are a hazard.

B.736 March 27, 2019 — Utica, MI

Luanne M. Easton

B.737 March 28, 2019 — United States

I have experience the distraction of this light. It is annoying and very distractful .

B.738 March 28, 2019 — Wallington, NJ

I have been blinded from as far away as 3 blocks so many times its not even funny. there are times where they are behind or in front of me and I cant see the road as im driving. inside my vehicle is like broad daylight very often. they are too bright. jeeps seem to all have these lights.

B.739 March 29, 2019 — New York, NY

They are extremely dangerous to on coming traffic

B.740 March 30, 2019 — Anderson, IN

Bright headlights can trigger seizures in people with photosensitive epilepsy.

B.741 March 30, 2019 — Murchison, TX

I have photosensitive with my generalized inactable epilepsy. Bright lights at night sends me into a grandmal seizure

April 2019

B.742 April 1, 2019 — Opp, AL

I had to have brain surgery due to photosenitive epilepsy. Bright headlights would cause me to have seizure. YES! Ban the bright headlights!!

B.743 April 4, 2019 — Tacoma, WA

Listen to BLINDED BY HEADLIGHTS by Jeff Alan Fowler #np on #SoundCloud https://soundcloud.com/jeff-alan-fowler/blinded-by-headlights

B.744 April 5, 2019 — Detroit, MI

I urge continued support for this petition to succeed.

B.745 April 6, 2019 — Davis, United States

I want all glary LED lights banned completely. There needs to be class action law suits against the manufacturers for making dangerous products - street lights, car lights, porch lights, motion detecting seizure/migraine inducing etc etc. The global roll out of these horrible lights without regard to sensitive receptors like migraine and epilepsy patients is one of the biggest scams of the century. Ban them now!!

B.746 April 8, 2019 — Beaverton, OR

Dramatically impacted with sudden loss of vision whether seen in oncoming traffic or the rear view, I am adding my signature to thousands of others who have experienced the dangerously blinding glare of the HID headlights. We are asking that all blue light technology be banned on behalf of the lives of citizens across the country. The AMA stated that blue-rich light causes pain and damage to the human eye and suppresses melatonin at five times the rate of other wavelengths. They have urged people to move lighting toward the more natural and warm red-end of the spectrum. We are asking Congress, the Department of Transportation and NHTSA to take this matter seriously and ban all blue-light technologies on vehicles and to keep tail-lights, brake-lights and turn signals to a maximum brightness no greater than that allowed for traffic signals. Kathryn Thomas, B.S.N, M.A.E.T. Nursing Professor and Adjunct Linfield-Good Samaritan School of Nursing Potrland, Oregon

B.747 April 9, 2019 — Lake City, TX

I'm signing because the new ford truck is running four headlights on the low beam button. If you flash them you can't tell the difference when they flash back with their high beam. I cannot believe that this has been accepted through the safety council.

B.748 April 12, 2019 — Munster, IN

Makes it hard to see anything other then those damn headlights.

B.749 April 14, 2019 — Floyds Knobs, IN

The use of binding headlights are a danger to the public and on the public highways across America. These lights will cause more wrecks on the highways and be a detriment to everyone.

B.750 April 19, 2019 — Omaha, NE

Every night on my 15 minute drive home from work, I have to slow down, (sometimes stop completely), look toward the right curb, and hold my hand in front of my face to not be blinded at LEAST 10-15 times. I don't understand why, but the problem seems to be getting worse. Being blinded while driving is not only SO dangerous, it has caused people to drive off the road, but is also enraging, causing blinded drivers to then retaliate by turning on their high beams, increasing the danger of the situation. Why is it legal for these companies to make and sell aftermarket HID kits? There are actually studies proving that they do not improve the driver's visibility, but actually decrease distance of visibility and cause the driver's pupils to dilate, limiting their peripheral vision. (http://www.danielsternlighting.com/tech/bulbs/Hid/conversions/conversions.html.) These companies should be forced to stop creating and benefiting from this

incredibly inconsiderate safety hazard, and law enforcement should enforce the safety of the public by citing these aftermarket-HID-installing-drivers.

B.751 April 19, 2019 — Omaha, NE
Yes! They are actually physically painful to my eyes too!

B.752 April 19, 2019 — Omaha, NE
I do feel instant physical pain behind my eyes when being blinded by these types of headlights, even when holding my arm up to block the light from my eyes, and it is enraging.

B.753 April 19, 2019 — Omaha, NE
The aftermarket ones that people put on their cars are not legal at all.

B.754 April 19, 2019 — Savannah, MO
It is dangerous and impossible to see. When these bright lights come into view I have to squint or sometimes entirely close my eyes.

B.755 April 21, 2019 — Mandeville, LA
I've almost wrecked multiple times because of LED headlights on other cars

B.756 April 24, 2019 — Tacoma, WA
We still need signatures! 500,000 to get to the next level!

B.757 April 29, 2019 — MA, United States
You can't tell if the driver passing by you put them on low beam.

May 2019

B.758 May 2, 2019 — Newcastle upon Tyne, ENG, United Kingdom
The blue-white colour temperature of modern headlights is a serious problem for blinding oncoming drivers, pedestrians, and for light pollution. Let's find a sensible level.

B.759 May 7, 2019 — Middletown, CT
I get migraines so my eyes are very sensitive to these.

B.760 May 8, 2019 — Nacogdoches, TX
Lifetime Migrainer!! These lights blind me and give me migraines!!

B.761 May 13, 2019 — West Orange, NJ
They are blinding head on andx in mirrors, I don't see any benefit, really do not see any better then you did with the older style lights, they do not improve road vision

B.762 May 17, 2019 — Bountiful, UT
It is breaking the law, and my eyes.

B.763 May 17, 2019 — Spanish Fork, UT
Brooke Brailsford

B.764 May 17, 2019 — West Valley City, UT
Headlights are much brighter now, as well as some brake lights.

B.765 May 18, 2019 — Battletown, KY
I'm signing this because my mom has seizures everytime she sees these led lights, so therefore she can't drive at night.

B.766 May 18, 2019 — Birmingham, AL
There is no need to be able to see into space. If I am blinded by your headlights and you're more than 50 feet away... unnecessary.

B.767 May 18, 2019 — Boynton Beach, FL
They hurt your eyes and serve no real purpose in normal driving conditions!

B.768 May 18, 2019 — Dothan, AL
Because it's dangerous

B.769 May 18, 2019 — Endicott, NY
These lights are blinding duh!!!!

B.770 May 18, 2019 — GULF BREEZE, FL
I drive to work in the dark and have had to pull over and let someone pass because they were blinding me. My husband hit a deer because someone going the other direction blinded him and he didn't see the deer.

B.771 May 18, 2019 — Gulf Breeze, FL
I have a problem seeing

B.772 May 18, 2019 — Las Vegas, NV
Headlights are too bright, people have them on low beam and looks like they are on HIGH. It's glaring and it hurts your eyes.

B.773 May 18, 2019 — Marseille, France
These lights are a hazard.

B.774 May 18, 2019 — Milton, FL
LED lights are dangerous when coming at me on the highway.

B.775 May 18, 2019 — Milton, United States
Blinding LED headlights have no place on our highways or city streets; no wonder so many pedestrians are accidentally hit! What are auto manufacturers thinking??

B.776 May 18, 2019 — Milton, United States
Unfortunately, those yellow glasses are useless for many people—I've tried 2 kinds, both useless…

B.777 May 18, 2019 — Murfreesboro, United States
LED lights are so dangerous, esp. on the two lane back roads with no guard rails. They blind oncoming traffic to the point of not being able to see where center line or outer edge of road is located. Too many Have already lost their lives because of these LED lights. They, in my opinion, need to be banned. I used to have 20/20 vision, but not anymore

B.778 May 18, 2019 — Navarre, FL
Drivers safety is first

B.779 May 18, 2019 — New Castle, PA
These lights are extremely bright making visibility nearly impossible when a coming at you

B.780 May 18, 2019 — Northport, AL
I am so afraid to drive at night because of the terrible glare that comes with these bright lights. When I do, I have to put on my brakes because I can't see the road and then I'm afraid someone is going to hit me from behind.

B.781 May 18, 2019 — Pensacola, FL
I got eye problems yo

B.782 May 18, 2019 — Pensacola, FL
I have almost been driven off the roads numerous time because of the lights being so bright it's much harder to see.

B.783 May 18, 2019 — Puyallup, WA

I hate driving at night. The glare from headlights is very distracting. I hate trucks that have them. Up higher, right in your rearview mirror or eyes!

B.784 May 18, 2019 — Rochester, NY

I have been blinded and almost got hit head on because of those lights. My son was driving and was blinded by those lights and almost ran a stop sign which would have ultimately ended up in an accident since there was a car coming that had no stop sign.

B.785 May 18, 2019 — Rochester, NY

When these lights are coming toward you, especially at night, they are very distracting & make it difficult to see.

B.786 May 18, 2019 — Rochester, NY

Bright LED headlights make the street lines barely visible. It is dangerous and absolutely rediculous.

B.787 May 18, 2019 — Spartanburg, SC

Because I'm tired of being blinded while I'm driving.

B.788 May 18, 2019 — United States

The lights are blinding! They make it worse for drivers to be able to see.

B.789 May 18, 2019 — gillett, PA

rick bartlow

B.790 May 18, 2019 — milton, FL

These lights are way to bright and cause people to not be able to see

B.791 May 18, 2019 — rogue river, OR

I have to wear yellow glasses in order to drive at night because of these blue headlights.

B.792 May 19, 2019 — AL, United States

I have had several near misses due to the blinding led/hid lights

B.793 May 19, 2019 — Anthon, IA

I have migraines and these lights are excruciatingly painful to see coming toward me and impossible for me to keep my eyes on the road.

B.794 May 19, 2019 — Berry, AL

I have been blinded by them to the point where I've run off the road. Thank goodness for the treads on side of line that alerted me by the noise, bumping. If i had been on my motorcycle I'm sure i would have wreaked.

B.795 May 19, 2019 — Branchville, NJ

HID and LED lights are terrible! Sure they may make it easier for the person driving the vehicle to see, but when I approach that vehicle I can't see anything! These lights are not safe for other drivers!

B.796 May 19, 2019 — Carson, WA

I hate these led lights they have on cars these days. Yes the driver can see better but the other person can't see shit. You might as well tell everyone they can ride around with there brights on. I can't see anything except a tiny part of the white line when I pass a car with led lights. They look badass but I believe it causes a lot of wrecks. I know I've almost wrecked a few times passing a car with led headlights. All I could do is pray I make it past them cause I couldn't see shit. It's just not fair for the other drivers on The road to be blinded by these led headlights when it's dark and hard to see anyway. It's not Safe!

B.797 May 19, 2019 — Cashiers, NC

I can't safety drive at night anymore due to the fact that these headlights trigger a migraine. I literally have to pull over and get my boyfriend to drive or if no one is with me I have to stop and hope it passes quickly.

B.798 May 19, 2019 — Columbus, OH

The lights are so blinding it makes it unsafe to drive.

B.799 May 19, 2019 — Defuniak Springs, FL

I can't drive at night anymore cause these blind me and give me a blinding headache.

B.800 May 19, 2019 — Delphi Falls, NY

im signing cause they are to bright should be that way can cause a accident or the other driver might not see someone walking along the road or a deer coming out

B.801 May 19, 2019 — East Wenatchee, WA

They hurt my eyes and make me look away from the road or have to adjust my mirrors

B.802 May 19, 2019 — Elma, WA

They are dangerous. They are blinding.

B.803 May 19, 2019 — Emmett, ID

They are dangerous

B.804 May 19, 2019 — Eugene, OR

I am tired of being blinded by tall vehicles behind me and in front of me. It's hard on the eyes especially at night.

B.805 May 19, 2019 — Eugene, OR

I agree that these bright, newer headlights should be banned in every state. They are a major safety issue! Especially when a car is coming towards you in another lane. Also, when someone with those headlights is behind you it reflects on your rear-view mirror and when they are beside you and back a little ways it reflects on your side view mirrors and is blinding.. I've had times where I've had to pull over on the side of the road until that car has passed because the headlights were so bright. Something needs to be done about this.

B.806 May 19, 2019 — Grand Blanc, MI

Theses lights are dangerous!

B.807 May 19, 2019 — Kent, WA

Most of them are not at the right calibrated either and being too high. What blinds oncoming traffic!

B.808 May 19, 2019 — La Pine, OR

Yes, please because it's blinding especially when a person has light sensitivity. Almost had accidents a few times.

B.809 May 19, 2019 — Lacey, WA

I can't see crap when someone has these. I have had multiple almost wrecks because of them blinding me. So unsafe!

B.810 May 19, 2019 — Lakeville, NY

Hate them!

B.811 May 19, 2019 — Madison, AL

I have a real problem seeing to drive after I pass cars that have these blinding LED headlights.

B.812 May 19, 2019 — Manlius, NY

I dont like beening blinded by those coming towards me

B.813 May 19, 2019 — Maple park, IL

I drive home 5 nights a week, these lights blind me, sometimes making me see black dots like when you look at the sun they′re a danger

B.814 May 19, 2019 — Millinocket, ME

The LED lights are very blinding, especially to those of us that already have sight issues driving at night.

B.815 May 19, 2019 — Milwaukee, WI

These things are going to be the biggest safety concern next to impaired drivers this country has ever seen!

B.816 May 19, 2019 — Mount Bethel, PA

Hate Night Driving Because Of These Blinding lights!!!! These Will Cause Accidents!!! Outlaw Them!! !!

B.817 May 19, 2019 — Myrtle Point, OR

I deal alot with this situation. Even on low beam these headlamps are blinding. I believe they are a serious hazard to oncoming traffic. Myself and many others agree they should be banned!

B.818 May 19, 2019 — Myrtle point, OR

They are way to bright and are blinding!

B.819 May 19, 2019 — NC, United States

Christi Barrett

B.820 May 19, 2019 — North Syracuse, NY

They hurt my eyes and they are very distracting when coming at me.

B.821 May 19, 2019 — Orlando, FL

This is way too dangerous. Many times I have a hard time seeing the road

B.822 May 19, 2019 — Orono, ME

I have complained about these lights for years. It′s about time for something to be done about it.

B.823 May 19, 2019 — Pace, FL

Amen. Those bright lights are a danger. I despise them.

B.824 May 19, 2019 — Penfield, NY

I’ve been blinded by these lights! They don’t have to be that bright!

B.825 May 19, 2019 — Portland, OR

please ban these headlights. They are blinding to other drivers and they are dangerous for motorcyclists, pedestrians, and bicyclists because it is so difficult to see them while recovering from the glare.

B.826 May 19, 2019 — Portland, OR

Not only are these bright lights blinding to oncoming traffic, but the ″lifted″ pick up trucks make them even worse.

B.827 May 19, 2019 — Reedsport, OR

The new headlights make it impossible for me to drive safely at night. The glare obscures everything in my field of vision.

B.828 May 19, 2019 — Riverdale, UT

No one needs light that bright!

B.829 May 19, 2019 — Rochester, WA

It's about time someone did something about this! It's not only oncoming headlights that are blinding, but they also blind drivers when they shine in rear view and side mirrors, making it IMPOSSIBLE to see!

B.830 May 19, 2019 — Sandy, OR

When an oncoming car has its new LED lights on, I can't see! I love on a narrow windy road with drop off so that is dangerous! It's also blinding from behind.

B.831 May 19, 2019 — Seattle, WA

I've had issues with drivers running extremely bright headlights on U.S. 2 at night -- I work night shifts so I'm heading home at 3AM. I've had cases where the headlights were so bright that I could barely see the side of the road. It is a very serious safety risk. On top of that, HID light bulbs have a phenomenon that I call "color shift"...it shifts between warm colors and cool colors, and that actually can cause disorientation in drivers. I once had a truck behind me with HID's and they were glaring into my cabin, and I nearly drove off the road because of it. I want a return to Halogen spec lighting.

B.832 May 19, 2019 — Springfield, OR

I've thought for a long time that a lot of headlights were too bright these days.

B.833 May 19, 2019 — Sumter, SC

Headlights on newer cars are blinding. Emergency vehicle lights are even worse, those are the most dangerous for other drivers at night.

B.834 May 19, 2019 — United States

Why are these blinding white and blue lights even legal? It's illegal to drive around with high beams on, and it these should be illegal, too. They are even more blinding than high beams.

B.835 May 19, 2019 — United States

These lights are horrible!

B.836 May 19, 2019 — Waterford, MI

I can barely see the road with the lights so bright. My new teenage driver has same issue. Really scary.

B.837 May 19, 2019 — Zanesville, OH

Those lights are terrible on the eyes and I feel like it's dangerous!

B.838 May 19, 2019 — newark, OH

because those lights are ridiculously blinding to oncoming traffic!!

B.839 May 20, 2019 — Abilene, TX

Bright lights are dangerous for oncoming traffic

B.840 May 20, 2019 — Asheville, NC

It's dangerous all the way around. Some people have migraine triggers from these lights.

B.841 May 20, 2019 — Bishopville, SC

These lights are just to bright i have nearly been hit a few times because of people not being able to see

B.842 May 20, 2019 — Cicero, NY

I have been blinded many times by too-bright headlights and feel it's a very high risk danger

B.843 May 20, 2019 — Coos Bay, OR

I'm signing because the LED headlights are blinding and cause zero visibility at times.

B.844 May 20, 2019 — Eugene, OR

These LED lights are blinding and unsafe.

B.845 May 20, 2019 — Eugene, United States
I can not see the road when blinded by super bright lights at night.

B.846 May 20, 2019 — Fairport, NY
These lights are not helping, time to change them.

B.847 May 20, 2019 — Kent, NY
I can no longer drive at night because of these lights.

B.848 May 20, 2019 — Lennon, MI
I constantly have to stare at the white line on the side of road because many head lights are so bright. Glare, blindness, etc. I have to blink my eyes several times and weirdly I shake my head lol but many are crazy bright.

B.849 May 20, 2019 — Palmer, NE
Those lights kill my eyes so I try not to drive at night.

B.850 May 20, 2019 — Penfield, NY
I'm with you! I can't stand those lights

B.851 May 20, 2019 — Phelps, NY
I'm signing because this is very true. These lights are very bright and are more of a distraction to other drivers.

B.852 May 20, 2019 — Pittsfield, MA
I'm signing because I can't see when the car is coming at me, increasing my risk of an accident.

B.853 May 20, 2019 — Portland, OR
Not a frequent driver, but as a passenger and a pedestrian, the lights does hurt my eyes. As a deaf person, the eyes and the sense of sight is extremely important and i have to take good care of them.

B.854 May 20, 2019 — Poynette, WI
LED headlights are really bright and I cannot see anything when those cars with those headlights are coming at me from the other direction.

B.855 May 20, 2019 — Rochester, NY
I drive for a living and these lights are dangerous!

B.856 May 20, 2019 — Saginaw, MI
I'm signing because these lights are way too bright on the newer vehicles. I pretty much avoid driving at night and early morning hours because I'm tired of being blinded by the headlights.

B.857 May 20, 2019 — San Antonio, United States
These lights really are blinding and you can't see they really need to do away with these lights.

B.858 May 20, 2019 — Slaterville Springs, NY
I can't support and stress this enough. I have almost crashed several times. Not to mention my head kills me after. I shouldn't have to face migraines due to vehicle headlights being so dang bright. There's okay bright and HOLY CRAP! I'm pretty sure it's an easy fix!

B.859 May 20, 2019 — St. charles, MI
These are HORRIBLE. You cannot even see the white lines on the road when a car/truck with these headlights come at you. The can cause so many accidents because the driver of the oncoming car can't see for a few seconds after one of these cars go by. They ARE DANGEROUS....not SAFE.

B.860 May 20, 2019 — Suttons bay, MI
Brite light coming at me are unsafe. They make me want to stop in the middle of the road

B.861 May 20, 2019 — Syracuse, NY

Ban them lights

B.862 May 20, 2019 — Traverse City, MI

I am diabetic and with fluctuating blood glucose levels, vision is also affected. I use anti reflective coating on my lenses for my glasses which helps cut down on the glare, but these headlights are just plain blinding to the point of needing sunglasses just to cut down on the glare of these ultra bright led headlights when they′re coming at you. It burns your retina and hurts to have to see them while driving at night when there's nowhere to temporarily divert your vision to.

B.863 May 20, 2019 — United States

They are blinding and very distracting!!!

B.864 May 20, 2019 — WEST VALLEY CITY, UT

The bright lights prevents me from driving

B.865 May 21, 2019 — Ballinger, TX

I′m also blinded by these lights.

B.866 May 21, 2019 — Berlin, NY

I am signing because i am ONE that has a problem with glare and these lights. So not necessary

B.867 May 21, 2019 — Columbia City, IN

I agree so dangerous blinding.

B.868 May 21, 2019 — Denver, CO

I cannot possibly drive at night safely with my family in the mountains

B.869 May 21, 2019 — Flirida, TX

Save lives, it’s more important than your bright fancy lights.

B.870 May 21, 2019 — Hudson, NY

We should regulate headlamp manufactures to specific lumen/brightness output. That way, no matter what the technology, the brightness would be roughly the same. On top of that, the ″cold″, ″sharp″ looking blue wavelength should be reserved for only emergency vehicles.

B.871 May 21, 2019 — Lapeer, MI

Those lights are blinding. Can’t see anything. They need to go

B.872 May 21, 2019 — North Providence, RI

Totally agree, while I have a 2019 Buick Envision, it′s maddening to me that every fourth or fifth driver flashes his or her beams at me to turn off my high beams when I don′t have them on same thing with my 2017 Buick. The lights are way too bright, I even brought it back to the dealer to see if maybe there was an issue with where they were pointed but they said nothing was wrong.

B.873 May 21, 2019 — Tuscola, United States

The LED’s make it hard to drive at night

B.874 May 22, 2019 — Amsterdam, NY

It’s very scary

B.875 May 22, 2019 — Frankfort, IL

Lyyn gray

B.876 May 22, 2019 — Greenville, NH

I often have to hold my hand up to mitigate the brightness of lights off oncoming traffic because I simply can′t see. Not to mention it actually hurts my eyes. When they are behind me I have to flip my mirrors.

B.877 May 22, 2019 — Salt Lake City, United States

I rarely flash my brights at oncoming traffic anymore these days because often what seems like someone with their high beams on is just someone with LED or HID lights on ″low″. It′s hard to tell for sure anymore. Anyway, glad to see many people speaking up about this. Always thought it was ″just me″.

B.878 May 22, 2019 — United States

Those lights are insane and I have a light case of night blindness, they bother me even with my corrective glasses

B.879 May 23, 2019 — Liverpool, United Kingdom

Ban bright car lights in uk too. Very hard to drive in uk as well at night. They blind me eveytime need banning and normal bulbs should be fitted as this is good on the older cars which is nicer on my eyes. Good luck of getting it banned in america.

B.880 May 23, 2019 — Saratoga Springs, NY

I've been blinded many times by the "blue" headlights and no standards or regulations are in place to protect other drivers.

B.881 May 23, 2019 — Traverse City, MI

Waaaayy too bright. 歷 It's like being a deer caught in headlights!! Whoever decided that, didn't think too long or hard on it. 浪

B.882 May 23, 2019 — Troy, NY

The bright lights make it impossible to see at night especially in the rain

B.883 May 28, 2019 — Bangalore, India

it is very much required for saftey of the people

B.884 May 28, 2019 — India

It very dangerous for opposite side driver as nothing would be visible as it leads to major accidents and may cause death

B.885 May 30, 2019 — Floresville, TX

These lights are dangerous during night time driving. I hope more lawsuits come about until they are completely banned for automobile use!!!

B.886 May 30, 2019 — Rye, CO

Bright headlights cause me to be temporarily blinded by them. Why can′t we go back to the normal headlights like we used to have? I support Banning these new bright ones.

B.887 May 31, 2019 — Baker, United States

I agree; LED headlights blind other drivers when approached from behind or head on, causing inability to focus on the road.

June 2019

B.888 June 1, 2019 — Malaysia

Not only effect on human but also environment and our precious sky indirectly.

B.889 June 1, 2019 — Petaling Jaya, Malaysia

This is important!

B.890 June 4, 2019 — Hartford, OH

I am signing up because it really hurts our eyes and could causing blind us to get back normal on the road.

B.891 June 5, 2019 — Santa Barbara, CA

Tremendously dangerous, frightening when you are driving and cannot see!! Please outlaw these lights!!

B.892 June 8, 2019 — Torrance, CA

At night on the freeway the glare is so bad from the cars behind me that are equipped with the super bright LED and HID headlights that I need to disable the rear and side view mirrors by pointing them in a direction away from the glare so I cannot see any of the traffic behind me. This puts me at a greater risk for having an accident.

B.893 June 9, 2019 — Coos Bay, OR

Blinding headlights should be illegal/banned.

B.894 June 16, 2019 — Reno, NV

These light create a terrible glare and leave a lasting effect on my vision even after they pass.

B.895 June 18, 2019 — Jupiter, FL

I'm signing because im tired of a**holes in lifted trucks that don't care if they blind other people with their headlights

B.896 June 19, 2019 — Carwoola, Australia

I drive on rural roads and cannot believe that some lights are legal, they are as bright as high beams.

B.897 June 25, 2019 — Salem, NH

The headlights hurt my eyes.

B.898 June 25, 2019 — Valrico, FL

I completely agree

July 2019

B.899 July 2, 2019 — Washington, DC

Good morning Vietnam it's about time someone took initiative to do something about this. I thought I was going to have to argue with all the police about not being able to see down the road, having police tell me that I'm too old to drive because I can't see anymore. The people that put those bars across their top or under the fog lights and every light coming out of the vehicle is a HD highbeam in your face burning up your eyes, they're just nuts. I have rednecks around where I live and they're just decorating their vehicles with these bright lights, they just love messing with people doing anything they can do to be offensive pricks...

B.900 July 2, 2019 — Wendell, MA

Ban LED headlights, tail lights, yard lights, bicycle lights. According to this Quora article looking at oncoming LED headlights is several thousand times stronger that looking directly at the sun. They bleach our rods and cones - needed to see colors. They accelerate macular degeneration. http://www.lightmare.org/

B.901 July 4, 2019 — Lexington, KY

I was on the interstate for about an hour tonight and counted 164 pairs of painfully, blindingly bright low beam headlights. My head and eyes still hurt from counting them and I won't do that again. This is getting ridiculous and more and more pop up every day. Even semis use them now. How is this legal?! They are so dangerous and should be banned.

B.902 July 7, 2019 — Menasha, WI

They hurt my eyes and blind me from incoming cars. DANGEROUS.

B.903 July 8, 2019 — Hooksett, United States

Because I get blinded at night, mostly in the rain. This is not ok and it needs to change

B.904 July 9, 2019 — Australia

I'm signing because blindingly bright headlights are unnecessary and dangerous.

B.905 July 13, 2019 — Mills River, NC

These lights are a lot worse on a truck because they are up higher. I see nothing but glare. I don't even see the cars in front of me anymore. I also get a big fricking headache.

B.906 July 14, 2019 — East Amherst, NY

These lights hurt and make driving at night even more dangerous.

B.907 July 17, 2019 — Llanddeiniol, ENG, United Kingdom

Strong LED headlights blind me when at the wheel.

B.908 July 18, 2019 — Miami, FL

I almost drove off the highway in the Mississippi Delta region because of night blindness caused by an oncoming car equipped with these lights. They pose a major risk for any night drivers!

B.909 July 25, 2019 — Paia, HI

yes, that's me. if you have those bright LED lights in your car and you drive by me I'm turning my hi-beams on full blast to burn your eyes out of their sockets and give you a taste of what you're doing to me. Anyone who is ignorant and selfish enough to drive a car with those invasive lights deserves nothing less than that, and no apologies!

B.910 July 27, 2019 — Grand Island, United States

While I am driving I have to shut my eyes against these solar flares and hope I do not have an accident. Even in broad daylight. These diabolical people who put these on the market and continue to do so are CRIMINAL and they just get away with it.

B.911 July 27, 2019 — Oshawa, Canada

They blind me

August 2019

B.912 August 2, 2019 — Dixon, IL

I have had many close calls because of those headlights I think they should be banned

B.913 August 4, 2019 — syracuse, NY

Everyone I've discussed this with has had the same experience of being blinded by oncoming headlights at night.

B.914 August 13, 2019 — Auckland, New Zealand

They are a danger. I am constantly blinded while driving.

B.915 August 13, 2019 — Houston, TX

They are extremely dangerous !! So blinding, when you try to look off so to keep control of your vehicle, YOU almost run off the road. They ARE NOT. necessary

B.916 August 13, 2019 — United Kingdom

LED headlights literally make the road disappear when a car with them drives towards me with them on. It doesn't even have to be pitch dark for me to be blinded either. Car headlights need to be regulated and tested. There's research that proves LED lights damage the retina of the eyes.... When we drive at night, the lights shine directly into our eyes, as we have to look straight ahead at the road ahead, so we cannot avoid them shining into our eyes! This is dangerous and really needs to be looked at!!! Thank you for creating this petition <3

B.917 August 16, 2019 — Jacksonville Beach, FL

Because these super bright lights are out of control & enough is enough already!

B.918 August 19, 2019 — Fort Wayne, IN

I drive at night delivering newspapers for 3 hours a night, I get home and my eyes feel like they're burning. I'm sure it's damaging my retna. If someone was to walk in the street, or a deer,I would never see them because of the blinding light,also have my review mirror facing the right,so behind drivers don't blind me,which makes it useless.Going to the eye doctor soon for a exam to see if it's damaging my eyes.These LED headlights have got to go!!! I can guarantee law suits will start soon.

B.919 August 20, 2019 — Minneapolis, MN

I like to drive without being blinded

B.920 August 25, 2019 — Jenks, OK

The life you save could be your own or a family member or friend!

B.921 August 25, 2019 — Louisville, KY

These type lights are actually too bright!!

B.922 August 30, 2019 — petrolia, CA

I live at the end of a long, narrow, winding country road, where i am often blinded by what i call, if you will excuse the expression, Asshole Lights. I am delighted to promote a ban on these Asshole Lights!

B.923 August 31, 2019 — petrolia, CA

Especially with cataracts.

September 2019

B.924 September 1, 2019 — Pensacola, FL

I've thought these lights were painful from the beginning. I'd love to see them replaced by a softer option that doesn't sear the retina

B.925 September 3, 2019 — ********, PA**

I have night blindness n it's hard enough for me to see without those blinding headlights. Get rid of them! Ban them!

B.926 September 4, 2019 — London, ENG, United Kingdom

LED headlights regularly blind me and make driving dangerous.

B.927 September 10, 2019 — Denver, CO

I'm blind!!!!!

B.928 September 11, 2019 — Arnold, MO

If i cant see behind me to merge safely on the highway because some asshole in a truck tailgating me has illegal headlights, then i shouldnt be held responsible for an accident that happens because of it.

B.929 September 15, 2019 — Boaz, AL

Because I have migraines and these horrible lights are one of my triggers, and they are so bright I can't see the road even if the lines have been recently painted. I'm fine with normal lights, but these HID hazards need to go. I hope this ban extends to gas stations and any lights visible from the road.

B.930 September 16, 2019 — Port Alberni, Canada

These lights give me a migraine. Very dangerous, have to look away. These horrible headlights just caused a horrible accident with 2 young students being killed because the driver had to swerve away from the blinding oncoming headlights. Ban them completely and go back to the normal headlights please!!

B.931 September 17, 2019 — New Rochelle, NY

How are these "safer" if I'm blinded to the extend that I cannot see ANYTHING!! They are ridiculously bright even during daytime. Apart from what should be the obvious blinding danger of these things, their sharp cutoffs, bouncing around in and out of sight increases stress and anxiety. It's

no different to having a laser flashed in your eyes. I now avoid night driving - even walking at night has become an annoying experience. I truly wish those in charge would DO SOMETHING!!

B.932 September 18, 2019 — Port Alberni, Canada

I am signing this because these bright headlights burn my eyes when they are coming towards me. If I have been on a dark road they come around a corner and my eyes don't have time to adjust. They are making our roads less safe.

B.933 September 20, 2019 — New York, NY

Almost got Into an accident today, please ban these bright led lights

B.934 September 21, 2019 — Guildford, ENG, United Kingdom

These new headlights are distracting, dazzling and dangerous. They need to be regulated and permitted brightness needs to be reduced to a safe level.

B.935 September 22, 2019 — Akron, OH

It's effecting my eyes, I have to drive at night with sunglasses because the car lights are piercing

B.936 September 24, 2019 — vancouver, Canada

Fuck those lights

B.937 September 26, 2019 — Derby, ENG, United Kingdom

Simply had enough of being blinded by these ridiculous lights and I feel bad about directing my wing mirrors to reflect straight back at the driver behind even though they should back off or lower their beams.

B.938 September 26, 2019 — Trenton, MI

Fed up with those damn lights blinding me and i am not that old. What is wrong with the cops? Ticket the hell out of those dangerous idiots!

B.939 September 28, 2019 — Pensacola, United States

The headlights are blinding amd dangerous to anyone driving

B.940 September 29, 2019 — Colrain, MA

Personal experience blinded by these lights!!

B.941 September 29, 2019 — Wichita, KS

I can't see

B.942 September 30, 2019 — Melbourne, FL

They make it hard to drive at night

October 2019

B.943 October 1, 2019 — Ipswich, ENG, United Kingdom

After spending 15 months in hospital after a car accident, I do not want to be reliving those months again, if of course I am still living.

B.944 October 2, 2019 — Northampton, MA

Headlights do not need to be as bright as some of them currently are...

B.945 October 3, 2019 — Savannah, GA

YES I HATE THEM SO MUCH

B.946 October 4, 2019 — Bay City, MI

I can't drive at night. I mean I can but I'm blinded. I literally slow down so they can pass.

B.947 October 6, 2019 — Clark, NJ

Anything to reduce the brightness of headlights like this!

B.948 October 6, 2019 — Clark, NJ

Me too! I just pull over so they can get ahead of me. Way too dangerous.

B.949 October 9, 2019 — Plymouth, MA

These retina burners need to go!! The pain and blindness headlights AND tail lights cause is unacceptable!! Since when do we need 6 sets of headlights?

B.950 October 10, 2019 — Aliquippa, PA

Holly Tosadori

B.951 October 10, 2019 — Zephyrhills, United States

My cousin accident

B.952 October 11, 2019 — Frostburg, MD

My vision is becoming negatively impacted! We can see with regular halogen lights!

B.953 October 13, 2019 — Spring Hill, TN

Migraines, nausea, dangerous!

B.954 October 16, 2019 — Pell City, AL

I was blinded by super bright headlights the other night . The road was wet . The other driver was speeding too. I yelled to my son that I could t see and almost went down a embankment into a river . He never once dimmed his lights !!

B.955 October 17, 2019 — Myrtle Creek, OR

I too have been totally distracted by those LED lights front and back, during both daylight and night time driving.. They are absolutely distracting and one would require a pair of special glasses to minimize the glare that these LED lights create.

B.956 October 18, 2019 — Long Beach, CA

Can't see anything with these idiotic lights

B.957 October 18, 2019 — Phoenix, AZ

Such headlights create a dangerous and hostile landscape for other drivers and pedestrians.

B.958 October 19, 2019 — Lakeland, FL

It blinds you when they are either coming towards you or driving behind you.

B.959 October 20, 2019 — Belvidere, IL

Laurie McWilliams I hate them

B.960 October 20, 2019 — Brownsville, TN

I rear ended someone last Sunday, due to two improperly adjusted headlights. I look away and it still didn't help anything. I have been complaining about it for a while and everyone says: "Oh, you'll get used to it". WELL I AM NOW!

B.961 October 21, 2019 — Australia

Absolutely BLINDED from FRONT and REAR...!

B.962 October 21, 2019 — Bel Air, MD

I detest those LED headlights since they do nothing blind everybody especially when it is raining. They should have never been made for vehicles in the first place

B.963 October 22, 2019 — Charlotte, United States

They should either be banned or have an annual inspection of the lights to ensure they are aimed at an angle that wont blind drivers. It's a specially impactful when it's a taller vehicle.

B.964 October 22, 2019 — Epping, ENG, United Kingdom

Led lights are absolutely ridiculous how are the brightness of them legal

B.965 October 22, 2019 — Middle River, MD

I'm absolutely sick of being blinded by head lights, if it's illegal to drive with your high beams on, then why are these lights that to me seem brighter then high beams legal?!?!

B.966 October 22, 2019 — Springfield, OR

I drive a lot at night, and these obnoxious blue headlights are blinding and dangerous. We need to outlaw them and require manufacturers to switch to more yellow spectrum leds that are easier on the eyes and do not scatter light as much.

B.967 October 25, 2019 — Bentonville, United States

They are dangerous

B.968 October 25, 2019 — Cazenovia, NY

Standards for vehicle lighting has not kept up with the lighting technology. Spectral changes in light emission, intensity, and the sharpness or transition between full intensity and no light have all changed dramatically with HID and LED technology and need to be addressed. Drivers are experiencing persisting blindness post encounter with head on traffic that has HID or LED technology.

B.969 October 25, 2019 — Lexington, MA

These blinding headlights make night driving difficult and dangerous.

B.970 October 25, 2019 — Melbourne, FL

The glaring headlights make it harder to see and make my migraines worse.

B.971 October 25, 2019 — Merlin, OR

Yes. It is blinding the oncoming driver.

B.972 October 25, 2019 — Nokesville, VA

A little enforcement of the already-existing laws making it illegal to sell or use LED replacements for incandescent headlight bulbs would be nice.

B.973 October 25, 2019 — Shrewsbury, MA

Im signing because of the bright blinding headlights. Use at night is like bright lights in your eyes.

B.974 October 25, 2019 — Tucson, AZ

Lights that suppress melatonin are a very GOOD idea, but no lights should be too bright. I have been temporarily blinded by headlights in spite of my best efforts. Some lights are simply too bright. When I can't see, I panic.

B.975 October 25, 2019 — United States

Some of these LED and HID lights are too bright

B.976 October 25, 2019 — captain cook, HI

In rural areas where it is totally dark the fully dark adapted eye is especially vulnerable

B.977 October 26, 2019 — Beaumont, CA

This is extremely dangerous especially with raised pickup trucks that have not had there lights readjusted. Even more for me as I am 82 years old.

B.978 October 26, 2019 — Denver, CO

These lights are dangerously bright and need to be limited.

B.979 October 26, 2019 — Gastonia, NC

I'm tired of being blinded by mega bright headlights! I almost went into the opposite lane a few nights ago from lights blasting me in the face! I hate going out in the evening at all anymore!

B.980 October 26, 2019 — Germany

because I am a night protector and know very well about the shortfalls of blinding blue light. This really needs to be banned.

B.981 October 26, 2019 — Kannapolis, NC

These headlights blind me from the opposite direction, especially at night and when they reflect on wet road surfaces. They also blind me from behind too from high profile pick-up trucks. I have to duck below the glare to see out my front windshield. I use my headlights during the daylight, mostly out of habit. What irks me more is idiot drivers that don't use headlights in the rain, snow and fog despite local laws requiring them. Imagine the enormous amount of traffic tickets police could write not using headlights.

B.982 October 26, 2019 — Statesville, NC

Due to the fact that blinding oncoming traffic is more dangerous than driving in the dark ! It's way past time for these so called safety agencies do their jobs and that includes setting a maximum height for headlamps on ALL vehicles which should be no higher from roadway than 17 inches.

B.983 October 27, 2019 — Bristol, United States

I too have been blinded by them

B.984 October 27, 2019 — Cheyenne, WY

I'm signing because halogen headlights are completely blinding. The rest of us should then use our high beams at all times to compete to see the roads at night.

B.985 October 27, 2019 — Tazewell, TN

I hope to see that ALL LED and HID headlights on ALL vehicles - No Exceptions - become banned and illegal. They are blinding and endanger lives.

B.986 October 27, 2019 — West Roxbury, MA

As a roadway lighting professional, glare is the most underrated metric in design. Blue light glare is real but difficult to measure because it's effects are different per person. Older people are far more susceptible to blinding glare because as we age our eyes's corneas become less clear and the blue light scatters passing thru the eye just like it does in rain, or fog. The blue scattering is called "Rayleigh scattering". Car headlights are the worst offenders, but they should also look at warmer street lights (3000K CCT or less). The scattering effect is much more noticeable in inclement conditions (rain fog snow), but unfortunately the visibility studies are typically done in perfect conditions.

B.987 October 27, 2019 — Woodsboro, MD

Because these lights are terrible and are blinding.

B.988 October 28, 2019 — Pikeville, TN

They are blinding!!!

B.989 October 28, 2019 — Seattle, WA

I have nearly gone off the road countless times due to the blazing glare of the new hot white headlights. Particularly in rain they are a terrible hazard. They aren't necessary for seeing the road, and they should be banned.

B.990 October 28, 2019 — new tazewell, TN

Bright white head lights are blinding and dangerous.

B.991 October 29, 2019 — United States

They are a hazard and are a cause for the up swing in deadly wrecks in the last 2 years. They should be banned!

B.992 October 30, 2019 — Bear, DE

Yes!! Please, please, PLEASE, write requests to initiate legislation to your state senators and representatives - I did. Part of my letter - please use this first sentence in your letters to them or

something similar: This morning, a person was behind me and even just a short glance before covering my eyes, I has a bright spot appear in my field of vision that made it very difficult to see the road or anything else. I am only 58 - as I get older it will multiply this problem.

B.993 October 30, 2019 — Clear Lake, WI

LEDs should be banned!! and only the AMBER daytime running lamps should be used on all cars, trucks, and buses (including school buses) during daylight hours.

B.994 October 30, 2019 — Eden Prairie, MN

Too bright vehicle lighting is not only dangerous but also just a general nuisance to other drivers and anyone else near roads, driveways, and parking spaces wherever there are vehicles. The bright lights ruin the outdoor experience. What a shame. Too bright vehicle lighting is part of a general trend of too bright lighting everywhere, from digital signage, to flood lights, to LED interior lights that can be seen a great distance through windows, TVs in windows, places of business, outside, and high intensity LED tower strobe lighting that ruins vistas. We are facing an assault of bright lighting. I hope people join and form strong activist organizations that will fight bright lighting. We are also facing an onslaught of rising noise pollution everywhere. Many technological trends are adding stress to our lifes and reducing the quality of life and outdoor living.

November 2019

B.995 November 1, 2019 — AP, United States

Time to MAKE THESE LIGHTS a thing of the past! They are WAY toooo BRIGHT and impedes the driver heading towards it.

B.996 November 1, 2019 — Conway, SC

You really can't tell if they have their bright lights on or not, and they really do not care that they are blinding drivers.

B.997 November 1, 2019 — Conway, SC

They also negatively affect people just walking on the road. If a driver gets blinded he/she may not be able to see the person walking on the road. It has happened to me several times already.

B.998 November 4, 2019 — Arroyo Grande, CA

I drive with Uber and Lyft in my retirement. Some of the headlights I encounter are outrageously, blindingly and absolutely unnecessarily bright!!

B.999 November 4, 2019 — Bloomfield, NJ

I'm signing because this is incredibly true and sadly so. I had to give up driving at night because of these blinding headlights. When the transition from daylight tonight is coming it's even worse. Several times since the beginning of using these headlights in cars over the last years I have almost hit pedestrians. I now stop in the middle of the road at night when a car is blinding me with its headlights because I would rather have somebody angry behind me then hit somebody. That's a horrible way to live and this has to stop. The AMA gave these guidelines so many years ago and they have been totally ignored. It's unconscionable that so many people are complaining and that no one is doing anything about it. I doctors have told me that the lights are blinding. They feel helpless because nobody is listening. We cannot stand for this. It could be one of your loved ones that gets hit and then what will you do? You won't be able to turn the clock back and you will live with that forever

B.1000 November 4, 2019 — Brooklyn, NY

These blinding lights are just overkill. They are not needed.

B.1001 November 4, 2019 — Cliffside Park, NJ

I like to prevent undo trauma of accidents due to blinding head lights!

B.1002 November 4, 2019 — Monroe, CT

There becoming more an more dangerous , especially to elderly folks

B.1003 November 5, 2019 — Ashburnham, MA

These headlights are hazards! Get them off the road, please.

B.1004 November 5, 2019 — Lisle, IL

This is an unnecessary problem since LED lights can be any wavelength or color temperature based on filters around the source.

B.1005 November 5, 2019 — Port Washington, NY

Bonnie Utzig

B.1006 November 5, 2019 — San Diego, CA

I hate these blinding lights!

B.1007 November 5, 2019 — Wausau, WI

I agree 100%

B.1008 November 5, 2019 — san diego, CA

I'm glad I'm not alone in feeling like these overly bright lights are impairing my vision.

B.1009 November 6, 2019 — Agency, MO

These light are blinding when you come upon them on the road or behind you.

B.1010 November 7, 2019 — Douglasville, GA

I commute to school every morning. I cannot see even in broad daylight with these headlights because of the intense glare. They shouldn't be allowed.

B.1011 November 8, 2019 — Leusden, United Kingdom

Seventh Angel Care Revelation 10:7 / 11:15

B.1012 November 8, 2019 — Pueblo, CO

I work as a delivery boy. Whenever I work dinner shifts and it starts to get dark it becomes near impossible for me to see where I'm going due to LED headlights from on coming traffic blinding me

B.1013 November 8, 2019 — Seattle, United States

I am all for bright headlights and being able to see well in the dark, but being blinded by these lights is ridiculous. There needs to be higher standards for bright lights. For example, cars that have really bright HID or LED headlight systems need to have auto dimming feature installed, dim the lights when ambient light is high enough. We do not need SUPER BRIGHT HEADLIGHTS when driving in the city most of the time, the new LED street lights provide enough light as it is. When driving on dark roads though, all cars should be equipped with auto dimming or auto aiming headlights so they do not blind oncoming traffic.

B.1014 November 9, 2019 — Anchorage, AK

Fuck bright headlights

B.1015 November 9, 2019 — Corpus Christi, TX

I used to be upset with the consumers who are naïve and driving dangerous cars. The problem are the manufacturers. I am now going to start a list of manufacturers and model vehicles that are dangerous for the road: Ford F-150 Platinum 2020

B.1016 November 9, 2019 — Minneapolis, MN

LED headlights are making night time driving less safe.

B.1017 November 9, 2019 — Roanoke, VA

Fuck bright lights

B.1018 November 10, 2019 — Corpus Christi, TX

I believe this impairs other driver's ability to drive safely.

B.1019 November 10, 2019 — Worcester, MA

Led headlights are an absolute menace and should be banned by authorities if they are really interested in public safety.

B.1020 November 11, 2019 — OAKLAND, CA

I had a horrible drive home from Oakland down the 5 to LA. I was getting blinded from all directions (rear view mirror, side view mirrors, even some oncoming (despite there being a large median). I have a pounding headache today and find the general lack of concern about this to be alarming. Responses like "drivers will adjust as this becomes more common" is such capitalist b.s. These lights are terribly dangerous and unnecessarily bright. I don't think we need to go back to a world of solely halogen lamps but I do think we need to adjust the legal allowable lumens. It's like I've been seeing flashbulbs for the last 12 hours.

B.1021 November 11, 2019 — OAKLAND, CA

Also, I'm 34 so this ageism around who is affected is ridiculous. I would hop on a class action about vision impairment due to these lights in a heartbeat.

B.1022 November 11, 2019 — Phoenix, AZ

I agree with a complete and outright ban of LED and other blue-light headlamps and tail lamps on all moving vehicles (cars, trucks, vans, etc.) I also agree with another signer--if a person can't see properly at night with normal headlights, he/she shouldn't be driving! Get off the road!

B.1023 November 11, 2019 — Somerville, MA

I am an optometrist. Patients tell me they are bothered by these lights EVERY DAY! I am so happy someone is doing something about it, I will share will all of my patients and colleagues. These lights are a public safety issue effecting everyone, not just the elderly.

B.1024 November 12, 2019 — Seattle, United States

most new mercedes are awesome and have some of the most non blinding lights I have seen.

B.1025 November 13, 2019 — Rio dell, CA

I don't enjoy driving at night anymore because of all these awful headlights from high-end cars and kids putting ultra-bright LED/HID lights in their cars. It's a distraction and danger to all drivers on the road and I've wondered why DOT has sat on their asses doing nothing about it??

B.1026 November 14, 2019 — Petersburg, United States

When I first started seeing these headlights, I thought, "What the heck??!!!?? I thought that was illegal!!!" I still most emphatically think they should be. I used to hate them because of how horrible they are when someone is approaching you from the other direction. Then I drove a loaner vehicle that had them, and discovered that I couldn't see properly as the driver, either! Why does ANYBODY buy these cars?

B.1027 November 15, 2019 — Cambridge, MA

I've been doing a lot at night driving lately I have to for work since we have our shorter days. And my eyes are really bothering me and it's been difficult driving the hour and 15 minutes three nights a week. There is going to be more car accidents because of it that's for sure. Never mind it harming your eyes I don't want my eyes damaged because I have to drive at night.

B.1028 November 15, 2019 — Klamath Falls, OR

I just drove two nights across the Nevada and Arizona deserts on two lane highways 93 and 95. The glare from headlights of many of the oncoming vehicles, both cats and semi trucks, was nerve wracking. Three times I was temporarily blinded as they passed me. I had a headache when I arrived in Las Vegas that stuck with me to Phoenix.

B.1029 November 15, 2019 — McKinleyville, CA

Those lights are dangerous. Too bright, they actually blind you, when they sign in your face while driving

B.1030 November 16, 2019 — Exeter, NH

I'm signing because I can't see when people forget to turn the high beams off and I'm blind it's not safe.

B.1031 November 16, 2019 — Magnolia, DE

I cant see in the dark very well. And when these headlights come at you I TEALLY cant see

B.1032 November 16, 2019 — cranston, RI

These lights blind you even when they drive behind you. They cause me to see spots when they shine in my rearview mirror and I have to drive with the mirror angled down.

B.1033 November 16, 2019 — cranston, RI

Also,if it is against the law to drive closely to another car with high beams on why are these allowed?

B.1034 November 16, 2019 — cranston, RI

Also,if it is against the law to drive closely to another car with high beams on why are these allowed?

B.1035 November 17, 2019 — Bluff Park - Hoover, AL

I'm signing because I'm SICK of these new lights blinding me while driving at night!!!! They are FAR too bright and the idiot who came up with these lights should've known that they were far too bright to use!

B.1036 November 17, 2019 — Cork, Ireland

Evidence is mounting about the dangers if excessively bright, harsh, glaring artificial lights in our environment, especially after dark. Industry won't act until officials pass legislation to make them do so. Officials must listen not only to the science (which takes time to do properly), but to the experiences of ordinary people who suffer the effects of excessive lighting. Instead of waiting for years or decades for the epidemic to be proven (like with smoking), act now, and save the thousands of lives that are lost needlessly every year.

B.1037 November 17, 2019 — Metairie, LA

Lights are too bright. Dangerous

B.1038 November 18, 2019 — Fountain Valley, CA

Something needs to be done to monitor the brightness of these lights, which are more piercing - especially when surrounded by darkness. It's getting to the point that you can't drive at night because of being blinded by oncoming lights. Brake lights are too bright (combined with too many) also!

B.1039 November 19, 2019 — Dallas, TX

I never had a problem with the old lights. Now the new led lights cause me to have photo sensitive seizures. Thank you for petitioning for change.

B.1040 November 19, 2019 — Medford, OR

My wife gets ocular migraine whenever those blinding LED headlight shines her way. It also blinds me to the point I'm lucky I don't go off the road or hit anyone. Those LED lights are dangerous!

B.1041 November 19, 2019 — Phoenix, AZ

These are unnecessary and dangerp

B.1042 November 19, 2019 — York, PA

These lights are extremely bright for no reason, it isn't necessary. They blind and disorient drivers

B.1043 November 20, 2019 — Fresno, CA

THEY ARE BLINDING! It's entirely unnecessary and thoughtless. A pox on the inventor!

B.1044 November 20, 2019 — Grimsby, ENG, United Kingdom

I struggle driving at night because of led lights.

B.1045 November 20, 2019 — Pittsburgh, PA

The new chilling white headlights need to be removed from the roads please. I'm getting blinded from the front and also from behind me as well. Yes. They look very crisp and very cool. I'm sorry though; some things seem good but just don't work for the application.

B.1046 November 20, 2019 — Scunthorpe, ENG, United Kingdom

I believe they are dangerous to oncoming traffic especially in wet weather

B.1047 November 20, 2019 — Vallejo, CA

These headlights are terribly dangerous and cause great anxiety in drivers.

B.1048 November 21, 2019 — Sandbach, ENG, United Kingdom

The headlights are that bright I cannot see its sometime hard to make out if they are on full bean or not! They are so dangerous both in the opposite direction or when a car is behind you with the headlights on. I believe these need to be banned!

B.1049 November 21, 2019 — Staten Island, United States

My eyes aren't what the use to be. Those lights are blinding and cause headaches

B.1050 November 21, 2019 — Tallahassee, FL

I agree! I hate these blinding blue lights. They should be banned from normal use.

B.1051 November 21, 2019 — colfax, WI

They are very blinding and need to be banned.

B.1052 November 22, 2019 — Drumright, OK

Yes please let's save some lives by saving our vision!!

B.1053 November 22, 2019 — Drumright, OK

This affects me

B.1054 November 22, 2019 — Granbury, TX

Highway driving is not so bad. But on dark country roads its impossible to see when a car comes towards you... if there is someone with bright lights behind you it's even more dangerous, and its getting so much worse.

B.1055 November 22, 2019 — Hagerstown, MD

Have to be at work early in the morning and live in the country . I'm always looking for deer and when an oncoming car has these lights I can't see anything after passing and if there are following me it's so bright I have to move all my mirrors just to be able to see what's in front of me.

B.1056 November 22, 2019 — Hamilton, MT

They are a dangerous product!

B.1057 November 22, 2019 — India

it is required.

B.1058 November 22, 2019 — Indianapolis, IN

These awful things should have never been approved by the National Highway Safety Institute. They are way too dangerous!

B.1059 November 22, 2019 — Miami, FL

Of my friend and myself

B.1060 November 22, 2019 — Sparta Township, NJ

Light sensitive eyes and there are certain headlights that cause lasting difficulty with focus.

B.1061 November 22, 2019 — Staten Island, NY

Its blinding at night and could cause seriuos accidents

B.1062 November 22, 2019 — United States

because it an accident waiting to happen for the other driving in the opposite direction. if it hadn't happen already !

B.1063 November 22, 2019 — United States

I used to enjoy driving at night. Not anymore. The LED headlights are the main issue. HID lights never bothered me at all. There is something about the intensity and the color temperature of LED lights that just kills my night vision and causes so much glare. This is even worse on pick up trucks or some SUV's that sit higher than passenger cars. Have one pull behind you at a stop light and their lights are shining directly into your back window, blinding you by the rear view mirror. The Feds should require that all headlights be at a maximum height no matter how tall the vehicle is to prevent this scenario. More people will die on our roads until this issue is resolved.

B.1064 November 22, 2019 — Woodstock, United States

I'm a migraine sufferer and it's already hard to drive at night, but these horrible things are making me consider giving up night driving entirely. That would have a huge negative impact on my life, including possibly costing me the part time job that allows me to live a better life on disability and makes me feel like a contributing part of society. Adaptive glasses with my special prescription would be very expensive. It's backwards to expect people to spend money they don't have or sink deeper into poverty to adapt to these dangerous lights.

B.1065 November 22, 2019 — rensselaer, NY

They blind you when coming torge you

B.1066 November 23, 2019 — Columbia, MD

I'm signing because I have been noticing the past few months that I'm being blinded by these new fangled headlights. At first I thought these were high beams, but then I realized that they are different and much more bluish. IT makes a significant difference to me because I often drive on 2-lane undivided roads.

B.1067 November 23, 2019 — Durant, OK

With my sunglasses on during the day, the LED lights on cars are still brighter than sunlight reflected off chrome on cars. This is with my sunglasses on. These lights must be damaging to young people's eyes at night when they have no light protection glasses on. I envision a class action lawsuit in the near future.

B.1068 November 23, 2019 — Pittsburgh, PA

Driving at night is already difficult. Blinding lights on two lane roads are a nightmare and extremely dangerous. If it's raining, even more.

B.1069 November 23, 2019 — Tulsa, OK

These lights should be banned! I've had to slow to almost a stop numerous times on two lane roads because of these lights. I hate driving at night now.

B.1070 November 23, 2019 — United States

These lights kill my eyes for night driving that I'm afraid to get into a wreck. These lights blind me to where I can no longer see

B.1071 November 24, 2019 — Maple Plain, MN

I struggle to see every time I have these lights coming at me from the opposite direction.

B.1072 November 24, 2019 — Minneapolis, MN

Might also reduce light pollution so we can see the stars that are also blocked from our vision

B.1073 November 24, 2019 — Prescott, AR

They are so blinding ! That can be dangerous

B.1074 November 25, 2019 — Chicago, United States

The headlights have become so bright, they are now a distraction and hindrance.

B.1075 November 25, 2019 — Philadelphia, United States

They are dangerous

B.1076 November 26, 2019 — Philadelphia, MS

These lights are very dangerous even in daylight! They totally blind the driver in the oncoming car and they are so bright it remains in your eyes like you've looked at the sun too long. Hideous invention.

B.1077 November 26, 2019 — Waianae, HI

I'm signing because I'm happy that they can see better. But can they see me DRIVING OFF THE EDGE OF THE ROAD BECAUSE THEY BLINDED ME?????

B.1078 November 27, 2019 — Lebanon, IN

Because LED headlights are blinding and most drivers who use them also use fig lights which are also LED- making it hard to focus in the rain or darkness- they also tailgate with them in our rearview mirror- they need to be banned-

B.1079 November 27, 2019 — Minneapolis, MN

These lights are blinding and terribly dangerous, not to mention unhealthy for the human eye. They should be banned in all forms

B.1080 November 27, 2019 — Wheatridge, CO

As a pizza guy I drive a lot and these leds gotta go!!

B.1081 November 28, 2019 — Abbotsford, Canada

These things are as much a driving hazard as cell phones

B.1082 November 28, 2019 — Austin, TX

It's getting ridiculous out there. It's also getting dangerous. Something needs to be done or there are going to be a lot more accidents.

B.1083 November 28, 2019 — Bat Yam, Israel

Photosensitive

B.1084 November 28, 2019 — Manchester, NH

These new lights are dangerous. Not too many years ago you would get a ticket for having high beams on when approaching on coming traffic. Today's lights are so much brighter than old high beams, and more lights on the the new vehicles. Who needs four lights on one side of the car? Yes, eight lights in my rear view mirror. These need to be banned.

B.1085 November 28, 2019 — St. Albert, Canada

The led headlights are way too bright and can cause me to have a migraine.

B.1086 November 29, 2019 — Aloha, OR

These lights are horrible and cause you to be blinded at night in both directions and causing people to almost drive off the road in the dark due to people getting blinded! These need too band!

B.1087 November 29, 2019 — Jackson, MS

I don't like the bright lights.

B.1088 November 29, 2019 — Portland, OR

As someone who bikes at night I want to share these are not only blinding to me, the person who has to take care not to hit obstacles that can cause me to fall or end up in the road, but actually painful and sometimes nausea inducing for those of us with sensitive eyes.

B.1089 November 29, 2019 — chicago, IL

Having Epilepsy alone makes this unfair!!! Ad in someone w/ a brain injury, autism, even overstimulation & we cannot function. I don't know how this is ok & legal. Pleaseeeee no more of these lights

B.1090 November 30, 2019 — Springville, NY

They are blinding

December 2019

B.1091 December 1, 2019 — Brandon, FL

The DOT and police depts could make five times as much revenue from ticketing people with these headlights than they could speeders-! Please do something, it's very bad here in Florida.

B.1092 December 1, 2019 — Chicago, IL

It's hard enough to drive at night or when it is raining!!! What's the purpose!?

B.1093 December 1, 2019 — Dalzell, SC

I would love to see something like this become law!

B.1094 December 1, 2019 — Floral Park, NY

Too damn bright! There's no need. And people drive with their high beams on too. Tell them to get a clue! Dangerous!

B.1095 December 1, 2019 — King of Prussia, PA

Common sense says these lights are dangerous but the idiots at NHTSA don't care for passenger safety.

B.1096 December 1, 2019 — New Orleans, LA

These headlights are dangerous. They will kill people.

B.1097 December 1, 2019 — PLANO, TX

The new bright headlights are worse than someone with brights on. I am constantly traveling, and am,blinded at least 3 times every night I'm,on the road. I have have prescription yellow tinted glasses and they only take away a tiny bit of the pain my eyes feel,when confronted. These things are dangerous.

B.1098 December 1, 2019 — Perrysburg, OH

Night time driving is potential dangerous with LED lights on cars!

B.1099 December 1, 2019 — Perrysburg, OH

Night time driving is potential dangerous with LED lights on cars!

B.1100 December 2, 2019 — Castle Rock, CO

Enough with the excessively bright headlights on cars. They are dangerous.

B.1101 December 2, 2019 — Cincinnati, OH

They blind ME!!!!

B.1102 December 3, 2019 — Cheshire, CT

These blinding headlights are dangerous! Please ban them right away!

B.1103 December 3, 2019 — Plymouth, ENG, United Kingdom

Might as well be cornering with my eyes shut

B.1104 December 3, 2019 — Stockholm, Sweden

It is really difficult to see when blinded by HID and LED. There is NO better light for driving than halogen.

B.1105 December 3, 2019 — Warwick, MA

I like my rods and cones.

B.1106 December 3, 2019 — Windsor, MO

The headlights are a danger to any driver regardless of age!

B.1107 December 3, 2019 — turners falls, MA

I personally have find myself squinting at theses coming at me and feel that they are unsafe

B.1108 December 4, 2019 — Dunedin, New Zealand

These lights are dangerous.

B.1109 December 4, 2019 — GA, United States

I drive an older model truck, with the more yellow-white head lights. My truck is a normal height. It is a step up to get in and I am being blinded by small cars. I will flash my brights, so they will dim theirs, only to be flashed back, because they didn't have their brights on. I am in my 20s, this is not an old person thing. And of course then you have the jacked up trucks with these new lights.... They may as well have their brights on all the time! I literally cannot see the lines on the road at night and I work until dark everyday. I know you are suppose to look away or at the white line, but I couldn't see anything! Its so scary....Please help. I don't want to become a statistic...

B.1110 December 4, 2019 — Laurel, MD

Twice recently a large pickup truck was approaching with the blinding led lights on a windy back road I was traveling on. Both times I almost ran off the road due to being completely blinded. These lights are dangerous and worse than any "bright lights " from years passed. The courteous thing was to turn them off when another car was approaching, but now these new LED lights cannot be turned off.

B.1111 December 4, 2019 — Pomona, Australia

I am startled by the glaring LED lights. Car headlights should not be a dangerous distraction

B.1112 December 4, 2019 — Sault Ste. Marie, Canada

These lights induce migraines for me. and during the winter months it is especially scary when I cant see the road ahead of me..

B.1113 December 4, 2019 — Sault ste marie, Canada

It needs to be done

B.1114 December 4, 2019 — South Hadley, MA, NY

Anything that damages our sight should not be allowed.

B.1115 December 4, 2019 — Wanaka, New Zealand

These lights are blinding, and it doesn’t feel safe on the roads

B.1116 December 5, 2019 — Blythewood, SC

They blind me

B.1117 December 5, 2019 — Cedar City, United States

ITS RIDICULOUS HOW BRIGHT PEOPLE’S LIGHTS HAVE GOTTEN. RIDICULOUS

B.1118 December 5, 2019 — Dunedin, New Zealand

I can no longer drive on the open road at night, I find these lights absolutely blinding. As a father I refuse to drive on the open road after dark, in Otago that is before 5pm in fair weather, in peak winter. That sucks. ☒

B.1119 December 5, 2019 — Lewisville, TX

Tired of these headlights blinding me wtf

B.1120 December 5, 2019 — Saint George, UT

I'm sick of being blinded at night by ridiculous bright headlights that you can't even see where the road goes!

B.1121 December 5, 2019 — San Francisco, CA

These lights are not safe nor are they necessary.

B.1122 December 5, 2019 — Southeastern CT, CT

Ban LED brake lights as well. Enough is enough!

B.1123 December 5, 2019 — Toledo, OH

These headlights are so bad! They are blinding and should not be used for cars!

B.1124 December 6, 2019 — Bhubaneswar, India

I sincerely support this campaign

B.1125 December 6, 2019 — Utica, MI

I hate these over bright headlights so much. They cause instant headaches for me. When I am on a two-lane road and vehicles with LED lights are coming at me I am completely blinded I cannot see my lane or anything else, it's like drivers always have their brights on but even more intense.. These are so dangerous and we do not need this technology. Whoever invented this and allowed it to be put in vehicles is an idiot and I find this grossly negligent, because it's so blindingly dangerous for other drivers. Have you ever been in a car and then a high truck is coming at you with these hideous lights? you can't see a thing. It's bad enough when it's just a regular car coming at you with the Hideous lights. The trucks are ten times worse because they're higher and there is no escaping the light beam, and their headlights are generally larger than a car. There was nothing wrong with the old style headlights. Anything on that blue Spectrum should be completely banned. There should also be a petition to the automaker's to stop putting these in cars.

B.1126 December 7, 2019 — Rising Sun, MD

There is no real need for high intensity headlights. They are dangerously blinding on all vehicles, but particularly so on SUVs and pickup trucks. I used to enjoy night driving, but avoid it as much as possible now solely due to these ridiculously strong headlights.

B.1127 December 7, 2019 — Sterling Heights, MI

I'm concerned about safety and I hate these headlights!

B.1128 December 8, 2019 — Peoria, AZ

Except for motorcycles and emergency response vehicles, there is absolutely no need for this kind of blinding presence.

B.1129 December 10, 2019 — Middletown, NY

Please do something, these new lights are painful. I was behind an Escalade and the brake lights made my eyes so uncomfortable I had to look to the side. Seniors who are beginning to get cataracts will have acceleration of the condition. This is a crisis.

B.1130 December 11, 2019 — CHARLESTON, WV

They are way too bright and can not see anything because of them

B.1131 December 11, 2019 — London, United Kingdom

Frustrating how bright some of these flashy car lights are, unfortunately it won't be long before there's more collisions on our roads, due to this issue.

B.1132 December 12, 2019 — Island Pond, VT

The lights are too dang bright!

B.1133 December 12, 2019 — elgin, IL

I've had a run in with the insanely bright headlights.

B.1134 December 13, 2019 — Chelmsford, MA

LED lights are a huge hazard and impair drivers

B.1135 December 13, 2019 — Glendale, NY

It's is getting more difficult to drive at night as more and more cars have these overly bright headlights.

B.1136 December 13, 2019 — Middle Village, NY

I'm tired of being dangerously blinded by these headlights

B.1137 December 13, 2019 — New York, NY

I am afraid to drive at night because of the glaring headlights on the other side of the road. It is extremely dangerous and frightening

B.1138 December 14, 2019 — Ferndale, CA

These lights are very distracting causing me to not even want to look at a vehicle and see which way it is going which is obviously a dangerous reaction... But, I would like to avoid migraines and loss of my direction by looking at them. Please make them illegal!

B.1139 December 14, 2019 — Leesburg, FL

I want to be able to drive at night safely

B.1140 December 15, 2019 — Honolulu, HI

The lights have been hurting my eyes since their production in the market. Thank God for this petition.

B.1141 December 15, 2019 — Orangeburg, NY

I want the NHTSA and The USDOT AND Transport Canada to ban Daytime Running Lights (DRLs) because they do more harm than good, especially for those who are nearsighted and those with low vision impairments. DRLs cause glare for drivers in broad daylight, and it causes problems for people who forget to switch the regular headlights at night resulting in the rear taillights not coming on. PLEASE BAN DAYTIME RUNNING LIGHTS!!!!!

B.1142 December 15, 2019 — Queens, NY

They cause hazards to oncoming drivers who cant see!

B.1143 December 15, 2019 — University Place, WA

#banblindingheadlights

B.1144 December 15, 2019 — University Place, WA

I would bet that many accidents already have been caused by those dangerous blinding headlights!

B.1145 December 16, 2019 — Bowmanville, Canada

I'm a pedestrian and don't want to get hit by someone blinded by these lights.

B.1146 December 16, 2019 — Canada

I have almost driven off of the road (mountain clifside roads in BC!! Not just little ditches) on more than one occassion due to oncoming traffic with these lights. Even in otherwise perfect driving conditions.

B.1147 December 16, 2019 — Canada

Not quite so bright is a safety necessity.

B.1148 December 16, 2019 — Portland, OR

It's getting generally harder and harder to see at night because of them. They create excessive glare, which makes it very difficult to see pedestrians, particularly in winter, when it's dark most of the time and generally gloomy and rainy. I have stopped using my mirrors completely, which is itself disorienting and makes me feel insecure, but at least I'm not being blinded by the people behind me. These things are becoming standard on more and more cars, and now we're seeing them on large

trucks, as well as Semis and delivery vans, all of which have much higher profiles than a car, which means it′s impossible to aim them so that they are both a functional light source and also not blinding to other drivers. To make matters worse, we are also now seeing police and fire & rescue vehicles equipped with them as well. These are ″safety″ vehicles; city owned and tax payer funded safety vehicles. The irony of HID headlights on a safety vehicle would be amusing if it weren′t outrageous. I hasten to add that they are also appearing as standard on city buses and city work trucks. Between this and the safety vehicles, it seems clear that local and regional governments are perfectly fine with these lights and don′t care what they do to the people they protect and serve. People claim they feel safer with these headlights. That′s all well and good, but that sense of safety comes at the direct expense of someone else′s. If you use these headlights, one could even say that you are stealing someone else′s sense of safety and then selfishly and carelessly using it to beef up your own sense of safety. Under any other circumstance, would you be okay with someone stealing something which makes your life better so that they can make their own life just a little better still? I′m guessing no, you wouldn′t. So, why expect anyone else to be okay with it? And what kind of person are you that you′re okay with it? These headlights need to disappear from the face of the earth, but honestly, no matter how much we complain, I don′t believe the DOT really cares all that much about it. I wouldn′t even be surprised to find official DOT vehicles are all now equipped with them because that′s just how the new fleet vehicles come from the dealership.

B.1149 December 16, 2019 — San Jose, CA

Glad someone has taken this issue on. Driving at night has became a difficult task. There needs to be a ban on led headlights.

B.1150 December 16, 2019 — Trenton, NJ

I can′t see when it′s dark out and also never can see blinker with them

B.1151 December 17, 2019 — Kamloops, Canada

These types of headlights hurt my eyes and have impaired my vision so much so that I feared I′d drive off the road!!! They most certainly should ot be allowed my any means!!!

B.1152 December 17, 2019 — Washington, UT

I’m a retired aerospace engineer with 28 years experience in system safety engineer and management for DOD, NASA, Jacobs and Northrop Grumman. There is no “might be” with glare. Glare is a very well known Category I hazard causing “death or system loss.” The only two reasons allowing this to happen are incompetence or criminal behavior. Pick one and fix it.

B.1153 December 18, 2019 — Greenville, SC

I wear blue blockers throughout the day and have found they also work on the super bright headlights. Without them I find the lights extremely blinding, making it extremely difficult to drive. I think they should be banned globally. They also mess up our circadian rhythms.

B.1154 December 18, 2019 — Paisley, FL

I am signing this because these lights kill my eyes and I myself have a hard time driving when these LED headlights pass me head-on! Even during the daytime! These are dangerous and must be made illegal!

B.1155 December 18, 2019 — Sonoma, CA

It’s so hard to see the lines on the road when the lights are so bright. You can’t see anything. It’s so scary and I believe those lights cause accidents and should be band.

B.1156 December 18, 2019 — Vallejo, CA

Years ago, anyone driving at night could tell if a car had on their high beams or low beams. Low beams did not blind other drivers. High beams did. It was illegal to blind other drivers with high beams. What do we do today when all low beams are now HIGH BEAMS? Those who allowed this to happen must be identified. Who signed off on allowing low beams to become high beams? The car manufacturers could not put high beam lights on cars, and call them low beams, without legal authorization. We have recalls in this country when cars are made unsafe. Recall ALL HIGH BEAM CARS MASQUERADING AS LOW BEAM CARS! The science used to identify low beams vs. high

beams has been seriously compromised. What ever happened to lumens? Is there no yardstick to quantify the illumination a car headlight emits today? Are we a nation of idiots? How many years has this been going on for? Why are we even talking about this today? Is this going to be a PERMANENT problem with no solution whatsoever? I am really tired of signing WORTHLESS petitions that give me no reason to believe ANYTHING will change. Who is Donald Berry anyway?

B.1157 December 19, 2019 — Humble, TX

It is true. As an older driver they do blind me at night. Back streets are what I drive on

B.1158 December 21, 2019 — Stanford in the Vale, ENG, United Kingdom

Unhealthy unpleasant lights, LED streetlights are harsh and harmful and the ones on cars are a danger to driving.

B.1159 December 22, 2019 — Australia

Light pollution is ruining everything.

B.1160 December 22, 2019 — Green Bay, WI

Those lights are ridiculous and deadly!!!

B.1161 December 22, 2019 — Knoxville, TN

I don't like being blinded while trying to drive safely.

B.1162 December 22, 2019 — Northport, NY

The lights are too bright and the emergency vehicle's are even worse

B.1163 December 22, 2019 — Port Jefferson Station, NY

I have always found it difficult to drive at night with the oncoming headlights blinding you

B.1164 December 25, 2019 — Satellite Beach, FL

Literally blinds me every time I'm on the road and when I see these bulbs. Not to mention the owners are usually pretty aggressive knowing that they have weaponized their car's headlights against all other drivers since even without brights on, the lights are blinding. I was once flashed by an aggressive driver who owned either HID lights or LED's and I legitimately lost vision while I was trying to operate my car because some cretin let his ego overpower his reasoning on the road.

B.1165 December 25, 2019 — Sterling, IL

Technology is becoming the enemy. LED lights not only blind the driver, but also give me a massive migraine. The rear view mirror cannot even help darken the lights of the driver behind you, I have to pull over and let them pass in order to see. It is impossible to see deer crossing the road with the lights blinding you.

B.1166 December 26, 2019 — Granite city, IL

Pretty much anytime I am driving and a car that has these halogen light pulls up behind me I'm blind and unable to see the road or anything inside my car. They need to be illegal.

B.1167 December 26, 2019 — Nashville, TN

It's dangerous

B.1168 December 26, 2019 — St. Louis, MO

Halogen headlights are going to kill somebody, someday.

B.1169 December 27, 2019 — Jacksonville, FL

These lights are awful!! I'm sure they've caused wrecks

B.1170 December 27, 2019 — Sacramento, CA

Don't blind oncoming traffic!

B.1171 December 27, 2019 — South Anston, ENG, United Kingdom

Not only are lights getting brighter but drivers are driving permanently at night on full beam until blinded back

B.1172 December 28, 2019 — Monson, MA

Like many others I am blinded by on coming vehicles with LED headlights, and I find it impossible to drive with those headlights behind me. Please ban these headlights for the safety of all on the road.

B.1173 December 29, 2019 — Eastlake, OH

These lights cause blind spots and more accidents are occurring

B.1174 December 29, 2019 — Houston, United States

They are dangerous and distracting.

B.1175 December 30, 2019 — Greensboro, NC

Those lights are wack.

B.1176 December 30, 2019 — Lynnwood, WA

LED is Dangerous for everyone! Especially people who are light sensitive! Please ban these on ALL headlights!

B.1177 December 30, 2019 — Seattle, WA

I cannot see the road when these headlights cone at me. At barely 65 I am looking at having to stop driving at night.

B.1178 December 30, 2019 — Stanway, ENG, United Kingdom

I know what it′s like when your blinded by these led lights.

B.1179 December 31, 2019 — Denver, CO

Headlights that bright can cause visibility issues as they are as bright as high beams.

B.1180 December 31, 2019 — Frederick, MD

There are lots of old cars with new LED /HID lights too. These should be banned too.

Comments left in 2020

January 2020

B.1181 January 1, 2020 — Consett, ENG, United Kingdom

Becoming dangerous

B.1182 January 1, 2020 — Post Falls, ID

It is becoming increasingly difficult to drive at night, thus it affects my freedom. In what universe is it safe to blind a driver in a car that is coming toward you. Additionally, owners of these cars need to address the issue and have some empathy for those of us being blinded by their lights.

B.1183 January 2, 2020 — Mauldin, SC

These headlights are blinding and dangerous to on-coming drivers. Who ever thought mega-bright lights that could be seen from space was a good idea?

B.1184 January 2, 2020 — Meadville, PA

I hate theses things we don’t need to see bugs having sex!!

B.1185 January 2, 2020 — Niles, OH

These lights blind so many people at night when driving. They even blind the passengers as well.

B.1186 January 2, 2020 — United States

I am so tired of having to pitch my sideview mirrors off the road because of these solar flares burning a hole in my peripheral vision.

B.1187 January 2, 2020 — VALPARAISO, IN

The lights blind me

B.1188 January 2, 2020 — Voorheesville, NY

LED lights are known to cause injury to the photo receptors of the eyes! No government, industry or otherwise has the right to expose us to a product that causes injury. No excuse or explanation is acceptable to justify risking our eyesight! This is an outrageous agenda with companies such as Regeneron waiting to offer a solution after many people develop eye problems from this kind of light exposure. This agenda needs to be stopped!

B.1189 January 3, 2020 — Chicago, IL

street and auto LED lights are way too bright.

B.1190 January 3, 2020 — Exelsior springs, MO

because I have a hard enough time seeing at night with out them darn things in my eyes

B.1191 January 3, 2020 — Oak Park, CA

I have a small car, and can't seem to drive anywhere at night without a taller car or tuck with ridiculously bright lights practically blinding me.

B.1192 January 3, 2020 — United States

Led head lights blind both drivers and passengers in both oncoming traffic as well as traffic that drives behind your vehicle that bounces off of both sideview and rearview mirrors.

B.1193 January 4, 2020 — Hialeah, FL

To save lives one of which may be your own

B.1194 January 4, 2020 — Pittsburgh, PA

I won't even drive at night anymore because of these lights!!

B.1195 January 5, 2020 — Brooklyn, NY

Michael McGuinness

B.1196 January 5, 2020 — Swansea, WLS, United Kingdom

Shining an LED light directly into someone's eyes is assault, be it a car headlight or a bright LED torch.

B.1197 January 5, 2020 — Yonkers, NY

The lights blind you, that's the whole story!!!!

B.1198 January 6, 2020 — Rugeley, ENG, United Kingdom

Not only might these lights cause accidents, they damage the retina and confuse your body clock.

B.1199 January 6, 2020 — iow, ENG, United Kingdom

Blinded by these lights all the time

B.1200 January 7, 2020 — West Kirby, ENG, United Kingdom

Also the LED streetlights are very danderous to drive to, not to mention harmful to health and the environment. This roll out also needs to be stopped.

B.1201 January 9, 2020 — Carmel, IN

The cap on how bright manufacturers can make the auto headlamps needs to be now. More public info and news stories need to be instigated to make public aware of how damaging the LED beams are to the human eyes and how to get mechanical adjustments made to their vehicles, and to understand the auto on, auto dim, and manual switches.

B.1202 January 9, 2020 — Leeds, ENG, United Kingdom
Is deadly stupidity. Wake up you fashion victim sheep.

B.1203 January 9, 2020 — San Antonio, TX
LED headlights blind me when driving at night.

B.1204 January 9, 2020 — Warminster, PA
I have photosensitive following a brain injury. I can no longer safely drive at night or during increment weather in fear of triggering a intense migraine. I miss my freedom, ban these headlights and save lives!

B.1205 January 9, 2020 — las vegas, NV
These lights are a danger

B.1206 January 9, 2020 — saint louis, MO
Those lights are dangerous!

B.1207 January 11, 2020 — Rushville, IL
I can no longer drive safely at night due to these led lights. Both oncoming lights and rearview mirror reflection are blinding.

B.1208 January 12, 2020 — Carmel, IN
I agree! These are a nuisance! They don't only hurt my vision, but also anger me.

B.1209 January 13, 2020 — De Soto, KS
Judith Albright

B.1210 January 14, 2020 — Hallsville, TX
They make it extremely dangerous for oncoming traffic

B.1211 January 14, 2020 — Utica, NY
It's TRUE some headlights are to bright

B.1212 January 15, 2020 — New Orleans, LA
These headlights are blinding and should be banned!

B.1213 January 15, 2020 — Uddevalla, Sweden
I get blinded now and then...

B.1214 January 16, 2020 — Hudson, NH
I agree!

B.1215 January 16, 2020 — Yorba Linda, CA
The lights blind me so much that I cannot see well while driving. I am scared it will cause me to get into an accident!!!! Ban them please!!!!!!!!!

B.1216 January 17, 2020 — Nashua, NH
I hate bright headlights blinding me

B.1217 January 17, 2020 — Nashville, TN
I'm tired of being blinded by these obnoxious lights. They are a danger to everyone on the road.

B.1218 January 19, 2020 — Maiden, NC
They blind you

B.1219 January 19, 2020 — Montréal, Canada
These led lights are a true hazard! They make it really hard to focus once blinded by them on the road and can be dangerous

B.1220 January 20, 2020 — Hopkinton, MA

These high intensity life lesson lights make night driving more dangerous. My eyes are temporarily blinded by their brightness when b I drive at night.

B.1221 January 20, 2020 — Leverett, MA

Please remember that a MAJORITY of our population consists of folks over age 55 who are beginning to need cataract surgery and/or may be experiencing macular degeneration. Let's keep everyone's eyes HEALTHY by banning LED lights in/on motor vehicles. It may even save the eyes of millennials!

B.1222 January 20, 2020 — White Oak, PA

I can't drive at night now because of them.

B.1223 January 20, 2020 — Yarmouth, ENG, United Kingdom

Light pollution is a big problem and car headlights are getting brighter every year. It's hard to see where you are going when they pass you.

B.1224 January 20, 2020 — black diamond, WA

The vehicle that finally pissed me off enough to join this fight was a newer ford pickup. F-250 i think. Not only are the headlights ridiculous but the front is covered with about 100 smaller LEDs , The smaller ones apparently just for decoration. It was also lifted quite high making it clearly in violation. The lifts are often factory these days. My point is this vehicle was factory equipment. Time for us to go after the manufacturers as well.

B.1225 January 22, 2020 — Round Rock, TX

I've gotten pulled over because I was swaying on road because idiot behind me was blinding me, which was a cop. He asked why I was driving in such a manor and I explained why and I was let go. It does distract drivers and blinds us.

B.1226 January 22, 2020 — St-Eustache, Canada

From Québec, Canada HID & LED should be banned off our roads. A lot of the headlights on vehicles are not properly installed and shouldn't be over a certain amount of lumen in the LED lights of a vehicle. Some vehicles may almost be go compared as a Christmas tree, so much that they have at least 2 HID/LED headlights one above the other and not to mention that they also have an LED string around them. These are blinding for others on the road. If they were low mounted like the Fog lights, it wouldn't be such an issue but literally everyone has to turn their heads away from the road when passing by. I compare them as if, you were looking up to the sun for a few second and then trying to focus... we are clearly blinded. Nowadays, trucks, buses and pickups has them and they're all just at the face level because regular automobiles are lower. Not to mention that when they follow you, the inside of your car is completely lighted up. They should be a law against this, and or make sure that the lights on each vehicle are properly installed by its manufacturer only. The beam lights should be at a proper level within the original casing that fits with the car and should not be install by other then the manufacturer themselves It's enough, a lot of people can no longer take these.

B.1227 January 23, 2020 — Proctor, AR

I'm signing because I live out in the middle of nowhere with no other lights on the road, and I know I am not able to see anything else when I see these headlights come at me.

B.1228 January 24, 2020 — Roslindale, MA

Way too bright! Dim them down. Blind me when they are driving in back of me or when in front. Scary.

B.1229 January 25, 2020 — Manistee, MI

These headlites should have never been allowed on vehicles!!!

B.1230 January 25, 2020 — Roanoke, IL

I hate led head lights they blind me from being able to see the road

B.1231 January 25, 2020 — Tulsa, OK
I don't see well at night and brights coming toward me is hazardous.

B.1232 January 25, 2020 — Tulsa, OK
Zondra Clunn

B.1233 January 25, 2020 — Washburn, IL
When bright LED lights coming towards you are the only lights you can see at night in the country, you basically go blind.

B.1234 January 26, 2020 — Atherton, CA
I can't tolerate the glaring headlight beams at night. !!!!!

B.1235 January 26, 2020 — Fernley, NV
My wife is so blinded by these new lights that she's just about given up driving at night. Please stop the madness!

B.1236 January 26, 2020 — Hamburg, NY
I am blinded by them. Very dangerous.

B.1237 January 26, 2020 — London, ENG, United Kingdom
It needs addressing

B.1238 January 26, 2020 — Newark, DE
I'm professional truck driver and the lighting systems that are being used in newer model vehicles and commercial trucks also have in many occasions caused me to have to brighten my headlights in order for me to be able to see the road that I'm traveling on. That's because the glare cause by these types of headlights on my windshield is blinding me, specially at times when it's raining (at night) or after it finishes raining and the roads are still wet.

B.1239 January 26, 2020 — Oakland, CA
I thought only older drivers were impacted by these brighter headlights but it's ALL drivers. These headlights are just too bright and the flat is endangering other drivers.

B.1240 January 26, 2020 — Oakland, CA
Overly bright vehicle lights cause me eye pain and headaches. We need a national standard for head lights and tail lights in the subject of brightness.

B.1241 January 26, 2020 — San Francisco, CA
I am signing because the glare of these lights at night make it impossible to see pedestrians crossing the street.

B.1242 January 26, 2020 — Sanford, FL
I hate people who drive around at night with high beam headlights.

B.1243 January 26, 2020 — Shawnee, KS
Early bird

B.1244 January 26, 2020 — Stockton, CA
Blinding headlights make the roads dangerous for everyone especially in poor weather conditions. They make it hard for me to see the lines on the road or watch for bikes and pedestrians. I don't want to injure anyone or be injured.

B.1245 January 27, 2020 — Hollister, CA
This issue is out of control. About half of the vehicles are so bright even looking to the right edge of the road doesn't help. I'm not usually in favor of over regulation, but something must be done to stop the selling of these dangerous lamps.

B.1246 January 27, 2020 — House Springs, MO

Newer vehicles have lights around the headlights, the running lights are bright white, is there no regulation or restrictions on how bright they can be as long as there technically

B.1247 January 27, 2020 — Pipestone, Canada

They are dangerous to others !

B.1248 January 27, 2020 — Sunnyvale, CA

I've experienced problems with the new headlamp brightness over the past few years.

B.1249 January 27, 2020 — West Columbia, SC

They need to ban aftermarket LED lighting kits. Those are the true hazard.

B.1250 January 27, 2020 — egg harbor, NJ

Police cars need to be included in this. Their lights are seriously blinding drivers. I worry that when I see police lights, I cannot see anything but their lights. Very dangerous.

B.1251 January 28, 2020 — Morrow, GA

Agreed, when they keep all of their outside car lights on it's blinding even looking the opposite direction because they reflect off of everything

B.1252 January 28, 2020 — Villa Park, IL

LED headlights are the WORST! They blind everyone on the road and are extremely dangerous in snow and rain!

B.1253 January 28, 2020 — elwood, NY

As a car travel down the road and the light beam moves with the road the increasingly brighter lights get more and more dangerous as the beam passes over the driver. I've noticed it with many newer cars a half mile or more down the road and the light are blinding.

B.1254 January 29, 2020 — Bennington, VT

I agree light are to bright especially LED light some times i have to slow right down to 10mph from like 50mph

B.1255 January 29, 2020 — Dallas, TX

I shouldn′t be blinded by a car′s headlights when they are 30 yards behind me in another lane.

B.1256 January 29, 2020 — Lynn, MA

LorettaWongus-Carter

B.1257 January 29, 2020 — Lynn, MA

These lights are so dangerous. I can′t″r even make out the road because I just see bright lights. I try to avoid driving at night because of this. It′s Terrible

B.1258 January 29, 2020 — Media, PA

These lights are accident prone. Blinding and should be illegal.

B.1259 January 29, 2020 — Newbury, MA

I agree. Dangerous to all. Trucks with these lights are blinding. Lights do not have to be this bright for adequate sight. Adding fog lights to cars can help without blinding.

B.1260 January 29, 2020 — St-Eustache, Canada

HID & LED should be banned off our roads. A lot of the headlights on the vehicles are not properly installed and shouldn′t be over a certain amount of lumen in the lights of a vehicle. I would compare some vehicles like a Christmas tree, so much that they have up to 2 HID/LED headlights one above the other on each side and not to mention that they also have an LED string around them for decoration. These are just blinding for others. If they were low mounted like the Fog lights, it wouldn′t be such an issue but unfortunately we literally have to turn our heads away from the road when passing by. It′s like when you look up to the sun for a second and then try to refocus... we are

clearly blinded. Nowadays, trucks, buses and pickups has them and they're all at the face level because of the hight. Not to mention that when they follow you, the inside of your car is completely lighted up. They should be a law to make sure that the lights on each vehicle are properly installed and only by its manufacturer. The beam lights should be leveled within the original casing of the car brand and should never be installed by others. It's enough, a lot of people can no longer take these. Here are the regulation in Quebec, Canada. https://saaq.gouv.qc.ca/en/road-safety/modes-transportation/automobile/modified-cars/xenon-headlights/

B.1261 January 29, 2020 — Virginia Beach, VA

It's important to save lives

B.1262 January 29, 2020 — Winchester, MA

This is a preventable, dangerous situation.

B.1263 January 29, 2020 — Woodford, VT

These headlights are very dangerous to motorists whether they are coming at you or behind you you literally can't see! At night is the worst time!

B.1264 January 29, 2020 — portsmouth, NH

It's dangerous and blinding, it's worse than high beams !!!!

B.1265 January 30, 2020 — Las Cruces, NM

Slowly but surely I'm feeling forced to drastically reduce and/or completely stop my night driving because of these ridiculously dangerous headlights. Maybe some night the only vehicles on the road will be those using these type headlights & they can just blind each other!

B.1266 January 30, 2020 — Stratham, NH

Night time is a difficult time for me to drive at Baseline. When those bright bright lights are coming at me I am blinded. When the lights are behind me I am distracted as I use my left hand to cover my driver's side mirror

B.1267 January 31, 2020 — Big Laurel, KY

They blind oncoming driver and going to cause a lot of wrecks and fatalities

B.1268 January 31, 2020 — Chicago, IL

Headlights are extremely blinding!!!!!! Please do something!!

B.1269 January 31, 2020 — Felixstowe, ENG, United Kingdom

I'm sick to death of being blinded.

February 2020

B.1270 February 2, 2020 — Princeton, WV

If you need headlights that bright to see to drive, you don't need a driver's license.

B.1271 February 3, 2020 — Toronto, Canada

I'm blinded every night coming home from work. People need to at the very least limit their use of the "high beam"

B.1272 February 4, 2020 — Columbus, OH

I have to drive every night in the dark and it's awful if it's a truck with these lights behind my car because then I definitely can't see! These lights are horrible and should never have been allowed to be installed. Now Sylvania has a commercial talking about how great they are and it makes me want to scream

B.1273 February 4, 2020 — Duquesne, PA

I drive to work each morning around 6:15am when it is still dark out. Most mornings my view is obstructed or impeded by someone approaching me or following me with those dangerous LED

headlights and it is especially dangerous in wet weather conditions when the lights reflect off of the wet pavement.

B.1274 February 4, 2020 — Fredericksburg, VA

These lights are a hazard.

B.1275 February 4, 2020 — Glasgow, SCT, United Kingdom

My brother is suffering with this problem and many others I know

B.1276 February 4, 2020 — Tinton Falls, NJ

I can only see spots after that BMW blinded me.

B.1277 February 4, 2020 — West Long Branch, NJ

Carolyn Barnes

B.1278 February 5, 2020 — London, Canada

These lights may make the 1 person driving the vehicle with them installed feel more safe but the other 50 or more cars that they drive past (oncoming) are blinded! I can't count how many times i haven't been able to see or had to squint or even close my eyes because the brightness is so intense. Or when they are behind me, the whole cab of the truck lights up and every side mirror and rear-view mirror makes it even worse, the lights hit me from everywhere!

B.1279 February 6, 2020 — Dupo, IL

I signed because they are blinding and lately drivers are in such a hurry that they will sit with these blinding white leds on behind you till you speed up way past the speed limit and 5 miles over limit that cops allow

B.1280 February 6, 2020 — Dupo, IL

I agree with the potintioner 100% we are being blind by the bright LEDs when obeying the law.

B.1281 February 6, 2020 — Rushworth, Australia

These LED headlights are blinding oncoming traffic. They are brighter than most high beams and people will be blinded and run off the road and be killed.

B.1282 February 8, 2020 — Santa Cruz, CA

These lights BLIND ME

B.1283 February 9, 2020 — Oldsmar, FL

Not just LED headlights, but also LED streetlights!

B.1284 February 9, 2020 — Sobieski, WI

Incandescent bulbs are safe and have proven to be safe for many years LED bulbs blind incoming traffic and blind from behind perhaps the driver with the LED bulb can see better but the people around them have to have their eyes hurt as a consequence I could see these causing many accidents.

B.1285 February 9, 2020 — Toronto, Canada

too damn bright for us older drivers. We're already at a disadvantage.

B.1286 February 10, 2020 — Grand Isle, U.S. Outlying Islands

It's truly a Hazzard.. especially in our small towns.. you hget blinded

B.1287 February 10, 2020 — Portsmouth, United States

I am struggling to drive at night. I find it hard to tell if someones high beams are on or not. I hate the new led lights. They are just too bright

B.1288 February 10, 2020 — gig harbor, WA

I have spoken with several individuals of all ages who complain about the brightness causing distortion. It doesn’t matter your age. They are a hazard to driving

B.1289 February 11, 2020 — Augusta, ME

These lights are extremely dangerous and blinding to other drivers at night and during the day. There is no good reason or applicable safety reason to allow these lights on vehicles. Please listen to the data and to the AMA and ban LED lights on all motor vehicles.

B.1290 February 11, 2020 — Bellingham, WA

Those lights are horrible.

B.1291 February 11, 2020 — Bellingham, WA

They cause me to not be able to see for several seconds after one of these vehicles passing by me at night.

B.1292 February 11, 2020 — Magalia, CA

The new lights are blinding and distracting. They make driving by more difficult and have made greater the possibility of driving accidents and fatalities. Please outlaw these!

B.1293 February 11, 2020 — Sonora, CA

Carol Fairchild

B.1294 February 12, 2020 — Akron, OH

I have Lupus. Anytime I come across these headlights.. I AM BLINDED! My life and those around me are in danger. Whoever came up with these needs slapped!

B.1295 February 12, 2020 — Cheshire, United Kingdom

Yes, I almost hit a cyclist (riding with no lights) last night because I was blinded for a few seconds.

B.1296 February 12, 2020 — Cheshire, United Kingdom

I try to avoid driving at night these days - they are bliding and so dangerous. Surely the people who design them must be aware when they are driving themselves. Yes, it's impossible to tell if they are on beam or dipped. Even when dipped they are more blinding that the older lights are on full beam.

B.1297 February 12, 2020 — Cheshire, United Kingdom

And traffic lights

B.1298 February 12, 2020 — Cheshire, United Kingdom

I agree, although I never had/have a problem seeing with my old style lights.

B.1299 February 12, 2020 — Cheshire, United Kingdom

Yes, I almost hit a cyclist (riding with no lights) last night because I ws blinded for a few moments by oncoming traffic with those awful lights. Honestly, sometimes they literally make my eyes feel like they are burning.

B.1300 February 12, 2020 — Cheshire, United Kingdom

These lights even on dipped are much worse than old style lights ever were on full beam!

B.1301 February 12, 2020 — Dallas, TX

Please join our new Facebook group to further discuss news and research about the dangers of HID and LED headlights. I am happy to see how many people have signed this petition and I hope we can continue to collaborate to get headlights regulated appropriately. The group is called "Are LED Headlights Dangerous?"

B.1302 February 12, 2020 — United States

I agree with this the facts in this petition. These type of headlights are very dangerous.

B.1303 February 12, 2020 — milton, FL

The lights could at least be properly aimed. I flashed my lights once and the oncoming vehicle really blinded me when they hit their brights !

B.1304 February 13, 2020 — Auxvasse, MO

퓛퓮퓲퓰퓕퓫 퓜퓸퓻퓻퓲퓻퓸퓷

B.1305 February 13, 2020 — Cocoa Beach, FL

This is truly a real problem!

B.1306 February 13, 2020 — Lenoir, NC

Blinding lights are dangerous and cause accidents everyday.

B.1307 February 13, 2020 — Marshall, WI

How the use of these blinding lights on motor vehicles on U. S. roads was ever allowed in the first place is a huge miss / failure on the part of the government agencies meant to protect us. Their increasing use on tractor trailers cabs - where the headlights are higher and therefore more blinding - make this issue even more urgent. And as an avid walker as well as driver, I have to cover or shield my eyes from oncoming traffic at night because of the insane intensity of these new lights. Let's please roll back this technological advance to some kind of sane permitted national standard that doesn't offend / disable oncoming drivers and other users of our roads.

B.1308 February 13, 2020 — TX, United States

Bright LED lights are blinding for me and give me terrible headaches, which have made it nearly impossible for me to drive at night.

B.1309 February 14, 2020 — Canada

the old halogen headlights are the only things making our roads vibrant, headlights should only be at least 2700k or lower thank you

B.1310 February 14, 2020 — Fort Scott, United States

I am easily blinded at night now.

B.1311 February 14, 2020 — Hastings, MN

I have been blinded several times my these new headlights and don′t understand how car manufacturers can possibly claim they are safe. Especially when they′re on a truck!

B.1312 February 14, 2020 — Hogansville, GA

It′s hard enough to drive at night and then to be blinded by theses lights.

B.1313 February 14, 2020 — Ringgold, GA

I am tired of being blinded by those super bright lights.

B.1314 February 14, 2020 — Sulphur, LA

I have astigmatism. I have to actively close my eyes any time someone has these.

B.1315 February 14, 2020 — Toronto, Canada

These headlights blind me at night, and trigger some truly horrible headaches as well.... that′s not safe on the road, night driving is hard enough to begin with.

B.1316 February 15, 2020 — Acampo, CA

These lights must be eliminated for the sake of public safety. The blinding brightness of these lights are typically as bad as high beams at night, only full time! Personally dealing with this at night on two lane country roads, is aggravating and so unsafe. It makes no sense for lights to be this bright, much less legal.

B.1317 February 15, 2020 — Barrington, NH

I hate the white lights! So hard to see at night when they are coming at you!!

B.1318 February 15, 2020 — Fresno, CA

Nothing worse than blinding headlights Please ban the use of them

B.1319 February 15, 2020 — Galt, CA

Gloria Donaldson

B.1320 February 15, 2020 — LA, CA

Driving at night is becoming a dangerous ordeal. Cars headlights are too bright and i find i need dark glasses to dim the impossible non stop glare. Same foes for the red lights. It must be addressed.

B.1321 February 16, 2020 — La Mesa, CA

The headlight situation has become debilitating at times. If I get into an accident because of being blinded by the intensity of headlights, who is to blame? Will I be at fault? Will the car that's pulled up behind me and hauls A— after I crash, will they stick around so I can get their info??? Hardly!!! What are we to do??? HOW HAVE THESE BECOME LEGAL??????

B.1322 February 16, 2020 — Pittsburgh, PA

If you buy a new car and don't remove the new blinding ones you are part of the problem.

B.1323 February 17, 2020 — Lagrange, GA

I'm signing cause I CAN'T SEE with these things glaring into my car. Even if you reposition mirrors they are still blinding and a total distraction.

B.1324 February 17, 2020 — Llandrindod Wells, United Kingdom

I'm one of thousands who no longer drives in the dark due to being blinded by modern car headlights on twisting country roads! I'm a confident and competent driver and feel I am sadly losing my freedom due to this common issue. Lorries lit up like Christmas displays are a danger too as many drivers are distracted from concentrating on the road by their fancy lights!

B.1325 February 17, 2020 — MILFORD hz, WLS, United Kingdom

I agree

B.1326 February 17, 2020 — Salisbury, NC

These lights are terrible.

B.1327 February 18, 2020 — Fort Myers, FL

I'm tired of being blinded and I don't want to have an accident caused by said blinding. There are high beams and low beams for a reason... so you don't blind people driving on busy streets and cause accidents.

B.1328 February 18, 2020 — Ladoga, IN

These lights are dangerous. They literally blind me.

B.1329 February 18, 2020 — Liverpool, United Kingdom

I have regularly been blinded while driving passengers at work. And in my own vehicle. They are dangerous no argument about this fact. The end.

B.1330 February 18, 2020 — Sugar Grove, IL

I'm constantly being blinded by the LED

B.1331 February 19, 2020 — Longs, SC

I am sick and tired of being blinded at night because of these ridiculous headlights. Not only are they annoying and glaring but they are dangerous to drivers. They need to be gotten rid of!

B.1332 February 19, 2020 — Portland, OR

I have been close to blinded by these strong lights and almost went off the road many times. I'm starting to be anxious about driving at night and that is very limiting.

B.1333 February 20, 2020 — Deal, ENG, United Kingdom

I'm angry my driving is being impaired by on coming cars with led lights. It must be banned

B.1334 February 20, 2020 — Worcester, PA

I am an optometrist. LED headlights are causing problems for drivers of all ages. In my younger patients the LED lights cause them to over focus and their eyes suddenly act a lot more nearsighted, in older eyes blue light scatters more than any other wavelength of light. See my journal article for further info: https://www.reviewofoptometry.com/article/seeing-blue-the-impact-of-excessive-blue-light-exposure

B.1335 February 21, 2020 — Detroit, MI

The headlights, taillights, LED signs are blinding and dangerous. First responder vehicle lights are exponentially more bright. Unnecessarily bright at night. I'm afraid it will cause more accidents as people must look away in order to preserve sight

B.1336 February 21, 2020 — Lancaster, CA

These headlights are so dangerous. Gotten to the point I can't even drive at night. They just totally blind you. People have survived with regular headlights for many years why do we need these things that are going to cause accidents?

B.1337 February 21, 2020 — Reno, NV

I can not drive at night any longer because of the outrageously bright headlights! If I do, I usually get a bad headache and I am sick of it! Bright headlights are dangerous and uncalled for!

B.1338 February 21, 2020 — watertown, MA

They are so dangerous with the extreme contrast at night, between the headlights in front, behind, maybe addl sides, you lose the grey areas...like pedestrians, cyclists, scooters, skateboads, motorcycles, kids, dogs; even other cars nearby in your rearview disappear on a multi-lane road. Add rain at night. Glare from the wet road reflecting these beams at now more angles really fully blinding most ppl, for maybe small amounts of time but that's all it takes for a person, dark winter coat, to step into a crosswalk. A lot of people dont feel safe driving, walking, cycling at night. I commute from city to suburb and it's harrowing most nights. They are migraine inducing as well. So how many ways do these things need to be a menace before they stop putting them in these cars? Who is responsible for accidents being caused by these poorly thought out and hazardous headlamps?!

B.1339 February 21, 2020 — watertown, MA

They are so dangerous with the extreme contrast at night, between the headlights in front, behind, maybe addl sides, you lose the grey areas...like pedestrians, cyclists, scooters, skateboads, motorcycles, kids, dogs; even other cars nearby in your rearview disappear on a multi-lane road. Add rain at night. Glare from the wet road reflecting these beams at now more angles really fully blinding most ppl, for maybe small amounts of time but that's all it takes for a person, dark winter coat, to step into a crosswalk. A lot of people dont feel safe driving, walking, cycling at night. I commute from city to suburb and it's harrowing most nights. They are migraine inducing as well. So how many ways do these things need to be a menace before they stop putting them in these cars? Who is responsible for accidents being caused by these poorly thought out and hazardous headlamps?!

B.1340 February 22, 2020 — Caspar, CA

I am really offended by overly bright headlights. It's hard to believe they are legal, considering how dangerous they are. I have to shield my eyes and hope I'm seeing enough to continue.

B.1341 February 22, 2020 — Duncannon, PA

I experience this everyday.

B.1342 February 22, 2020 — Elk Grove, CA

Im being blinded to the point of danger.

B.1343 February 22, 2020 — Sacramento, CA

Please ban all blue-light technologies on vehicles and keep tail-lights, brake-lights and turn signals at a maximum brightness no greater than that allowed for traffic signals.

B.1344 February 23, 2020 — Fresno, CA

Long over due

B.1345 February 23, 2020 — Los Angeles, CA

I can't tell you the number of times my vision got fucked because some guy went and installed bright ass LEDs on their headlights. Why these people aren't charged with reckless driving or whatever is outrageous. Most all of them don't even have the decency to get the lights calibrated to be tolerable on the road. It's worst than getting tailgated, because atleast with tailgating I can fucking see

B.1346 February 23, 2020 — Philadelphia, PA

So glad there's a petition for this. Just within the past year or so this has become more noticeable and it's becoming a big problem. They are so overly bright even when I'm not looking directly at them it seems like there's a stadium light shining in my eyes. I have to use my hand to shield my eyes becuause the brightness is so harsh. I'm only in my 30's and wasn't expecting to have issues with driving at night for another at least another 20 years. It's not just a problem with car headlights either. Some street lamps in my area have been upgraded to LED and the glare from those hurts my eyes while driving too.

B.1347 February 23, 2020 — San Diego, CA

I'm signing because I am constantly blinded by these headlights lately. These are dangerous. I have to choose between either being blinded when a driver with these lights is behind me, or seeing out of my mirrors because the only way to see is to adjust my mirrors so that they reflect the light away from me. But this means that I cannot see out of my mirrors! Not only are these lights blinding, but they are also extremely agitating and distracting. This is not only affecting seniors and those with vision impairments. I am 27 with pretty good vision and I am struggling to drive at night when these lights are behind me.

B.1348 February 23, 2020 — Virginia Beach, VA

The new headlights greatly impact my night vision and create a hazard for drivers even if high beams aren't used.

B.1349 February 24, 2020 — Graham, NC

I personally hate these headlights! They aren't any more effective than the old fashion soft white headlights and the only thing they are good for is blinding other drivers and putting people at risk for crashing. Especially in the rain.

B.1350 February 25, 2020 — Los Angeles, CA

I'm a 63 yr. old full time driver who has come very close to hitting pedestrians due to being blinded by these super bright lights. I feel that many (immature) drivers use these lights as weapons, and get pleasure out of annoying others. I wanna do my part to help dial it back before more lives are destroyed.

B.1351 February 25, 2020 — San Francisco, CA, CA

I drive at night and these lights make it more difficult to see.

B.1352 February 26, 2020 — Birmingham, AL

Modern headlights especially ACURA, Honda and Toyota are to bright. They cause you to temporarily be blinded.

B.1353 February 27, 2020 — Alliance, NE

It is getting harder and harder to drive safely at night. In Nebraska, lots of people spend hours on the highway and I have almost been ran off the road meeting some of the vehicles with these lights. They also cause macular degeneration which is irreparable damage that causes blindness.

B.1354 February 27, 2020 — Eugene, OR

These bright lights are dangerous!

B.1355 February 27, 2020 — Lincoln, NE

I often notice the lights of oncoming cars are quite blinding and different from the lights that we have always seen. Please go back to the original headlights so that we do not have this be yet another road hazard. Thank you.

B.1356 February 27, 2020 — Mesa, AZ

Blue light spectrum is blinding, destroys your night vision, and completely unnecessary, all headlight should be yellow like how it was not even 15 years ago

B.1357 February 27, 2020 — NY, United States

I'm in favor of preventing light pollution and this is a big contributor. Not to mention the obvious potential for accidents and harm.

B.1358 February 28, 2020 — Berea, KY

I hate them they blind you

B.1359 February 28, 2020 — Goshen, IN

I can and I need to.

B.1360 February 28, 2020 — Union, MI

I'm signing this because blue light is not good for the eyes, and it's super blinding and damaging to the cornea. Many studies show this and I want to do my let you help spread health and wellness.

B.1361 February 28, 2020 — Versailles, KY

Blinding LED Headlights are a danger to drivers and should be banned to help save lives .

B.1362 February 28, 2020 — salvisa, United States

Signed

B.1363 February 29, 2020 — Bronx, NY

I despise those lights, they blind me

B.1364 February 29, 2020 — Carlsbad, CA

The Auto Club is wrong...drivers will never get "acclimated" to these headlights, but continue to be endangered by these blinding lights.

B.1365 February 29, 2020 — Dunkirk, NY

Let's not lose lives for annoying headlamps plz I do dislike them too.

B.1366 February 29, 2020 — Mahopac, NY

I flipped my car over 4 days ago. Actually wnet airborne 15 feet in the air and landed upside down on account of being blinded by LED lights in oncoming traffic. Luckily no one else was involved, I was able to walk away with scratches, bumps and bruises. My car a total loss. Thankfully, it did it's job an kept me cocooned in safety bags. These led lights are disgusting, and so selfish. They need to be banned!

B.1367 February 29, 2020 — St Charles, MO

These lights are dangerous!

March 2020

B.1368 March 1, 2020 — BRISTOL, ENG, United Kingdom

It so dangerous to the income driver

B.1369 March 1, 2020 — Bronx, NY

As a driver, I believe there a driving hazard. Extremely dangerous.

B.1370 March 1, 2020 — Covington, TN

They blind the heck out of you while trying to drive

B.1371 March 1, 2020 — Goonellabah, Australia

I was driving on a back road one night and was being tailed by a car with blinding lights so had to point my rear view down. Suddenly another car approached with blinding lights and I could not see the edge of the road and wound up in a ditch requiring road service, wheel rim repair and a new tyre. It could have been much worse. These lights also give me mild headache like lasers and I believe they should be banned and all production ceased with full scientific and medical investigation done.

B.1372 March 1, 2020 — Kyogle, Australia

Unnecessary bright lights are dangerous!

B.1373 March 1, 2020 — Lismore, Australia

These new headlights are so dangerous. Can we have the old ones back please. They don′t help the driver and blind the people in oncoming cars.

B.1374 March 1, 2020 — Newport, MI

The lights are extremely distracting. Especially at night

B.1375 March 1, 2020 — Seattle, WA

Due to the brightness of these lights, it now takes longer for my eyes to adjust back to normal after having them blind me starting from quite a distance away. It′s not only dangerous it′s also very annoying!!

B.1376 March 1, 2020 — St Charles, MO

It′s awful. I see them and it′s a shock.

B.1377 March 2, 2020 — Detroit, MI

These lights are so blinding!! It′s going to, if it hasn′t already, cause accidents!! I get totally blinded and I′m mad about it!! How can they allow this? No different then me driving around with MY brights on!!

B.1378 March 2, 2020 — Lancaster, NY

Finally some much need attention to this.

B.1379 March 5, 2020 — Antioch, TN

I have night blindness and these make it IMPOSSIBLE to see when coming either toward or in rear view 郎

B.1380 March 6, 2020 — Charleston, Canada

This is definitely an issue for anybody. These LED headlights blind everyone and they aren′t any more effective than the old fashion headlights but instead all they are good for is blinding other drivers. Banning these headlights should′ve been done long ago

B.1381 March 6, 2020 — Sacramento, CA

I think all these new supersonic headlights whether factory OEM on new cars and trucks or aftermarket bought from the auto parts store, are extremely annoying and down right dangerous, I get almost completely blinded by mostly every other car or truck coming at me with those LED or projector style LED′s, takes awhlie for my eyes to recover, these new headlamps can′t be any good for anyone′s eye sight as well, it′s just ridiculous!

B.1382 March 7, 2020 — Altoona, United States

I can′t see the road or or a person should one come in front of me if a car with these lights are coming at me.

B.1383 March 7, 2020 — San Pablo City, Philippines

Blinding headlights are dangerous.

B.1384 March 7, 2020 — United States

The headlights are dangerous and extremely irresponsible!

B.1385 March 7, 2020 — gateshead, ENG, United Kingdom

these lights are to bright

B.1386 March 8, 2020 — Pratt, United States

My wife had lasik eye surgery and has issues with bright lights star bursting. These insanely bright lights virtually blind her when cars are coming towards her or behind her. I also have mild light sensitivity and these lights blind me as well so I can only imagine. These lights create dangerous driving conditions for everyone including those who use them because they blind other drivers. Please save lives and everyone's eyes.

B.1387 March 9, 2020 — Federal Way, WA

Save lifes

B.1388 March 9, 2020 — Little Falls, NJ

Anthony Cunningham Sayreville,New Jersey

B.1389 March 10, 2020 — Kennewick, WA

this is good, unironically

B.1390 March 11, 2020 — Columbus, OH

Cindi Fox

B.1391 March 11, 2020 — Port Orchard, WA

These lights hurt your eyes.

B.1392 March 12, 2020 — Birmingham, AL

They ARE dangerous! I am literally driving blind when a car with HID or LED is in front or behind me. I have a panic attack every time I have to drive in the dark because I can't see where I'm going. Praying that I don't run off the road and kill myself or someone else. We've gotten by just fine with normal headlights!!! Not everyone can afford the headlights or a new fancy car with them already installed. So the driver with death ray headlights can see 5 miles up the road but I can't see a single thing, that just doesnt make sense. People in my hometown used to get tickets if they had the blue halogen lights, but now it's a norm. It's not a "safety feature" it's a freaking safety hazard because one person is putting multiple people in danger and it's getting rediculous. When you drive at night your pupils naturally dilate. And then when you pass a blinding light that looks bright as the sun, it's painful! And then your pupils naturally try to contract and then you can't see whats in the dark anymore. It's simple science and we shouldn't have to fight this that hard!

B.1393 March 12, 2020 — Palm Springs, CA

I have been at the brink of fatal accidents because of blinding headlights it should be prohibited !!!!

B.1394 March 12, 2020 — Trenton, MI

FIX FOR BLINDING LIGHTS HERE!!! PAY THE JERKS BACK! MAKE THEM SEE HOW YOU FEEL!!! I HAVE HAD IT BEING BLINDED. I bought a 14x14 mirror with a handle and a hole at the end, I first stabilized the mirror on the flat part behind the back seat with some masking tape, it holds but doesn't mess with that area , i threaded the string thru the hole of the mirror handle, then at the top of the back window i taped down a small U shaped piece of plastic to thread the string thru, then i looped the string thru the passenger above window handle, then thru my handle above my door, the string hangs down for me to reach, when a BLINDING vehicle gets behind me, i pull that string, the mirror goes up, and WAAAALLLAAAA that driver is blinded by his OWN LIGHTS. They immediately go around me having no idea what hit them!!!! So, this fixes the rear. For the front i have a boat searchlight, i am careful to only blind someone at stoplights who are blinding me on the other side. I can use this on rear drivers as well, but the mirror is perfect for that. I will continue to terrorize them like they have me until the LAW does something about this ALLOWED dangerous practice. I don't even wear glasses and i REFUSE to buy night glasses because of these A*******. Besides, they don't work very well. Car Jockey's installing these saying pointing these lights down makes a difference, that is BS, it only makes a bit of difference, these car jocks just want to keep getting paid to change lights. A LOT of pickup drivers buy these lights with brand new vehicles. So,

fight fire with fire. Give them a dose of there own meds. For they don't care there blinding us at ALL! We have been fighting this for years, and lawmakers still DO NOTHING. Driving is no longer pleasant, they have laws against TEXTING, but none on this! Just as dangerous! Why???

B.1395 March 12, 2020 — Trenton, MI

Read my response just above you, i have a fix for these rude idiots. It really works, at least for the ones behind you. These Bad LED lights are not factory installed, people buy brand new trucks and change the lights right after. After begging lawmakers, i have taken this into my own hands. More people need to, then the blinding light drivers will start complaining, it will be hilarious. Paybacks.

B.1396 March 13, 2020 — Arbor Vitae, WI

I drive a medical transport at night. Constantly blinded from oem and aftermarket led lights.

B.1397 March 13, 2020 — Memphis, TN

America is a country with no discipline.

B.1398 March 13, 2020 — Peterborough, ENG, United Kingdom

These LED headlights are a real nuisance and causing problems to eyes, they are blinding and even worse in suv's and 4x4's as they are higher up.. Nothing worse than a suv or 4x4 sitting close behind while driving and putting lots of pressure on as they blind you, it's even come to the stage where I've got out my car had a few words..

B.1399 March 15, 2020 — Cataula, GA

I agree with this 100%.

B.1400 March 29, 2020 — LONDON, ENG, United Kingdom

I have photophobia (which is quite common), and the blinding bright white headlights is very dangerous. It's not just the brightness, it's the colour temperature of the whiteness. Headlights are usually more a yellow tint, but these super white ones are dazzling and I've nearly crashed several times after being blinded by them.

B.1401 March 30, 2020 — Westland, PA

Why is it acceptable for people to be color blind but not acceptable to be blinded by brighter lights? Very Simple Request " TAKE A POLL" The poll I am getting is at least 40 % of the drivers don't like seeing these new headlight coming at them. Then why are GM Truck running light even brighter then the regular headlights? Why are jeeps interchangeable headlight low beam seam like they are full time high beams? Would it Kill our auto makers to TAKE A POLL to help protect the on coming drivers?

April 2020

B.1402 April 5, 2020 — Wootton, ENG, United Kingdom

I hate these lights, they don't need t o be so bright.

B.1403 April 7, 2020 — Portsmouth, United States

I am having to stop driving at night because the car lights actually HURT my eyes...PAIN...in my eyes.

B.1404 April 11, 2020 — Odessa, TX

I come very close to head on collision several times, I work driving a fuel transport in West Texas oilfields, on 2 lane no shoulder roads these way too bright lights people are changing to are extreamly deadly... I've been blinded (temp) and regained sight to find I've drifted over the center line... traffic is horrible out here and you get a line of cars bumper to bumper alot in the mornings and it can be deadly out here... please ban these headlights and save lives!

B.1405 April 12, 2020 — Puducherry, India

I'm a young driver who would like to live for a longer time and fight climate change and not die in a road accident before that.

B.1406 April 29, 2020 — Wickliffe, OH

Led street lights #1 . No diffusers , the brightest blue light they can find . Just wrong . Also the flashing lights off emergency vehicles, once again, the rawest unfiltered brightest beam of light being shined directly into motorists eyes. Did engineers even go to college ?

B.1407 April 30, 2020 — Garden Grove, CA

It's damaging to your eyes and dangerous while you can't see crossing pedestrian and other traffic.

May 2020

B.1408 May 6, 2020 — Conroe, TX

I can no longer drive at night due to people using these lights.

B.1409 May 7, 2020 — Mountain View, United States

These lights are dangerous and unhealthy!

B.1410 May 8, 2020 — Canberra, Australia

LED are excessive

B.1411 May 9, 2020 — Dallas, TX

We need laws in America badly to fight the people that are intentionally playing games with their headlights. I've been a truck driver for better than twenty years and many people know what they are doing I have to use a laser pen to force people to turn their damn headlights down and in some cases they refuse or simply can't because they have intentionally aimed their headlights too high. We Truckers are sick of it!!! The government allowed all this madness to happen they can fix what they broke.

B.1412 May 12, 2020 — Portage, United States

Surprised there are not more people who would like to address this issue. Thank you for starting this petition!!

B.1413 May 15, 2020 — Hurricane, UT

These god damn trucks man, it's 8 in the morning and you are literally choosing to keep your lights on. you're distracting and blinding oncoming traffic. ASSHOLES.

B.1414 May 15, 2020 — United Kingdom

It is a fact that it disturbs my vision whenever am driving pass a car, van whatever it may that uses LED lights. It's two BRIGHT

B.1415 May 16, 2020 — Cypress, TX

Ban bright headlights or allow tinted windsheilds

B.1416 May 20, 2020 — Sweet Home, OR

Please feel FREE

B.1417 May 20, 2020 — Sweet Home, OR

Feel FREE to SHARE with your Peeps!!!

B.1418 May 20, 2020 — Sweet Home, OR

I Agree! And what happened to the studies they we're supposed to be performing at two different colleges in the Midwest? Each article I have read states that these new Blinding White Bright lights are not good for our eyes yet we can't seem to get them off the road.

B.1419 May 20, 2020 — Sweet Home, OR

AMEN !

B.1420 May 20, 2020 — Sweet Home, OR

I See This Too!

B.1421 May 20, 2020 — Sweet Home, OR
Yes!

B.1422 May 24, 2020 — Australia
Information from Australia https://samotor.raa.com.au/the-dangers-of-modern-headlights/

B.1423 May 24, 2020 — Canberra, Australia
Its time we put our bodies health first above any new technology

B.1424 May 25, 2020 — Australia
I hate being blinded by headlights on cars & bikes. Its dangerous!

B.1425 May 25, 2020 — Chicago, IL
We don't need extremely bright headlights. Yes, we need headlights in order to drive a car, but they can't be too bright.

B.1426 May 30, 2020 — Commerce, GA
Need to ban them

B.1427 May 30, 2020 — St Augustine, FL
Lane Miller

B.1428 May 30, 2020 — Summerdale, AL
I believe these lights cause more wreckage and night blindness when I encounter these on the road I usually have to come to an almost stop when they pass me.

B.1429 May 31, 2020 — Hawthorne, NJ
This is very dangerous! Please fix this issue before more lives are taken for such a small problem

B.1430 May 31, 2020 — United States
Because I cant see when people use those bright blinding lights

June 2020

B.1431 June 21, 2020 — United Kingdom
save lives all lives matter

B.1432 June 22, 2020 — Battle Ground, WA
I am BLINDED by headlights when I drive at night. Those coming towards me, and those behind me. The LED lights that are a blue hue should be illegal. The yellow hue is much easier on the eyes. I don't often drive at night because of the extreme glare from headlights, especially those on new cars.

July 2020

B.1433 July 1, 2020 — Epsom, ENG, United Kingdom
These lights increase the risks associated with driving and cause RTCs.

B.1434 July 6, 2020 — Hamilton, New Zealand
I have to pull down a very dark filter to nearly completely block my view of the oncoming side of the road.

B.1435 July 10, 2020 — Derby, ENG, United Kingdom
I find myself often having to stop in the road because I cannot see where I'm going due to stupidly bright lights equipped on oncoming traffic. The simple view of regulating lighting by their wattage is no long accurate, those standard were set when filament bulbs were the normal. Compare the lumen output from a 35w filament bulb compared to a 35w LED. Also newer lighting has much much blue light spectrum which scatters and is harmful to health. I believe the colour temperature should also be controlled and limited to no more than 4700k

B.1436 July 29, 2020 — Florence, KY

I work third shift and I HATE these lights!!!! They give me Migraines.

B.1437 July 30, 2020 — Australia

Sick of being blinded at night and am concerned about safety on the road

August 2020

B.1438 August 18, 2020 — ocala, FL

I've been ran off roads numerals times from these bright lights. They prevent a normal ability to drive at night. But they include unshielded streetlights shining for blocks away into private residences. And.... spotlights on houses pointing up & off owners property. In turn, this prevents residents from being able to walk for exercise! Bright lights disrupt circadian rhythms of all living beings, even plants. It appears most citizens don't care or perhaps just ignorant to the damage in process to this planet. Not to mention taking away our right to see the beautiful night sky. It's no wonder so many children have no knowledge of science since the simple joy of viewing the Cosmos thru a telescope is non-existent in many cities & towns. We used to be able to drive to the countryside to see the night sky but with so many home owners duped into believing these bright LEDs are healthy, many have these lights with no shields or covers, sending billions of $$ wasted energy into the sky per NASA.

B.1439 August 21, 2020 — Australia

I dislike large 4WDs behind me blazing these ridiculous lights in my mirrors. They don't focus well on the road, but rather spread light in all directions.

B.1440 August 21, 2020 — Buddina, Australia

I find driving st night challenging when oncoming vehicles have high intense white LED lights

B.1441 August 22, 2020 — MN, United States

I have had to pull off the road when these are behind me - blinding and dangerous!

B.1442 August 22, 2020 — Murfreesboro, TN

These lights are blinding! I already have trouble seeing at night and these make it worse. It's gotten to the point that if I don't know exactly where I'm going, I can drive at night because of these lights! And I'm only 50!!!

B.1443 August 26, 2020 — La Porte, TX

Excessively bright headlights have repeatedly made it to where I couldn't properly see while driving at night, causing me to nearly run a stop sign one time and nearly hit a pole on another. Ban these pointless safety hazards! No one needs them!

B.1444 August 27, 2020 — United States

I have almost ran off the road several times due to idiots failing to dim these lights. I hate meeting a car using HID. I took the HID headlights out of my housing as a courtesy to other road patrons.

B.1445 August 29, 2020 — Hayward, CA

BLINDING LIGHT HURTS MY EYES!!!!

September 2020

B.1446 September 3, 2020 — GAINESVILLE, FL

Those lights are blinding and have no place on public roads. Strictly off-road only!

B.1447 September 3, 2020 — Pensacola, FL

Don't forget the damn smart phones and such. -signed, a sportbike rider.

B.1448 September 7, 2020 — Bath, NY

Those lights are blinding , in back of you, or coming at you. Dangerous !

B.1449 September 7, 2020 — Rolla, MO

I've almost been run off the road when cars with these bright blue lights come from the other direction. The glare seems to negate any potential safety benefit to the driver of the car with the offending lights. We have high beams that can be toggled on/off for a reason! The blue also scatters more, causing light pollution and potentially making it harder to see in fog or snow.

B.1450 September 12, 2020 — Lockport, United States

I feel extremely unsafe driving with LED lights flashing in my direction. It makes it incredibly difficult and painful to drive with those lights directly in my eyes

B.1451 September 16, 2020 — Arlington, TX

I have severe light blindness

B.1452 September 18, 2020 — Keansburg, NJ

I've been blinded 1 to many times.

B.1453 September 21, 2020 — Auburn, AL

Your improved vision is not justified at the expense of others on the road. Use normal headlights or don't drive.

B.1454 September 28, 2020 — Bronx, NY

They are too bright and blinding. When they reflect on rear view and side mirrors they are also a nuisance.

October 2020

B.1455 October 2, 2020 — Halifax, Canada

2018+ Toyota Corollas are still the worst here in Canada. All new higher trucks, and even Acura SUVs with their new LED units too. What I won't stand for are the new Jeeps with their LED lights in the driving lights and fog lights. It's the most a-hole selfish thing I've seen. Worst than older civics with ebay bulbs.

B.1456 October 2, 2020 — Pompton Lakes, NJ

Because they are dangerous.

B.1457 October 7, 2020 — Brooklyn, NY

This extreme intensity of brightness can't possibly be necessary for the vast majority of driving situations. But this intensity and glare is dangerously blinding for oncoming drivers. Combine this with the huge popularity of SUVs and crossovers and these extremely bright lights seem to hit directly on eye level for drivers who are in passenger vehicles that sit lower to the ground. If the new, blinding lights are intended to be trained at the roadway, that's not what's happening. It's very stressful - even for a very experienced driver in a familiar area - to simultaneously avoid the oncoming car, parked cars along the road - and, especially pedestrians and cyclists. This seems to be part of a virtual arms race - much louder horns, much brighter lights. And the drivers behind these lights don't seem to realize the danger they are causing - including to the themselves. I don't know what else to do other than slow down - and flash my brights briefly at a distance to try and let the oncoming driver know their lights are too bright. I cannot fathom how blinding oncoming drivers can be allowed given the comparatively limited benefits to those with the brighter headlights. We want to encourage healthy public activity like running and walking and cycling. But I have found pedestrians and cyclists on my side of the road extremely hard to see when blasted with oncoming headlights trained at eye level.

B.1458 October 8, 2020 — Troy, MT

Because when confronted with these lights, I am temporarily blinded. Not safe.

B.1459 October 12, 2020 — La Puente, CA

I hate not being able to see well when driving and these lights make night driving terrible especially when it's a new suv or truck that accidentally turned on their high beams on top of their annoying led lights

B.1460 October 14, 2020 — Harrison, OH

the lights today are sooo bright they hurt my eyes and often trigger headaches and migraines

B.1461 October 14, 2020 — Jacksonville, NC

I'm signing because on a daily basis, I am unable to use my side view mirror to check lanes when driving to work due to these lights. When the interior of your car looks brighter than noontime sunlight at 5:30 in the morning, it's dangerous.

B.1462 October 15, 2020 — Gilmer, TX

LED headlights are blinding! Let's get rid of a totally needless danger on our roads.

B.1463 October 16, 2020 — San Antonio, TX

Super bright headlights are dangerous. There's no need for headlights that bright in a city or around other drivers. We have separate brights for a reason. Install them as your brights so you can have a lot of light when it's actually necessary without blinding other drivers.

B.1464 October 17, 2020 — Mission, TX

Those lights get me dizzy and I was close to crashing and fainting

B.1465 October 21, 2020 — Boise, United States

Bright LED lights are dangerous.

B.1466 October 22, 2020 — Jacksonville, FL

- YESTERDAY- THIS HAPPENED TO ME BECAUSE I COULD NOT SEE - Driving to a new workplace before daylight in a drizzling rain, no street lights, no visible road markings, tons of glare from oncoming hyper-headlights multiplied by the reflections on wet pavement made my visual acuity so poor that I turned into the near lanes of a divided highway... had to drive a half mile against traffic (thankfully sparse) before I found a paved crossover. This is not my first incident with hyper-bright LED blindness, just the latest. Even under ideal conditions I often can't see turn signals next to the hyper-headlights. I don't dare flash high-beams at a hyper-brights coming at me for fear that might be their low-beams blinding me.

B.1467 October 24, 2020 — Placerville, CA

I find it scary driving at night when I'm constantly being blinded by headlights that are way more bright than they ever needed to be

B.1468 October 27, 2020 — Crystal Lake, IL

I wasn't aware of this blaring problem until my shift changed and I leave my house by 4:30AM. Now that I drive through the dark every morning I am regularly blinded by cars. This is especially bad on curvy and hilly side roads. I thought some people were just driving with their brights on so I flased mine at them only to be assailed with their brights. It is so bad that I have to keep my sunglasses ready so I can put them on then take them off again so I can see without getting blinded. These do it yourself LED upgrade kits should be illegal, especially since they often beam straight ahead instead of aiming downward towards the road ahead of the vehicle. Trucks are especially egregious in this regard.

B.1469 October 29, 2020 — Bradford, ENG, United Kingdom

Super super dangerous

B.1470 October 29, 2020 — United States

These are so bad for our vision & they are blinding at times, esp for those with less than perfect vision. Some do it just to annoy people (turn them on before its dark) while other cars turn them on

automatically. Im sure they cause accidents, its like the blaring sun & at the LEAST are a huge safety hazard. Weve all had the regular lights, should stay that way

B.1471 October 29, 2020 — Wabamun, Canada

SHOULD BE ILLEGAL ABSOLUTELY BLINDING

B.1472 October 30, 2020 — Clermont, FL

As a professional class a cdl driver with over 30 years experience I'm surprised these blinding headlights are legal i am blinded consistantly at night to the point of almost crashing on certain sections of interstate and highway. Also so bright my eyes take time too recover these lights are gonna cause fatal accidents guaranteed

November 2020

B.1473 November 10, 2020 — Oklahoma City, OK

I'm signing because I'm tired of being dangerously blinded while driving. I'm for safety but safety for ALL drivers not just THE driver.

B.1474 November 11, 2020 — Leedstown, ENG, United Kingdom

These style lamps are far to bright and cause momentary night blindness. They are just dangerous to oncoming traffic. Plus they are bright enough to blind you to obstacles such as narrowing verges and pedestrians on country roads at night.

B.1475 November 14, 2020 — Everett, WA

These LED headlights are completely blinding and dangerous on the road!

B.1476 November 14, 2020 — Lynnwood, WA

These lights are a hazard. Causing temporary blindness of other drivers and countless other problems that a light that bright presents

B.1477 November 19, 2020 — Doagh, NIR, United Kingdom

Dangerous in the extreme!!!

B.1478 November 20, 2020 — Manalapan, NJ

These lights are too bright and blind on coming driver's

B.1479 November 20, 2020 — Monroe Township, NJ

They are so blinding in front of you and behind you . It's equal to hanging your brights on. What's the difference ? None !

B.1480 November 20, 2020 — Philadelphia, PA

I feel it affects all and it can cause accident

B.1481 November 21, 2020 — Peterborough, ENG, United Kingdom

These are going to cause a while bunch of accidents. But then why should I bother signing, it's just another tally for the government to add to population control.

B.1482 November 23, 2020 — Durham, NC

My mother was killed by flash blindness while driving.

B.1483 November 23, 2020 — Hastings, MN

LED lights are DANGEROUS! I've lost count of the number of times I've been totally and completely blinded by them and couldn't see where I was going but had to keep moving forward at the speed limit anyway because slowing down would have caused me to be rear ended.

B.1484 November 24, 2020 — Pittsburgh, PA

These lights are dangerous!

B.1485 November 25, 2020 — Hialeah, FL
That shits too bright

B.1486 November 27, 2020 — Los Angeles, CA
I agree that headlights have definitely gotten to an unsafe level of brightness over the years. More is not better when it comes to proper headlights.

B.1487 November 28, 2020 — Yorktown, IN
My wife and have almost crashed multiple times cause of people with led bulbs.

B.1488 November 30, 2020 — Greeley, CO
Blinded by the light...

B.1489 November 30, 2020 — Springfield, IL
Driving at night is difficult for me as is, without that blankety, blankety headlight glare.....

B.1490 November 30, 2020 — Thatcham, ENG, United Kingdom
LED MUST be banned !!!

December 2020

B.1491 December 1, 2020 — Auburn, IN
I'm tired of being blinded by o. Coming g vehicles with bright lights.

B.1492 December 1, 2020 — Rogers, AR
These lights are only beneficial to the person/person's driving the car in which they are installed but putting other drivers in harm's way

B.1493 December 1, 2020 — Tyler, United States
This shit gives me headaches and as the bright lights get closer, my eyes can barely see the lines and what is ahead of me. And I have perfect eyesight, imagine what it's like for someone with out perfect eyesight to see, other than blinding ass headlights, that of which are sometimes worse that other vehicles bright headlights.

B.1494 December 2, 2020 — Targoviste, Romania
Return to normality! The bad light kills!

B.1495 December 2, 2020 — Washington, DC
I'm signing because I care about the well-being of the people.

B.1496 December 3, 2020 — Constanta, Romania
I hope...

B.1497 December 3, 2020 — Eatontown, NJ
Can't see cause this shit

B.1498 December 3, 2020 — Endicott, NY
I hate the blinding LED headlights! It is dangerous for other drivers who don't have them and annoying to be blinded by assholes who want to be boss of the road!

B.1499 December 3, 2020 — Hope Mills, NC
I can't believe these things are allowed on the road. I can't see anything for several seconds when they pass and it's on many cars here.

B.1500 December 4, 2020 — New Brunswick, NJ
I have difficulty seeing at night and these just make it worse.

B.1501 December 5, 2020 — Arlington, VA
These lights blind drivers at night for several seconds and accidents are going to happen.

B.1502 December 5, 2020 — Dawson, GA
Tired of not being able to see when the LED headlights pass. They are gonna cause deaths.

B.1503 December 7, 2020 — Rochester, NY
I fucking hate led lights

B.1504 December 8, 2020 — New York, NY
Led lights are annoying

B.1505 December 8, 2020 — bedford, VA
These new lights are DANGEROUS!!!! IVE ALMOST BEEN IN A FEW ACCIDENTS BECAUSE I COULDN'T SEE!!!!

B.1506 December 8, 2020 — bedford, VA
These blinding lights need to be illegal!!!

B.1507 December 9, 2020 — Charlotte, NC
Night vision is hard enough for some but add these lights to the mix and they truly are dangerous!

B.1508 December 9, 2020 — United States
These lights have caused me driving issues after dark on my narrow country roads and I can't believe these headlights haven't already been outlawed. No brainer, they are hazardous!

B.1509 December 10, 2020 — Cary, IL
I want to be able to see at night when passing cars

B.1510 December 13, 2020 — Hialeah, FL
Kenneth Howison

B.1511 December 13, 2020 — San Diego, CA
It has been my experience over the last few years that it's becoming very unpleasant to drive at night. More and more cars have blinding headlights. Most annoying situation which is becoming all too common: SUV or pickup truck behind me or just on the left lane super bright lights blind me through my side mirror. In that situation I have only one option: raise my hand to block the light, which means essentially that I cannot see what's happening on the side, unless I accelerate or slow down so that they pass me. Anyway we need to ban blinding headlights. They are increasing the risk of accidents.

B.1512 December 15, 2020 — Arlington, WA
I'm afraid I will hit a walking pedestrian one day, due to not being able to see from the blinding headlights of these others drivers.

B.1513 December 15, 2020 — Wyoming, MI
I just watched a news story on how a car safety is pushing for companies to phase out halogens because LEDs are safer since you see farther; but nothing said about this issue.

B.1514 December 16, 2020 — Palm Coast, FL
The lights blind me terribly. I already have issues seeing halos around lights while driving at night and these lights are terrible.

B.1515 December 17, 2020 — Seattle, WA
Because Lights have gotten so bright and Dramatically in the past 2 years - it has to be addressed

B.1516 December 18, 2020 — Biloxi, United States
To hell with people who own these things. I vote we behead them publicly.

B.1517 December 18, 2020 — Norfolk, VA
I too have eight issues when people have auto- high beams.

B.1518 December 18, 2020 — Webster, NY

they are dangerous and annoying!

B.1519 December 19, 2020 — Saint Paul, MN

I can’t deal with being blinded day and night by these ridiculous lights. I’m glad you can see 1,000 miles ahead of you but it’s horrible for the rest of us. It’s gotten so bad that I have to move my side mirrors down because I can’t deal with the constant, painful brightness in my eyes. This needs to stop. NOW.

B.1520 December 20, 2020 — Barnhart, MO

Posted it and have talked to other people who feel like we do.

B.1521 December 20, 2020 — bucuresti, Romania

For life !

B.1522 December 27, 2020 — Silverado, CA

Anyone who suffers from even a slight stigmatism like I have had since I was 30 knows these LED are horribly dangerous. It's not just the lumens it's the blue light that is plain awful. People suggest you should just look away OMG how dumb is that!

B.1523 December 31, 2020 — Alvarado, TX

I'm so glad I found this, I've been saying how I don't understand how they are legal when they literally blind you, cause you to see spots, and distract from the road. They need to go

Comments left in 2021

January 2021

B.1524 January 2, 2021 — Truro, ENG, United Kingdom

From one who suffers migraines, these lights often bring them on, I hate them always having to shift my windscreen mirror

B.1525 January 4, 2021 — Ann Arbor, MI

These lights are incredibly blinding. I have stopped driving at night because of these horrid lights. And during the day, many are STILL blinding.

B.1526 January 4, 2021 — Howard, OH

Please ban. This type of headlights is going to cause many accidents and deaths that are unnecessary.

B.1527 January 4, 2021 — Lawrence, United States

I am deeply moved by this petition. I am not often an irate person and rarely feel that my options should be imposed to the masses but when it comes to the topic of headlight brightness I am incredibly passionate and have even considered starting petitions of my own. Thank you for creating this .... I feel very seen (but with the warm glow of a normal headlight not anything dangerously bright if you get my drift [which is what happens to my driving when I am blinded by an LED headlight])

B.1528 January 4, 2021 — Pointe au Baril, MI, Canada

I can't see when driving at night. It's more dangerous becuase of these lights.

B.1529 January 5, 2021 — Charlottesville, VA

This is a concern that doesn't only affect older drivers or people who may already be visually impaired. This is a concern for all people on the road.

B.1530 January 6, 2021 — Princeton, NJ

I am about to do further research online, but it is already obvious to me that the headlights I am exposed to as a driver and as a pedestrian, in daylight and in darkness, hurt my eyes -- in the same way that a glance into the sun hurts one's eyes. And everyone to whom I have mentioned this problem

has agreed that it hurts their eyes, too. Someone has to take action immediately, as the damaging lights are becoming more and more prevalent on the road, and it looks as if the NHTSA is the agency to whom the task of saving our eyesight must fall. It is interesting to hear that the excessively bright and blue headlights might be shown to be causing an increase in motor vehicle accidents -- I find that highly plausible, based on the lengths to which I have to go in order to protect my eyes while driving. And I am glad to hear that the American Medical Association has already taken a stance requesting that these damaging lights be banned. I also want to point out that the great benefit touted for LED lights -- reduction in electric power consumption -- does not apply in the case of a fossil-fuel-driven vehicle in which a standard alternator is used to generate 12-volt power; this technology, driving the lights and the entire onboard electrical system off the vehicle's engine as a byproduct of the fuel combustion, generates more power than is needed to light even the older-generation incandescent headlights, so no power saving is achieved by the switch to LED lights, except in the case of all-electric vehicles. This is another simple case of unintended consequences that arise when new technologies are adopted without sufficient prior testing for long-term harm. Please take action immediately! There is also an epidemic of macular degeneration leading to blindness in older folks, and it appears to be linked to the wholesale switch to LED lighting, both in vehicles and in our homes and workplaces.

B.1531 January 6, 2021 — Wabamun, Canada

The LED lights are so blinding that I put my visor down and this compromises how much I can see in front of me. I get headaches from too much exposure to these lights. Building and street lights are also ridiculously bright.

B.1532 January 7, 2021 — Halifax, Canada

We are past the ebay H1 in a civic days! It's 2021 and the latest and greatest culprits are: Any 2020+ Jeep with LEDs 2017-2018 Toyota Corolla 2019 Ford Explorer 2015+ Escalade 2019/2020 Subaru Forester 2019+ Honda Civic Also not all roads are level and here in Canada (ie - twinned highways) and we don't have self adjusting headlights. Recall all vehicles that have these lights!

B.1533 January 7, 2021 — Stonehaven, SCT, United Kingdom

i'm signing because i'm one of the many who struggle with exactly this problem.

B.1534 January 8, 2021 — Fayetteville, AR

These lights blind me because I can’t look at then head on. I have to look or wear sunglasses. These are dangerous and cause so much time and distraction from driving.

B.1535 January 14, 2021 — Le Roy, NY

I shouldn't need special shaded glasses to drive at night

B.1536 January 14, 2021 — Portland, OR

Overly bright, blue-rich white lights are unnecessary, waste energy, and are harmful to all forms of life.

B.1537 January 15, 2021 — Garland County, AR

These lights are annoying, far too bright and blinding.

B.1538 January 16, 2021 — Colorado springs, CO

I get blinded all the time when I'm driving and people don't seem to care.

B.1539 January 16, 2021 — Lansing, MI

I believe in safe driving and blinding lights are not safe

B.1540 January 18, 2021 — Chicago, IL

Because I'm tired of not being able to see when I'm driving. I'm doing this because driving at night I am blinded by the bright lights. I'm signing this also because I have a new teenager who will be driving who is already complaining while sitting in the passenger seat that they can't see past the cars coming in are concerned for my safety and theirs

B.1541 January 18, 2021 — Coal City, IL

I agree with this, but I am unsure what can be done to fix the problem. A large percentage of newly manufactured vehicles are produced with these lights. There are so many on the road today that were manufactured like that legally. What do you do about them?

B.1542 January 19, 2021 — Bilston, ENG, United Kingdom

I believe that some lights are far too bright and actual increase the risk of accidents happening

B.1543 January 19, 2021 — Newark, DE

I am a shift worker that has to drive at night. I regularly fear that I am going to get in an accident. These lights are dangerous and unnecessary.

B.1544 January 20, 2021 — Nashville, TN

I can't see

B.1545 January 21, 2021 — Warden, WA

At least start with trucks. They are in direct line of sight with opposing traffice

B.1546 January 22, 2021 — Pittsburgh, PA

I have only been driving for 6 years now, and HID/LED headlights have made those years miserable as soon as the sun goes down. I can barely see at night thanks to everyone driving their own miniature suns around and searing my eyes.

B.1547 January 23, 2021 — Crestwood, KY

horribly bright and blinding, so bad that in bad weather it makes it impossible to see

B.1548 January 25, 2021 — Plymouth, WI

I hate getting blinded by poorly aimed low beam lasers.

B.1549 January 26, 2021 — Shawnee, KS

Make the emphasis on the spectrum of light. That is what matters the most. Get rid of the blue lights,

B.1550 January 27, 2021 — Nashville, TN

It's time the DOT and Congress intervene as they did in the late 80s or 90s regarding headlight brightness. About 6yrs ago, I asked a young Nissan engineer Why the new bright blinding headlights; his reply with a smirk, "If we can save a buck...." These daylight headlights are extremely Dangerous. I, as do other friends, now wear sunglasses when driving at night in the city or on interstates. I also now always have the rear view mirror in "reflective" position, though that does NOT help if a truck or SUV is behind nor does it block blinding light in side view mirrors. With our US population getting older, blinding older drivers is hazardous to them and other drivers, as is the case for inexperienced young drivers. I'm also told by friends that replacing these horrible headlamps is incredibly expensive on certain high-end cars. Congress needs to ask. I'll be writing Pete Buttigieg and President Biden.

B.1551 January 29, 2021 — Cleveland, OH

I've experienced this blinding phenomenon and I think it's important for standards to be set regarding hue and brightness in the interest of safety.

B.1552 January 30, 2021 — Morgan Hill, CA

I'm a Truck Driver. I sometimes have a car beside me that I can't see because all I see is the LED lights on the car behind him. With LEDs coming twards me on a busy two-lane, I may not see the tail lights of the car in front of me.

B.1553 January 30, 2021 — Plainville, IN

I own a small trucking company and drive after dark. These headlights are dangerous to drivers. Cause blindness

B.1554 January 30, 2021 — San Bruno, CA
It's very frightening, and very dangerous not being able to see on the road. Also, those bright lights can cause headaches constantly in the rearview and sideview mirrors.

B.1555 January 30, 2021 — San Bruno, CA
It's frightening, and dangerous not being able to see while driving. I've also experienced the headache inducing effect with these lights constantly in my rearview and side mirrors.

B.1556 January 30, 2021 — San Bruno, CA
It's frightening, and dangerous not being able to see while driving. I've also experienced the headache inducing effect with these lights constantly in my rearview and side mirrors.

B.1557 January 30, 2021 — San Bruno, CA
It's frightening, and dangerous not being able to see while driving. I've also experienced the headache inducing effect with these lights constantly in my rearview and side mirrors.

B.1558 January 30, 2021 — San Bruno, CA
It's frightening, and dangerous not being able to see while driving. I've also experienced the headache inducing effect with these lights constantly in my rearview and side mirrors.

B.1559 January 30, 2021 — San Bruno, CA
It's frightening, and dangerous not being able to see while driving. I've also experienced the headache inducing effect with these lights constantly in my rearview and side mirrors.

B.1560 January 30, 2021 — San Bruno, CA
It's frightening, and dangerous not being able to see while driving. I've also experienced the headache inducing effect with these lights constantly in my rearview and side mirrors.

B.1561 January 30, 2021 — San Bruno, CA
It's frightening, and dangerous not being able to see while driving. I've also experienced the headache inducing effect with these lights constantly in my rearview and side mirrors.

B.1562 January 30, 2021 — San Bruno, CA
It's frightening, and dangerous not being able to see while driving. I've also experienced the headache inducing effect with these lights constantly in my rearview and side mirrors.

B.1563 January 30, 2021 — San Bruno, CA
It's frightening, and dangerous not being able to see while driving. I've also experienced the headache inducing effect with these lights constantly in my rearview and side mirrors.

B.1564 January 30, 2021 — San Bruno, CA
It's frightening, and dangerous not being able to see while driving. I've also experienced the headache inducing effect with these lights constantly in my rearview and side mirrors.

B.1565 January 30, 2021 — Sicklerville, NJ
Mark DeBiase

B.1566 January 31, 2021 — Wahoo, NE
They’re ridiculous, and flat out rude.

February 2021

B.1567 February 7, 2021 — San Diego, CA
Lights should adjust when cars are in lighting levels areas.

B.1568 February 9, 2021 — Waterloo, United States
I can’t see when driving

B.1569 February 10, 2021 — West Springfield, MA

It's getting to the point where I need to pull over until it's safe to continue driving. I also have a lot of trouble focusing and seeing on the road when they are behind me, forcing me to adjust my mirrors which is almost as dangerous as not doing so. Please make these headlights illegal for the safety of the people.

B.1570 February 13, 2021 — Australia

Ironically an avoidable dangerous hazard.

B.1571 February 14, 2021 — Erlanger, KY

I now have LED headlights, they are too bright. I have trouble seeing the road in the distance, it's like there is a line...because they have to aim down.

B.1572 February 14, 2021 — Saratoga Springs, UT

I'm tired of being blinded and fearful of getting in an accident because of headlights being so bright.

B.1573 February 14, 2021 — st andrews, SCT, United Kingdom

LED makesroads more dangerous and retinas less responsive

B.1574 February 15, 2021 — Charlotte, NC

Can't see at night with those bright headlights.

B.1575 February 15, 2021 — Hendersonville, NC

These lights are blinding and dangerous. I need to be on the road at night for work so I have no choice but to put up with them. I should not have to take my life into my hands every time I go to work because oncoming headlights are blinding me.

B.1576 February 15, 2021 — Kitchener, Canada

On far too many occasions I have been blinded by these lights. They are too dangerous!!!

B.1577 February 15, 2021 — Summerville, SC

I agree. No rules and now became a competition who has the brighter.

B.1578 February 15, 2021 — United States

They are making the road dangerous! I have had a lot of problems seeing the road due to these lights!

B.1579 February 15, 2021 — crosby, TX

I'm a truck driver and these headlights are too blinding.

B.1580 February 16, 2021 — Cincinnati, OH

These new lights are horrible at night and actually hurt my eyes.

B.1581 February 16, 2021 — Croswell, MI

These are terrible. It makes it so hard for me to drive.

B.1582 February 16, 2021 — Mt Vernon, OH

My husband is an over the road driver. He has been off work because the lights blind him at night and he is afraid of having an accident.

B.1583 February 16, 2021 — Summerville, SC

I'm signing because way too many times I have had to slow down and almost stop in the road because the lights coming up behind me or in front of me and blinding me and I can't see the road.

B.1584 February 17, 2021 — Flagstaff, AZ

I also find it dangerous because the blinding light blocks out other light coming from my rear view mirrors, making it impossible to clearly see other cars. This makes it very dangerous when changing lanes, or turning. It also takes my attention away as the brightness is painful and distracting.

B.1585 February 21, 2021 — Calgary, Canada

Cant see a damn wink when someone with led headlights passes by

B.1586 February 22, 2021 — Lehi, UT

So many times I′ve been blinded on the freeway and had to hold my hand up to cover my side mirror to see. Also, I feel like some cars always have their brights on.

March 2021

B.1587 March 3, 2021 — NC, United States

These lights are blinding to oncoming traffic putting many people at risk of an early death. BAN THEM NOW!!!!

B.1588 March 4, 2021 — Nashville, TN

I′ve not had an accident Yet, though have had Many close calls due to being blinded by another vehicle′s headlights. Turning onto roads where a daylight car/s is coming is particularly dangerous as one is blinded when turning and as noted many times here by others, it takes a minute or two see clearly again. Even when sitting a light or stop, an SUV or truck with them blinds me from the Sideview mirrors, so I now wear sunglasses as night when driving. And ALWAYS drive with the review mirror in reflection position. I spoke with a couple of 18 wheeler truckers who won′t put them on their trucks because they find them dangerous too, and they even get blinded by their fellow truckers. For the last 2yrs I′ve thought about writing AAA and the FHA to see what their accident stats are involving daylight headlights. And lastly, talking with a young Nissan engineer about 5yrs ago, he said regarding Why the change to daylight headlights, ″If we can save a buck, we will.″ Manufacturers definitely need regulating and the illumination set to night light amber. Same with all exterior lighting from buildings.

B.1589 March 4, 2021 — hudsonville, MI

I got into five accidents because of so much LED lights

B.1590 March 10, 2021 — Eugene, OR

My tail lights are someof these, and I have been looking at smoking them with a film.

B.1591 March 11, 2021 — Georgetown, United States

I’ve been ran off the road with these extra bright headlights.

B.1592 March 15, 2021 — Canton, OH

I usually let them pass and get. Behind them turn .y brights see how they like it

B.1593 March 15, 2021 — Stamford, NY

These lawless blinding lights have been getting worse by the week since around 2011 AND we have still yet to slow down the corrupt and greedy automobile industry from making these standard on most ALL new automobiles. You will never see me bow t acceptance of this safety hazard nor ever support the auto industry/dealers ever again!!! Stop this madness already.....ugh.

B.1594 March 17, 2021 — Portland, OR

Because these headlights are a dangerous threat to night time traffic safety, destroy night vision, and cause eye damage

B.1595 March 22, 2021 — Asbury Park, NJ

The new suoer vright headlights cause temporary blindness much in the sane manner thet oldvcanera flash bulbs did. Nultiply this times 2, and veing obe’s eyes are adjusted to nightine dark, the new super bright lights cause temporary blindness, nuch lije going into a movue thestger on a sunny day. Drivers in oncoming traffic becone temporarilary blinded.A SERIOUS PROBLEM.

B.1596 March 22, 2021 — Lincoln, NE

I get blinded by headlights on those big-ass ″petro-masculinity″ trucks all the time. Getting really sick of it.

B.1597 March 24, 2021 — LONDON, ENG, United Kingdom

these headlights could cause a serious accident , should be banned

April 2021

B.1598 April 8, 2021 — Gibsonville, NC

I'm tired of being blinded at night, losing my night vision for several minutes each time. That's a lot of time to not see wildlife.

B.1599 April 9, 2021 — Crawfordville, FL

I've almost wrecked a few times and I've had to come to a complete stop a couple of times. I cannot believe that these are even legal. I'm all for LEDs but some of these are way too bright. And Installed wrong. I am so grateful I came across this petition. Thank you guys for all your support please keep sharing.

B.1600 April 9, 2021 — Crawfordville, FL

The people should have them right!

B.1601 April 10, 2021 — Warner Robins, GA

I hate those lights! Even when not on bright they are blinding, rather in front or behind.

B.1602 April 16, 2021 — Austin, TX

Several bad experiences with this issue!

B.1603 April 18, 2021 — San Diego, CA

Absolutely! Please get rid of these bright headlights. Especially within city limits, there's just no reason why cars should have such bright lights. Also, SUVs and higher vehicles should definitely not be allowed to have bright headlights on city roads.

B.1604 April 20, 2021 — ventura, CA

Too much glare coming from the new car headlights l. It's as if drivers have their bights on 100 percent of the time. This can't be good for our eyes. Light glare is distracting!

B.1605 April 21, 2021 — Bangalore, India

I believe what Neela is fighting for is right. Bright lights do cause health problems

B.1606 April 21, 2021 — Fountain Valley, United States

UNBELIEVEABLE that these blinding lights are legal! I have to wear sunglasses when I drive at night because of these dangerous lights. Or I have to look away when I drive. Please Please Please ban these lights! I assume they cause eye damage as well!

B.1607 April 23, 2021 — Apollo Beach, FL

Mark Orlosky

May 2021

B.1608 May 1, 2021 — Bronx, NY

It's amazing how something dangling from your rear view mirror is illegal and "distracting" but these lights that cause you to not see the road are fine. People have these on during the day and they are brighter than daylight. The same people that are "pro-mask" are the same people nearly killing people with these lights.

B.1609 May 10, 2021 — Oneida, TN

They are blinding and if you cannot see good enough to have normal headlights you dont need a license.

B.1610 May 11, 2021 — Indianapolis, IN

My eyes ducking hurt

B.1611 May 11, 2021 — Lawrence, KS

I like to see

B.1612 May 16, 2021 — West Palm Beach, United States

I have nearly been run off the road by these LED headlights. They are so bright the edge of the road can no longer be seen. These are DANGEROUS.

B.1613 May 21, 2021 — Edmonton, Canada

We've had the science on this for years: white LED lights reduce visibility at night. Whether they're on cars, streetlights or buildings they are a safety and ecological hazard that need to be addressed. With great brightness comes great responsibility, something that most people have failed to show.

B.1614 May 23, 2021 — Frederick, MD

This is one rare case where government regulation can prevent an arms race between drivers.

June 2021

B.1615 June 5, 2021 — Everett, PA

Oncoming vehicles with these lights blind me. They are not safe to other drivers. When facing these light often times I have to turn my head away from the road and or hold my hand up to try and block the light. None of this is safe and could easily cause a accident. I don't state into the sun in the day time why would I want to stare at it in the night while I'm driving when it's harder for your eyes to adjust.

B.1616 June 5, 2021 — New York, NY

lights are waaayyy to bright!

B.1617 June 5, 2021 — Rochester, MN

The lights have an intense bright beam that hinders oncoming traffic from correctly viewing the road and hazards ahead of them. The intense bright headlights are a road hazard with a good potential of causing accidents

B.1618 June 5, 2021 — San Diego, CA

These too bright, badly adjusted lights are dangerous and I'm scared when I have to drive at night !!!

B.1619 June 5, 2021 — San Francisco, CA

I am rendered effectively blind for 3-5 seconds at a time by these headlights, and when driving on a two-lane highway at night, it is terrifying. It does not need to be this way.

B.1620 June 5, 2021 — vineland, NJ

i have an SUV and cannot see when these pickup ups wit these type of lights come at me! I cannot imagine being in a car with these blinding lights coming at me. We use to have laws against these types of high intensity lights on vehicles, enough already!

B.1621 June 6, 2021 — Albuquerque, NM

The glare from headlights at night is extremely painful, and I have no choice but to drive at night. It's ridiculous.

B.1622 June 6, 2021 — Burlington, VT

I am blinded by these blue-white headlights. I am 68 and it's making night driving harder. There was nothing wrong with the warm yellow-white headlights. Just drive the speed limit and you won't out run your vision. Regarding safety, having all cars run automatically run headlights while running, day and night, would help tremendously.

B.1623 June 6, 2021 — Culver City, CA

I avoid driving at night because of these.

B.1624 June 6, 2021 — Endicott, NY

Each year, in the past few, my discomfort increases with the rise of SUVs & led lights; this is also a safety issue for older drivers, and therefore for everyone!

B.1625 June 6, 2021 — Hollister, CA

Being blinded by another driver's headlights and possibly causing a car crash is the result of an industry that values looks and buyer appeal over safety. Past time this issue was fixed.

B.1626 June 6, 2021 — Hope Valley, RI

I'm tired of being blinded by LED lights. I am afraid of getting into an accident because of it.

B.1627 June 6, 2021 — Los Angeles, CA

How did it get to this point?

B.1628 June 6, 2021 — Los Angeles, CA

Its dangerous to drive at night. I cannot see for the glare!!

B.1629 June 6, 2021 — Pomona, CA

I hesitate to drive at night because of high-mounted bright lights behind me (I'm 70)

B.1630 June 6, 2021 — Portland, OR

omg, finally - thank you! this has to stop.

B.1631 June 7, 2021 — Abbotsford, Canada

Truck driver, and they're too bright

B.1632 June 7, 2021 — Aiken, SC

I am constantly blinded by oncoming headlights, to the point that I avoid driving at night. This is ruining my social life!

B.1633 June 7, 2021 — Anchorage, AK

These lights are absurdly bright and make it hard to see- an accident waiting to happen. I hate them so much!

B.1634 June 7, 2021 — Blairsville, GA

hard to see at night

B.1635 June 7, 2021 — Boulder, CO

These lights are a danger to all other drivers on the road. How selfish can you get? Ban them!

B.1636 June 7, 2021 — Brewster, NY

I have also been blinded by these after market high power LED lights.

B.1637 June 7, 2021 — Gatineau, Canada

Older people are having a hard time driving at night since they released those headlight.

B.1638 June 7, 2021 — Greenwich, CT

I've been struggling with bright lights for offer 10 years now - from oncoming traffic, rear view cars and stop/blinker lights. I want to ask to also advocate limiting luminance on traffic and road side lighting (such as signage and billboards). Furthermore, I would like to see after-market lights, typically meant for off-road use, banded for use on roads (such as the LED arrays on bumpers, grills, mirrors and roofs, as well as extra flood/beam lights). Lastly, I would like to see strong limits on the use of high beam lights, both through better driver education and stricter enforcement. There is an increase number of drivers using high beams, many of them turning those on by default as soon as they start their cars.

B.1639 June 7, 2021 — Hollywood, FL

I am signing because this kind of new-fangled light has nearly blinded me on several occasions and NOW I cannot in good conscience drive at night. Fancy for you [whoever you are who owns these

lights] deprives me of freedom! Maybe someone out there can make some kind of lens that really neutralizes or diffuses glare might be the answer. IF I am forced to buy new night-driving goggles, so be it.

B.1640 June 7, 2021 — McLean, VA

I cannot drive on winding two-lane roads in Fairfax County, Virginia at night because on-coming vehicles blind me with their bright lights. Enough is enough. There are hundreds of highly paid automotive and lighting engineers who could resolve this issue if the government would mandate a solution.

B.1641 June 7, 2021 — Morristown, NJ

I drive at night and completely agree that this is an overlooked danger which needs to be addressed.

B.1642 June 7, 2021 — New York, NY

The macho 50% of Americans are blinding and deafening the other 50%.

B.1643 June 7, 2021 — Northampton, MA

I've literally had panic attacks driving at night faced with oncoming headlights.

B.1644 June 7, 2021 — Owen Sound, Canada

I find the brightness and glare from the newer LED headlights on higher-riding vehicles like trucks and SUVs to be overwhelming, and even dangerous. It can often cause drivers like me, in a conventional sedan-type vehicle, to have to avert our eyes.

B.1645 June 7, 2021 — Pittsburgh, PA

These lights are dangerous! I have had to adjust my driving many, many times, oftentimes pulling over to the berm, to get out of the glare of those vehicles wielding them.

B.1646 June 7, 2021 — Rockwall, TX

I drive a lot of 2 lane rural roads. It's terribly blinding.

B.1647 June 7, 2021 — San Francisco, CA

I'm signing because these blinding vehicle LED headlights including, halogen and HID lights are a blinding nightmare for me. In particular, SUVs blind me when their headlights' glare is reflected in my rear view mirror as well as, directly from oncoming traffic. Automakers promote them as a safety feature when, in reality they pose a danger. I find myself reflexively removing and raising my arm and shielding my eyes with my hand, which further interferes with my view and further disrupts my focus. Lexus and other luxury vehicles began coming out with LED lights in 2006 and in the past several years they are being pushed by most automakers because the cost of manufacturing of the lights has become cheaper. As usual, it's about the money and lack of regulation, quality control, and lack of training and know-how on using the proper installation kits and alignment of the headlight beams. Especially aftermarket LED light bulbs, which are intended for off-road vehicles, not basic transportation vehicles. We need better training, quality control and regulation of these types of headlights. Typically, as in many other American industries, the kind of training, quality control and regulation is given short shrift in the rush to get the newest, improved "bigger and better" product out the door to compete in the market to make more money for the Company.

B.1648 June 7, 2021 — Seattle, WA

Not only are extremely bright lights dangerous to the health of our population, but can cause a whole demographic of people to stop driving. For example, people with headaches and seizures are typically unable to drive due to the increasing bright lights that are being put into vehicles. The new Hyundai has 9 bright blue-white lights to "assist" people to see safer. We have road lights and if the area is too dark then we need more road lights. Today, while driving my child they had a seizure because of new brake lights on the vehicle in front of us that blinked in a strobe-like pattern depending on how hard the person was braking. These types of lights should be banned due to people being sensitive to light patterns and the intensity of lights. These types of bright lights and blinking should be only allocated for emergency vehicles.

B.1649 June 7, 2021 — Spartanburg, SC

I was surprised, but heartened, to find I wasn't the only person to find the headlights coming at me uncomfortably bright! I thought before reading the NYT piece that it was just me. Let's stop and reassess what we mean by "safety..." not being able to look where you're going at night surely doesn't fit the definition. .

B.1650 June 7, 2021 — Stafford, VA

I shouldn't have to squint to drive.

B.1651 June 7, 2021 — Tlaquepaque, United States

having to use rear mirror damping but still get blinding light from side mirrors

B.1652 June 7, 2021 — Wimborne, Dorset, ENG, United Kingdom

I am being "Blinded by the Light" Courtesy Bruce Springsteen and Manfred Mann. And those strobing bicycle headlights are blinding and dangerous. These lamps/lights need to be regulated.

B.1653 June 7, 2021 — Winter Haven, FL

I am very sensitive to light making night driving nearly impossible. The risk of facing these headlights is dangerous for some as the extreme brightness causes a light blindness, possibly causing an accident.

B.1654 June 7, 2021 — salt lake city, UT

Number of high position lights shining right in on car drivers. Drivers license that will not lower their lights.

B.1655 June 7, 2021 — west jordan, UT

I'm signing because the headlights are blinding

B.1656 June 8, 2021 — Gettysburg, PA

I'm signing because I still want to be able to drive at night, and the blue lights are blinding.

B.1657 June 8, 2021 — Milwaukee, WI

We need to keep safety first on our roads and eliminate the hazards that can cause distraction, especially when driving at night.

B.1658 June 8, 2021 — Piedmont, SC

Drivers can help reduce the blinding effects of their vehicle's lights by turning off the fog lamps. Some drivers don't even know when these lights are on and they add to the light emitted from the vehicle. At least 20% of drivers leave fog lamps on full time.

B.1659 June 8, 2021 — South Hadley, MA

I have been saying this for DECADES, even more so now that I am a professional driver! What is worse is that many vehicles are sporting four or six lights. I believe that many drivers do not realize how bright their lights are nor how to turn their "extra" lights on and off! Chevy, South Hadley, MA

B.1660 June 9, 2021 — Alameda, CA

I have stopped driving at night due to cars that have bright white lights.

B.1661 June 9, 2021 — Anaheim, CA

I support this petition.

B.1662 June 9, 2021 — Ann Arbor, MI

These bright lights are a significant safety hazard

B.1663 June 9, 2021 — Austin, TX

I thought I was alone in noticing this problem. Glad to hear that my opinion is shared.

B.1664 June 9, 2021 — Austin, TX

I agree completely with the author and thank him for this petition. I believe this sort of intense light that shines directly into the windshield of oncoming traffic and rear view mirrors of others should be illegal and changed in some way to dim their effect on other drivers.

B.1665 June 9, 2021 — Birmingham, AL

There are certain vehicles in which the headlights are blinding and cause unsafe and very annoying driving conditions

B.1666 June 9, 2021 — Childersburg, AL

I have to pull off of the road every time one of the vehicles get behind me or slow down to a crawl when coming toward me.

B.1667 June 9, 2021 — Emmett, ID

The extreme bright lites are insane and dangerous. I hate them. I also feel that way towards the police car flashing lights. What ever happened to the ole single red flashing light on top of a police car that everyone knew what it meant and how to respond?

B.1668 June 9, 2021 — Georgetown, Canada

I feel this is the right thing to legislate as well as have all Truck and SUV night lights angled down a bit more as they are also blinding at night and come level with my eyes in any car.

B.1669 June 9, 2021 — Lawrence, KS

These bright headlights are such a problem for me, thus I find myself not even wanting to drive at night.

B.1670 June 9, 2021 — San Juan, United States

pone en peligro el conducir en la noche porque la brillantez de los focos perturban la visibilidad del conductor que recibe el resplandor

B.1671 June 9, 2021 — Wilsonville, OR

These extremely bright headlights do impair the driver whose eyes are extremely bothered by having to advert their gaze from the road till the offending oncoming vehicle passes. Likewise one has to flip their rear view mirror up when you have a vehicle behind you with these LED lights, but they still can be very disturbing as when said vehicle is fairly close their LED lights are reflected in my side view mirrors. Only thing for that is to change lanes, if another lane is available, to get away from that vehicle that is following. They should be illegal as they do affect other drivers.

B.1672 June 10, 2021 — Atascadero, CA

SUVs/trucks are the worst because their lights are high off the road an aimed straight into the oncoming car. The headlights that automatically dim work terribly on country roads that curve or have lots of dips in them and the lights aren't set up to dim far enough away from the oncoming car. The lights are a huge safety problem.

B.1673 June 10, 2021 — Charlotte, NC

These blinding headlights are dangerous. It used to be illegal to drive on an interstate with your high-beams on; why are these super-bright headlights allowed?

B.1674 June 10, 2021 — Duluth, MN

They are not only distracting but it also difficult to see anything past them. I am most aware of this while driving through areas with a lot of deer as I scan the roadside watching for the tell tale reflection in their eyes.

B.1675 June 10, 2021 — Durham, NC

In the last few years I've begun to find that I can't see the road very well at night due to the excessively bright glare of oncoming headlights. Everything other than the headlights looks black to me. I feel this is not only unpleasant, but also unsafe. When in traffic, I sometimes have to avert my eyes from the bright red LED brake lights of cars in front of me. Some cars are much worse offenders than

others. I've also noticed that even LED-based stoplights can be so bright that I can see them from a mile away but I can't see the surroundings. I thought for a while I was just getting old and my eyes were not as good as they used to be (I'm in my early 40's), but a recent news article on the subject has me convinced that this is not my imagination -- it's a genuine problem experienced by many people.

B.1676 June 10, 2021 — Palo Alto, CA

I'm signing because my eyes have been painfully effected by these over-bright headlights for years! I like the softer old lights. Why do we need these when most cities are so flooded with LED's anyway?! They are harsh and they hurt the eyes.

B.1677 June 10, 2021 — Tampa, FL

I usually wear sunglasses when I drive at night or raise my left hand to block oncoming traffic. Can we also lower the height of SUVs & other taller vehicles so they aren't at the level of the eyes of the car drivers? Why can't their headlights be at the same level as cars, since they need to hit the road rather than blind oncoming drivers? These lights are also blinding in rear and side view mirrors that I have to redirect at night.

B.1678 June 11, 2021 — Berkeley, CA

As an independent elder, I have noticed for years that the blinding lights are creating unsafe driving conditions. They're also threatening my independence as the lights are a serious risk factor for accidents that I want to avoid. They're doing the opposite of what they're intended to do — public safety!

B.1679 June 11, 2021 — Black Hawk, CO

It is vital to restrict the brightness for safety. "Brights" are available when not following someone or approaching someone coming the other way. That is enough. But what really needs attention is the popular trend toward people using their fog lamps at all times. It is illegal to do so in many places. Yet it is never enforced. Some of these fog lamps are as bright or brighter than the headlights. They are for FOG, not regular driving, and should never be used when approaching or following someone. They have somehow become "fashionable" to be a big shot showing off that you have fog lamps.

B.1680 June 11, 2021 — Indianapolis, IN

Blue/bluish, too high and too bright even with streetlights on. The driver with these lights may see better, but those impaired/blinded may end up aiming for such vehicles unintentionally...

B.1681 June 11, 2021 — New York, NY

Nathan Currier

B.1682 June 12, 2021 — Australia

Please sign

B.1683 June 12, 2021 — Richmond Hill, NY

Dionisia p viloria

B.1684 June 12, 2021 — Tempe, AZ

LED lights have been a terrible addition to our daily lives and overall health. To continue allowing LED lights on a car, either headlights or taillights, would only prove that our leaders, car manufacturers etc, care nothing about our safety while we're on or off the road. LED headlights blind drivers and black out everything around their glare for only a moment, but it only takes a moment to cause an accident. The worst part is the blurred vision we're left driving with for several moments after when anything could happen.

B.1685 June 16, 2021 — London, KY

My experience is that these lights are extremely bright and make it nearly impossible for me to see anything else when opposite them. My husband is a trucker and it is equally impairing to them. We value our CDLs, our lives and our fellow drivers lives.

B.1686 June 18, 2021 — Portland, OR

I'm one of the older drivers who is blinded by the lights! Fix them!

B.1687 June 19, 2021 — Durham, NC

Where I live, the roads are 2-lane, hilly, curvy, and unlighted, and it's deer country! The blinding glare from oncoming LED headlights make it impossible to see upcoming curves and in-road hazards such as deer. I do not have this problem with oncoming halogen headlights.

B.1688 June 20, 2021 — Graton, CA

These lights cause more accidents, affect health and vision and impact bird migration.

B.1689 June 20, 2021 — New Braunfels, TX

These new lights are to bright

B.1690 June 20, 2021 — Philadelphia, PA

These headlights should be made illegal immediately. Besides being blinding, those who drive with them are not able to see what is in front of them and turn on their bright lights and running lights to help see better. The color temperature does not light up the road as well as other headlights do.

B.1691 June 20, 2021 — Tijeras, NM

I have, like most all drivers, been nearly unable to see for a number of seconds while driving due to these terrible lights that Never should have been allowed on cars but should Obviously be outlawed from being installed on new vehicles and removed retroactively from existing ones. Do we Need to wait for X number of highway deaths before a serious change is made?

B.1692 June 23, 2021 — Searsport, ME

Blinding headlights make it impossible to see the road or any pedestrian or cyclist beside the road. They are horrible to have in the rear view mirror. Driving at night for any great distance in traffic becomes visually exhausting, which is unsafe for everyone.

B.1693 June 24, 2021 — MD, United States

My father deals with this issue regularly and has a huge problem seeing the lines on the road when faced with these unnecessarily bright headlights. I'm not against HID's but I am against the overuse of various types of LED's especially because I've seen an uptick in my area of people applying many aftermarket parts to their vehicles in recent years.

B.1694 June 26, 2021 — Willimantic, CT

cause i'm short and i drive a short car. i'm at eye level with these fucking mini-suns and i'm tired of the road migraines >:(

B.1695 June 29, 2021 — Reykjavik, Iceland

The LED headlights on cars are destroying our environment and our eyes

July 2021

B.1696 July 1, 2021 — Livingston, TN

I've almost gotten into multiple wrecks because these types of headlights blind me. They're beyond distracting - they actually become physically painful and it becomes hard to focus on anything else when they're in my view.

B.1697 July 4, 2021 — Saint Paul, OR

I read through the petition, and I want to be clear that my signature is intended to support a ban on use of LED lights at night while pointed at other drivers. It's important on our farm to have light bars and such to help illuminate equipment we may be trying to fix at night before we need it the following day. But we use switches to control them, and no aftermarket LED headlights are installed. Those who are not responsible in the installation and/or use of LED lights should not be allowed to use them, or at least fined.

B.1698 July 11, 2021 — Irvine, CA

Blinding lights are a hazard to lives

B.1699 July 14, 2021 — Australia

Bright headlights are incredibly dangerous. There needs to be strict regulation to limit their brightness. I once couldn′t even see the road in front of me because I was blinded by the headlights of a new Mercedes SUV.

B.1700 July 18, 2021 — El Granada, CA

With the blinding head on lights at night on my local two lane roads, it is often impossible to see if there is any dangerous object in the road ahead. Most of the time roads are clear, but I have witnessed several times where heavy damaging items are laying in the middle of the road that likely fell from a truck. If I would hit one of these items that I could not see, it could cause death/injuries to me and/or people in the on coming traffic.

B.1701 July 18, 2021 — West Point, GA

Please ban these headlights. They blind me even though I focus on the passenger side road lines. People refuse to dims these blinding headlights are also contributing to theses road deaths.

B.1702 July 20, 2021 — Halifax, Canada

Canada here: - Our divided highways are not level on each side, so you may always be below the ″cut off″ point for some parts of the highway - We still have a lot of side roads where you will be blinded by these, especially if it has small hills (toyota corolla you are the worst here). If you come over a hill you will be blinded - We do not have a law to mandate self adjusting headlights, so all trucks with a load in the back or just high off the ground will blind you with these headlights This is the most selfish thing I′ve seen auto manufactures do. Jeep you are the worst and Toyota how dare you. You are selling the vehicles like this knowing the ″a-holes″ of the world will buy it and no-one cares... Well we care! Enough is enough. These lights are for off road use.

B.1703 July 21, 2021 — Chicago, IL

At the age of 66, these needlessly overly-bright and misdirected headlights and streetlights have made impossible to drive safely especially on highways. Many times I had to pull over and let my husband drive who does not have astigmatism.

B.1704 July 21, 2021 — Lafayette, CA

Having to face blinding bright white headlights is a painful experience, damaging to our eyes, and dangerous. Thank goodness there is proof that they need to be banned.

B.1705 July 24, 2021 — Jacksonville, FL

I drive a lot early in the morning for work. Just about every morning I experience a vehicle with blinding light and most of these people have no consideration for other drivers. It is very difficult to drive when these lights remain behind you in your rear view or head on. I find myself dodging the reflections from my mirrors or moving out of the way, just so I can see.

B.1706 July 25, 2021 — Samford Valley, Australia

I agree - I’ve been blinded by some of these and nearly come to grief !

B.1707 July 31, 2021 — Jacksonville, FL

For Austin Lee Beebe and my road rage ¯_(ツ)_/¯

August 2021

B.1708 August 10, 2021 — Victor Harbor, Australia

I agree

B.1709 August 15, 2021 — Portland, OR

these headlights are dangerous.

B.1710 August 17, 2021 — Sunnyvale, CA

Where do you actually sign the petition? All I see is the Take the next step! which is a funding request. How about an immediately obvious button?

B.1711 August 25, 2021 — Shirley, IN

I am tired of people putting my personal safety and others at risk by acting smug with their bright headlights and motorcycle headlamps on full bright during the day, as they're passing by on the road. Let's get this petitioner's goal achieved, and get the ball rolling!

B.1712 August 26, 2021 — Ithaca, NY

This is common sense. Anyone who hasn't been blinded in a dangerous way by HID or LED headlights is in for a serious scare when it finally happens

B.1713 August 27, 2021 — Liverpool, ENG, United Kingdom

These lights are dangerous and for people who suffer from Migraine , painful .

B.1714 August 31, 2021 — Amersham, ENG, United Kingdom

I am fed up with being dazzled by these extremely bright headlights.

B.1715 August 31, 2021 — Harrow, United Kingdom

Driving on a road that has street lights or not when a vehicle approaches with glaring lights all visibility is lost and the chances of a crash are extremely high.

September 2021

B.1716 September 2, 2021 — Durham, NC

Shelley Reaves

B.1717 September 4, 2021 — New Westminster, Canada

It blinds my eyes at night with headlights that are too bright. It's very dangerous for drivers

B.1718 September 9, 2021 — Danbury, CT

Also daytimes lights are a hazard. DC

B.1719 September 10, 2021 — Rhyl, WLS, United Kingdom

Peter jones

B.1720 September 12, 2021 — Orem, UT

This needs to be addressed at the national level with a total recall of all of these new vehicles using this technology. I think given a choice, most people wouldn't choose these awful lights, but it's what comes standard and who is going to choose to change their headlights at the cost of 100s of more dollars.

B.1721 September 12, 2021 — Orem, UT

Do not like being blinded by headlights that have no business being that bright. They do not increase safety but are instead potentially unsafe.

B.1722 September 16, 2021 — Durham, NC

These lights create a hazard for all drivers!

B.1723 September 17, 2021 — United Kingdom

LED headlights are blinding even when dipped especially in rainy conditions. I use my fog lights all the time now just to pick out the road nearside and centre white lines which are increasingly being left out after road repairs and maintenance.

B.1724 September 18, 2021 — Halifax, Canada

Please stop this nonsense! We got 3′ lifted trucks/jeeps with LED headlights and LED foglights. Only one who can see is that guy in the jeep. No-one else can see around him! Subaru, you just did this! This is crazy, what are we doing??

B.1725 September 19, 2021 — Portland, OR

Add these dangerous LED headlights to under lit cyclist weaving in and out of traffic and unlit pedestrians dashing across the street wearing black at night in the rain during the early dark days of

winter in high density neighborhoods in the city and it is simply a cluster bomb of accidents waiting to happen. So scary to imagine a car accidentally hitting a pedestrian or cyclist. No more High beam LED headlights. Cross the street at the cross walk. Lights and helmets on cyclists. Even lights on pedestrians. No random dashing across the street. I'm talking dense city streets.

B.1726 September 20, 2021 — Bay Village, OH

I just purchased a 2021 VW ID4 with LED headlights. However as a driver age 70 I have noted that headlight glare is definitely more of a problem for me at night AND I do not have 20/20 vision with my glasses on! This change makes sense.

B.1727 September 22, 2021 — Fairport, NY

In my experience, bright lights at road level create a halo of darkness, where you can't see the vehicle itself or what is behind or around those lights. A significant contributor to dangerous situations, no doubt!

B.1728 September 22, 2021 — Oxnard, CA

I've been blinded by these ridiculously bright lights in a construction zone and hit a barrier that wasn't visible as a result.

B.1729 September 22, 2021 — Sardinia, OH

The last time I visited my family in the city I came down with a severe migrane headache from the continues onslaught of extremely bright, blinding LED headlights. The sheer amount of light pollution between the streetlights (now LED) and the headlights in virtually every cat on the road destroys my night vision, makes it impossible for me to use my mirrors for safety, and makes nighttime divinga exceptionally difficult. Stop this madness, NOW.

B.1730 September 22, 2021 — Vermillion, SD

LED lights and the light pollution they cause have negative effects on our health and environment. People share a common heritage to the skies and stars. Enjoyment of this common heritage is diminished by bright LEDs and the light pollution attributed to them.

B.1731 September 23, 2021 — Austin, United States

I have to look away when faced with the LED lights in oncoming traffic. Even the low beam lights used in the daytime are a problem. AN OVERWHELMING majority of drivers believe new car headlights are becoming far brighter than they need to be, according to research by The RAC. The motoring group found 91% of those surveyed believe car headlights are becoming too bright, with 60% admitting they're regularly dazzled, even by dipped headlights.

B.1732 September 23, 2021 — Bentonville, United States

These lights are dangerous on rural roads for oncoming traffic.

B.1733 September 23, 2021 — Chicago, IL

Phyllis Abrams

B.1734 September 23, 2021 — Morristown, NJ

I have been victimized by many drivers at night with blinding headlights especially from the rear.

B.1735 September 23, 2021 — Park Forest, IL

The super bright lights make it very hard to see the actual traffic, much less pedestrians. The LED craze is in so many stores now, and some make it impossible to look up, but at least they're stationary, and I can avoid them. But the one on cars— in front of me, or in back of me— are temporarily blinding, and I truly hate what the do to our vision. Please use some common sense to get rid of known driving hazzards!

B.1736 September 23, 2021 — Providence, RI

RON CAVALLARO This and police car strobe lights are a menace!

B.1737 September 23, 2021 — United States

I suffer greatly from these HD blinding blue ray lights that has evidence that it's HARMFUL for human eyes.

B.1738 September 24, 2021 — Los Angeles, United States

This needs to be done

B.1739 September 25, 2021 — Sylmar, CA

I'm signing because I have experienced many times the dangerous hazard of being temporarily blinded by oncoming overly bright LED headlights and nearly wrecked my car on numerous occasions because I couldn't see the road nor anything or anyone around my vehicle while those lights adversely affected my vision. I agree that headlights should be regulated and restricted to lower levels of brightness that will create safer driving conditions for drivers that are facing them.

B.1740 September 25, 2021 — Tampa, FL

There has to a limitation set on the blinding headlight brightness. They only get brighter and brighter.

B.1741 September 27, 2021 — Downey, CA

This is a safety issue-clearly!!! We,the public should not have to insist that the producers of these products cease and desist production and distribution ...it should be illegal to:produce,distribute,sell,use for use on our roads, highways and byways!

B.1742 September 28, 2021 — Lewisville, TX

LED and HID headlights blind me when I drive at night. I have to slow down because I really can't see because of these super blinding lights in my eyes. These lights cause a danger to oncoming traffic because they make it impossible to see.

B.1743 September 29, 2021 — Cleveland, TN

Ban Blinding Headlights and Save Lives!

B.1744 September 29, 2021 — Spanish Fork, UT

I have personally had trouble seeing momentarily while driving at night due to blindingly bright headlights either behind me, or oncoming the opposite way. These can be very dangerous and we need to put an end to them!

B.1745 September 30, 2021 — Hesperia, CA

I hate those freaking lights

October 2021

B.1746 October 2, 2021 — Reading, ENG, United Kingdom

I have stopped driving at night because of these awful lights.

B.1747 October 4, 2021 — Warren, MI

I agree 1000% I actually bought Tac Night vision glasses not ready to give up driving! But the experts say you get 40 more feet of distance you can see! Lol

B.1748 October 7, 2021 — Salford, ENG, United Kingdom

Forced to pull over and let vehicles behind take over and nearly closing eyes from oncoming vehicles

B.1749 October 7, 2021 — United States

I hate those lights u cant see shit when there coming at u blind ur ass

B.1750 October 8, 2021 — Hell, AE

I have a hard enough time seeing at night WITH my glasses much less when someone is brightlighting me with the light of 1000 suns and your eyes take time to recover after and if anything is in the road in front of you there is a good chance you're not seeing it and smashing it full speed. Ridiculous they've ever been allowed at this brightness ever anyway.

B.1751 October 8, 2021 — Leesburg, FL

I agree there have been many times I almost wrecked and literally felt like I was not going to make it. Many people do blind other people on purpose I don't think some people understand how dangerous it is or maybe they do and just don't care.

B.1752 October 8, 2021 — Lexington, KY

It is not legal for a blind person to drive and therefore should not be legal to blind someone while driving. I have experienced these 'blinding lights' and because of them, now only drive at night when absolutely necessary. I regret that my ability to go out at night has been restricted. Since AAA and AARP have no interest in helping with this problem, perhaps a class action suite against the manufacturer would be appropriate. I volunteer to be your lead plaintiff.

B.1753 October 8, 2021 — Mableton, GA

These new headlights are even to bright for daytime usage

B.1754 October 9, 2021 — Appleton, WI

Mine too!

B.1755 October 9, 2021 — Appleton, WI

Can you get Tac Night vision in prescription glasses?

B.1756 October 9, 2021 — Appleton, WI

I hate them so much. I have gotten quite a few migraines from bright sunlight and and sensitive to bright lights.

B.1757 October 9, 2021 — Appleton, WI

I have pulled over and let people pass because of this

B.1758 October 9, 2021 — Saranac Lake, NY

I almost lost my life twice because of these stupid lights. I was blinded by oncoming traffic and couldn't see that traffic stopped in front of me. These lights should've been banned years ago. Until someone dies and the family sues, nothing will ever be done.

B.1759 October 10, 2021 — Jacksonville, NC

The headlights are blinding!

B.1760 October 11, 2021 — Allyn, WA

Because of our northern latitude, we get early darkness in fall and winter. On several occasions, I have narrowly avoided an accident because of these blinding headlights. Even when a driver switches from high-beams, the headlights appear overly bright to oncoming drivers. On our rural roads with minimal installed lighting, drivers tend to keep headlights on high for better visibility, unaware that their lights are blinding oncoming drivers. We also get frequent fogs during these colder months, which scatters the bright light, creating an even larger zone of bright-blindness. European countries require auto manufacturers to mitigate this hazard. Why is the US so backward on this?

B.1761 October 11, 2021 — House Springs, MO

I live off of a dangerous road and have been blinded so many times by oncoming halogen headlights it's a miracle I haven't veered off the road. I am shocked that such a dangerous nuisance is not being acknowledged by the masses and rectified:

B.1762 October 11, 2021 — North Myrtle Beach, SC

They are blinding and very dangerous

B.1763 October 12, 2021 — Wise, VA

I believe this to be true.

B.1764 October 14, 2021 — Boise, ID

As a wearer of glasses these produce a ridiculous amount of glare, and as a driver of a newer care with them there is no discernable advantage to visibility. I would rather not have them nor be blinded by them.

B.1765 October 14, 2021 — Edgewood, MD

I hate it to honestly people need to be Courteous and careful on the road

B.1766 October 15, 2021 — Hove, ENG, United Kingdom

The headlights are too bright.

B.1767 October 18, 2021 — Albany, NY

These harsh and blinding LED headlights are a danger to all. You're not driving safer if you are blinding other drivers. Please ban LED headlights now.

B.1768 October 18, 2021 — Las Vegas, NV

I hate driving at night because headlights have become ridiculously bright in recent years

B.1769 October 18, 2021 — Rochester, ENG, United Kingdom

Blinding headlights are dangerous

B.1770 October 20, 2021 — Federal Way, WA

These blinding lights are making it very hard to stay on the road when approaching a vehicle equipped with them.

B.1771 October 21, 2021 — Pottstown, PA

These lights are totally unsafe!

B.1772 October 25, 2021 — Lebanon, TN

I support this petition. Please review, sign and share my son's petition to Dell. Thank you! God bless. https://chng.it/7jKzphDD

B.1773 October 25, 2021 — Long Beach, CA

In one particular scary instance I remember being at a four way stop late one night and all three opposing vehicles had these extra bright lights glaring into the intersection, and as my vision was practically blinded I barely saw, at the last moment, some pedestrians start to come in front of my car as I began to drive forward. Thankfully I noticed them in time and stopped, but that was too close for comfort, not to mention the terrible uncomfortableness in my eyes from that horrific, blinding brightness. And unfortunately this blinding is all too common in many circumstances, pretty much every day. This needs a remedy, like yesterday!

B.1774 October 25, 2021 — Tigard, OR

Passing by a whole line of cars coming from the opposite direction is scary. The brightness makes it more difficult to see in front of me. This increase in brightness has become remarkably more problematic over the last few years.

B.1775 October 26, 2021 — Decatur, GA

I cannot see when driving at night and passing other cars that have bright lights

B.1776 October 29, 2021 — Antioch, IL

I can't stand these blinding lights. They are unnecessary!

B.1777 October 29, 2021 — Bristol, ENG, United Kingdom

I am sick of being blinded by over bright headlights that make roads less safe

B.1778 October 29, 2021 — Spring Grove, IL

These lights are blinding and absolutely dangerous for oncoming vehicles! Sure glad THEY can see! And some of the vehicles have three lights on both sides! WTF!!! Whoever invented those ought to be.....

B.1779 October 31, 2021 — Carbondale, IL

I am signing this petition, because I suffer from chronic inflammation of my optic nerves (which causes bright white vehicle headlights to be impossibly blinding). I am able to handle the soft yellow headlights without too much difficulty. I am speaking up for the many thousands of people who suffer from optic nerve issues that cause artificial lights to appear extremely bright. -Chris Weston

November 2021

B.1780 November 1, 2021 — Gilberts, IL

I really hate those bright lights at night.

B.1781 November 1, 2021 — Halifax, Canada

We made it! 25,000 signatures! Let's get some action.

B.1782 November 1, 2021 — Lexington, KY

Bright lights in vehicles cause issues for the rest of us on the roads. This is dangerous. While the person driving with LED and HID lights may see better, the rest of us are blinded by them. Please ban these lights.

B.1783 November 1, 2021 — Pahoa, HI

I hate the LED lights on cars & trucks!

B.1784 November 2, 2021 — Yardley, PA

Ban the blinding lights! Light pollution is ruining neighborhoods, commutes, and a serious danger on all roads!

B.1785 November 3, 2021 — Boise, ID

I'm signing because I have been blinded by LED headlights and nearly crashed.

B.1786 November 3, 2021 — Riverside, CA

I think safety should always come before selfish and/or "cool." It used to be law to dim high beam lights as a courtesy if another vehicle is coming. These new halogens or whatever are even brighter than older high beam brights were/are. They are temporarily blinding and are causing many problems to other drivers. Get rid of these and encourage yearly eye exams. People need glasses not brighter lights.

B.1787 November 5, 2021 — Friday Harbor, WA

LED headlights have no place on our roadways period!!! They are so blinding! And you see spots afterwards. I find myself looking at the far right side of the road, but then I'm not even watching the road in front of me. Please outlaw them!!!

B.1788 November 6, 2021 — San Antonio, TX

I just click on my high beam on them they click on their even brighter ones but I leave mine on till they go by.

B.1789 November 7, 2021 — Independence, KS

they need to outlaw these lights. They blind you so you can't even see what lane you are in. DANGEROUS

B.1790 November 10, 2021 — Boston, MA

Morons Drive With These Blinding Lights That's Why They Look Brighter Far Away

B.1791 November 11, 2021 — Clinton, MA

They literally blind you

B.1792 November 11, 2021 — Springfield, OH

I find the bright lights difficult to.navigate around and annoying.

B.1793 November 11, 2021 — Warren, OH

These headlights create dangerous conditions for oncoming drivers. They are blinding.

B.1794 November 12, 2021 — Sonora, CA

LED headlights are painful, blinding and dangerous, creating a situation where we can no longer see at night while driving, which is especially dangerous when approaching a crosswalk with an oncoming car with LED lights.

B.1795 November 13, 2021 — Star, ID

I'm signing this petition because this is a justifiable cause! Just experienced this issue tonight!!!!

B.1796 November 13, 2021 — Vashon, WA

I have an astigmatism in both my eyes & these lights have caused that worst starring of any lights I have ever seen. It completely blinds me even just at dusk.

B.1797 November 14, 2021 — Poplar Grove, IL

Blinding lights are a nuisance

B.1798 November 14, 2021 — Seattle, WA

These lights totally blind me.And no I don't wear glasses.

B.1799 November 14, 2021 — Waynesburg, OH

The older I get, the more I hate them!!!!

B.1800 November 15, 2021 — McCall, ID

You can't see at night for them blinding you

B.1801 November 15, 2021 — Valdese, NC

they blind drivers coming towards them

B.1802 November 16, 2021 — Adelaide, Australia

I've been blinded!

B.1803 November 16, 2021 — Nesconset, NY

Its needed.

B.1804 November 16, 2021 — Pitt Meadows, Canada

I've been snow blinded because of the LED lights won't melt the snow and from drivers coming head on. They look like high beams and it is blinding.

B.1805 November 16, 2021 — Roberts Creek, Canada

I've been blinded by those dangerously bright LED headlights more than once. They're a menace on the road.

B.1806 November 17, 2021 — Akron, OH

I feel Endangered by these new lights!!

B.1807 November 23, 2021 — Dover plains, NY

The led headlights are getting out of hand!!!

B.1808 November 24, 2021 — Lake Elsinore, CA

Those Led lights are way to much blue light for those who were glasses. At some points at night we can't even see the road because of overly high Led lights blinding us from behind and oncoming traffic. More fatalities will come from these light source while on the road.

B.1809 November 24, 2021 — Manchester, NH

The public would benefit from a serious inquiry into how these lights affect other road users, and regulation to ensure that manufacturers are not putting out products that are unnecessarily unsafe

for others. Car manufacturers should be held to a high standard of safety for a community—not just the driver.

B.1810 November 25, 2021 — Endicott, NY

I've come close to hitting parked cars and pedestrians walking because of these headlights. Some lights are way too bright. And some people have 4 or even 6 of these headlights. BAN THEM!

B.1811 November 27, 2021 — Joliet, IL

It's hard to drive at night, dangerous, and scary for me with my kids in the car

B.1812 November 27, 2021 — Ramsey, NJ

Night driving has become a danger imposed on drivers by Detroit. Enough!

B.1813 November 27, 2021 — Sorrento, FL

I CAN'T FUCKING SEE AT NIGHT

B.1814 November 28, 2021 — Cupertino, CA

I have driven over 250,000 miles over the last 20 years. The recent change to bright lights on an increasing number of vehicles is not just an annoyance, but a serious safety hazard to other drivers. If the oncoming traffic has any vehicle with this new type of lights, I find that the light is quite blinding, and reduce severely my ability to see the road. Please do something about this before it is too late and we have too many vehicles on the road with this type of light!

B.1815 November 28, 2021 — Richmond, IN

They have blinded me to the point that I've had to completely pull off the road and stop!! I no longer can enjoy evening rides with my grandchildren

B.1816 November 28, 2021 — The Villages, FL

It's hard to see when headlights like that are coming at me.

B.1817 November 29, 2021 — Wichita, KS

I don't want to die so some entitled douchebag can follow spacecraft and pterodactyls at night!

B.1818 November 30, 2021 — Augusta, KS

I am tired of being blinded by these lights. I have to wear special glasses at night to drive and even then sometimes they are not enough.

B.1819 November 30, 2021 — Corning, AR

I have stopped driving at night because I can not handle the bright lights. Every time I pass a vehicle that has these headlights I end up having trouble refocusing and arrive at home with the start of a migraine. There is no reason for lights to be this bright.

B.1820 November 30, 2021 — Glasgow, SCT, United Kingdom

They are too bright! No need for it

B.1821 November 30, 2021 — Northumbria, ENG, United Kingdom

These lights are a joke and should be banned.

B.1822 November 30, 2021 — Temecula, United States

These lights are absolutely dangerous and I hope to god we can get a new law in place to save lives. I've dealt with these lights on two lane highways and it's not a nice feeling, you pretty much have to brake and wait cause you cannot see anything. Enough already, I know the whole inconsiderate jerk in a lifted truck is the life blood of the police force and it's supporters but at some point the public they supposedly serve must be taken into account.

B.1823 November 30, 2021 — Worth, IL

I believe these lights are a hazard on the road

December 2021

B.1824 December 1, 2021 — Lake Station, IN

These lights are blindingly bright and so unnecessary in city driving. They make it hard for other drivers, to see what's going on.

B.1825 December 1, 2021 — Leicestershire, ENG, United Kingdom

I was driving with my family the other day and the headlights blinded me and could have caused a serious accident

B.1826 December 1, 2021 — Oak Lawn, IL

I'm tired of being blinded!!

B.1827 December 1, 2021 — Roslindale, MA

These blinding lights are dangerous. I've been blinded by them on the highway driving home from work.

B.1828 December 1, 2021 — San Diego, CA

These led lights blind me regularly. Not sure why they are legal.

B.1829 December 1, 2021 — Wichita, KS

These are way to bright for cars ahead and behind...

B.1830 December 2, 2021 — Pittsburgh, PA

Joint Congressional Hearings & DOJ Investigation of Microwave Assaults on U.S. Citizens https://www.change.org/p/joe-biden-president-of-the-united-states-of-america-joint-congressional-hearings-doj-investigation-of-microwave-assaults-on-u-s-citizens

B.1831 December 2, 2021 — Pittsburgh, PA

Joint Congressional Hearings & DOJ Investigation of Microwave Assaults on U.S. Citizens https://www.change.org/p/joe-biden-president-of-the-united-states-of-america-joint-congressional-hearings-doj-investigation-of-microwave-assaults-on-u-s-citizens

B.1832 December 2, 2021 — Pittsburgh, PA

Joint Congressional Hearings & DOJ Investigation of Microwave Assaults on U.S. Citizens https://www.change.org/p/joe-biden-president-of-the-united-states-of-america-joint-congressional-hearings-doj-investigation-of-microwave-assaults-on-u-s-citizens

B.1833 December 3, 2021 — Bronx, NY

I like to see some changes.

B.1834 December 3, 2021 — United States

I am hardly able to drive at night anymore due to the strong headlights and lack of consideration of others not attempting to turn down their overly bright lights. It has become dangerous for me to drive as I literally cannot see the road in front of me.

B.1835 December 4, 2021 — Islamabad, Pakistan

It makes driving dangerous

B.1836 December 4, 2021 — Jubail, Saudi Arabia

Naheed Azhar

B.1837 December 4, 2021 — Toronto, Canada

Driving at night has started giving me headaches. Earlier I used to wonder what's causing this but over the time I have realized it's the bright lights from oncoming traffic in the new cars. I don't feel this with the occasional cars having old halogen bulb yellow lights. There are many times that I had to look away to protect my eyes. I wonder how many other people are facing this

B.1838 December 5, 2021 — Cincinnati, OH

I have a hard time gauging the distance or speed of an oncoming car with LED lights. Not only because of the way it looks but also they are often blinding. Whenever a large truck with LED headlights is behind me, the lights reflect off of my rearview mirror and are painfully blinding. This creates scary and unsafe situations for myself and others on the road. I can only imagine how awful this is for those with strong astigmatism and light sensitivities

B.1839 December 5, 2021 — Detroit, MI

I've almost been in several accidents involving 12 ft ditches because I'm blinded my trucks and suvs with insanely bright led headlights. Headlights brighter than my high beams ! Absolutely ridiculous this hasn't been handled already !

B.1840 December 6, 2021 — Denver, CO

Sick of it...it's already dangerous enough to drive at night.

B.1841 December 6, 2021 — Hamburg, NY

Its blinding

B.1842 December 6, 2021 — MANCHESTER, OH

Driving at night especially in rain and snow you cannot see when when you approach a vehicle with led bright lights

B.1843 December 6, 2021 — Pontiac, MI

I can't drive at night , specially approaching any curves on the road , if this lights are coming at me I have to slow down completely till they are no longer pointed directly in my eyes

B.1844 December 7, 2021 — Jamestown, NY

These lights are dangerous! You cannot dim them, and they blind other drivers!

B.1845 December 7, 2021 — Salisbury, NC

These lights make it difficult to drive at night, are blinding, and induce migraines and other issues in many people.

B.1846 December 7, 2021 — Terre Haute, IN

They are dangerous and I have to avoid night driving.

B.1847 December 8, 2021 — Miami, FL

I drive alot at night & these new lights are so bright & blinding it's ridiculous how it's even being allowed! Take these lights off the strets so we can see!

B.1848 December 8, 2021 — Milford, CT

These lights are extremely blinding, and also a threat and trigger to my health condition.

B.1849 December 8, 2021 — Monahans, TX

I suffer from chronic Migraine Migraine and night blindness. I have to drive to and from work on very dark roads with these headlights either coming at me or coming up from behind. On very narrow country roads, it's hard to look away and stay safe. It's even worse when it's on a work truck displaying two sets of these lights. Something has to be done about these lights before anyone else dies, and I sure hope that someone isnt me.

B.1850 December 8, 2021 — Orange City, IA

The LED headlights on these new vehicles and semis blind me so I can't see ANYTHING. These ****ing things...I can't even tell if they are on low or high beam they're so bright. If I think someone's halogens are on high beam but they aren't and I flash them, and they flash me back...no big deal. But if that happens with LED headlights and they turn on their high beams in retaliation it's like being forced to look at someone welding without a helmet and my eyes hurt for hours after. Anything that damages your eyes and creates deadly conditions is not a headlight: it is a WEAPON. And that's just what these LED abominations are. And they need to be BANNED. To anyone who says "people who

hate LED headlights need their eyes checked": if you need THAT much blinding light to drive at night, then you need YOUR eyes checked. And to everyone in the government who authorized this, take note. WE ARE COMING FOR YOU.

B.1851 December 8, 2021 — San Diego, CA

I hate excessive glare in eyes on night highways.

B.1852 December 9, 2021 — Malvern, PA

I can't drive safely with these brighter lights behind me and coming toward me

B.1853 December 10, 2021 — Hialeah, FL

I am blinded by theseights

B.1854 December 10, 2021 — Lake City, FL

Not only do these light make your side of the road not visible creating a safety hazard but if you're like me they give you an instant pounding headache. These headlights are a nuisance and should be banned.

B.1855 December 11, 2021 — Kinston, NC

I can't see at night with those blinding lights and it causes me to swerve and lose sight and once I gain my sight back another car comes with bright lights. It's ridiculous. It's dangerous. Something needs to be done. Stop fixing things that don't need to be changed and focus more on things like this!!!

B.1856 December 11, 2021 — Middlefield, OH

I can no longer participate in society because of how sick I get from LEDs. Please join me and the many who's lives have been turned upside down by radiation emitting deathiodes in the fight to bring awareness to the deeply painful and life endangering consequences of the lack of regulation and accountability in the 'lighting' market.

B.1857 December 11, 2021 — Reading, PA

I have nearly died in the car because of blinding headlights. I've swerved off the road, I've been unable to see the road in front of me, I've missed bends in the road and I've nearly hit the car blinding me before.

B.1858 December 12, 2021 — Waterville Valley, NH

Deborah Kenney-Hood

B.1859 December 13, 2021 — Canton, GA

I can barely drive at night anymore. I'm afraid of an accident because I am constantly blinded by LED lights aimed into my vehicle

B.1860 December 13, 2021 — FL, United States

I hate these lights. They hurt my eyes and head so bad.

B.1861 December 13, 2021 — Olathe, KS

I can't even see at night while driving anymore, and I'm only 25! With everything going online nowadays, were stuck staring at screens for hours. Sometimes against our will, with work from home! We can't afford to harm our eyes even further.

B.1862 December 14, 2021 — Huntsville, AL

I'm tired of being blinded with these bright lights! It's painful!

B.1863 December 15, 2021 — Kirkland, WA

Led lighting has its place but not for headlights or streetlights. The rays are harmful.

B.1864 December 16, 2021 — Lacey, WA

These new bright headlights are dangerous and blinding to other drivers.

B.1865 December 17, 2021 — Bridport, ENG, United Kingdom
Becouse these headlights are dangerous

B.1866 December 17, 2021 — Plainsboro, NJ
Driving stately is utmost important and this change can help reduce the accidents

B.1867 December 17, 2021 — ashburn, VA
it's highly dangerous

B.1868 December 18, 2021 — Avondale, LA
bc fuck them im trying to see to drive !!!! fuck u too if you have headlights brighter than the sun☒

B.1869 December 18, 2021 — Chicago, IL
It blinds you when u driving

B.1870 December 18, 2021 — O Fallon, MO
If this saves just one life it's worth it.

B.1871 December 18, 2021 — Portland, OR
In really tired of "driving by feel" everytime a car with a set of these lights passes me by. I'm likely going to crash soon.

B.1872 December 19, 2021 — Crossville, TN
bright led headlights with auto dimmers still to BRIGHT

B.1873 December 20, 2021 — Carlisle, MA
I get blinded by cars with LED lights and LED streetlights. We need help to stop this madness!

B.1874 December 21, 2021 — Gilmer, TX
It's dangerous, when you're blinded by these lights

B.1875 December 21, 2021 — San Diego, CA
It is so distracting and dangerous while driving and having these kinds of headlights blinding you! I have feared for my safety when I could barely even see the guide line to the right of my truck. Before these new LED lights became wide spread, that level of brightness was only used when your brights were on. There is zero reason for lights this bright esp when the majority of people drive in populated areas.

B.1876 December 22, 2021 — Albany, OR
I drive country roads often where conditions can be challenging without blinding bright white lights causing temporary blindness. A lot of the time road lines are faded or nonexistent in foggy, rain or other inclement conditions on windy roads these bright white lights. That have become the standard instead of a exception create a perfect storm for close call situations. I can handle old school standard halogen lights even with their brights, but these new led style lights make it impossible for ANYONE to see and we must not take away vision from our drivers.

B.1877 December 23, 2021 — Houston, TX
These lights are harmful and are going to cause many accidents!

B.1878 December 23, 2021 — Salt Lake City, UT
It's so bad that I get migraines any time I go out at night. It's just not reasonable to expect everyone with sensitive eyes to never drive after dark or in stormy weather. These lights are so bright and disorienting that it can lead to premature vision loss!

B.1879 December 23, 2021 — Toronto, ON, Canada
not only is it harmful to myself and other human road users outside of said vehicle, it is also penetratingly damaging to living creatures, notably insects who are disoriented, and disrupted by the effects; this in the sixth great extinction, in a biodiversity crisis...

B.1880 December 24, 2021 — Palm Springs, CA

This has been an issue for me for years!! My eyes are sensitive, and I also suffer from severe migraines. Bless the person who started this petition, and you've got MY signature!

B.1881 December 27, 2021 — Muskegon, MI

I deliver for a living and these lights are so bright that I have to block them with my hands or pull over and let them pass me. Nobody needs lights and powerful under normal driving conditions.

B.1882 December 28, 2021 — Spokane, WA

my astigmatism blurrs led headlights so they’re the only thing i see

B.1883 December 29, 2021 — Swadlincote, ENG, United Kingdom

Headlights on new cars are a joke

B.1884 December 30, 2021 — Johnstown, PA

I have had to quit my job as an Uber driver because I can no longer see when driving at night. This directly leads to bar patrons deciding to drive themselves because they don't have another option, which also adds to PEOPLE DYING.

B.1885 December 31, 2021 — Middletown, NY

Should be illegal

Comments left in 2022

January 2022

B.1886 January 2, 2022 — Palmdale, CA

I have been blinded!

B.1887 January 5, 2022 — Lee, FL

Alferd Carl Murphy!!!!!!

B.1888 January 5, 2022 — Springfield, VA

My motorcycle's headlight is not distinctive in a sea of bright DRLs, putting me at risk with inattentive drivers.

B.1889 January 6, 2022 — ALLENTOWN, PA

I am only 41 and have been struggling to drive at night for years already because of these headlights. Just last week the driver behind me had lights so bright that the reflected off of the median barrier and light up the interior of my vehicle.

B.1890 January 6, 2022 — Columbiana, OH

Blue lights or light containing more blue lessen a persons night vision. These new lights blind other drivers

B.1891 January 6, 2022 — Red Deer, Canada

I hate LED lights so painful on the eyes

B.1892 January 6, 2022 — Salem, MA

When I drive at night, and there's an oncoming car, I can't see a darned thing until it has gone by me. I try to look at where the road in front of me SHOULD be, and pray that I don't hit anything on the side of the road. It's even worse if I am driving in a regular car (I drive a light duty truck.) I have friends who refuse to drive at night because they are blinded by oncoming halogens. Please, please, just angle them DOWN a bit??? Why do they ALL have to look like highbeams are already on? And when they do switch on their highbeams, then I am white knuckling the steering wheel, slowing way down, because I am almost completely blind until they have gone past me. Please, especially for the shorter amongst us, please stop blinding drivers?? It's incredibly dangerous! It is light someone shining a flashlight directly into your face in the dark - all you can see is blinding light.

B.1893 January 6, 2022 — Salem, MA

We were just talking about this at work yesterday. Extra bright headlights, coupled with people having their high beams on, plus the fact that truck & SUV headlights are at the height of sedan windows, make for some dangerous driving conditions.

B.1894 January 7, 2022 — Houston, TX

I drive my car now with high beams all the time bc it bounces back some of the light and even though I know this is illegal; I have no other alternative.

B.1895 January 8, 2022 — Fort Worth, TX

Because I feel that these headlights are dangerous & deadly. My mom almost got in very bad accident because of these damn lights!! How many more people have to get hurt or lose their lives because of this stupid trend of LED lights. It has to stop !! ☒

B.1896 January 8, 2022 — New Braunfels, TX

I am signing this petition because the high intensity lumens (3000-4000) from LED highlights should be illegal, not the specially-designed glasses that are an alternative solution for driving at night. Once again it is a matter of money and power supported by the stronger lobbyists. I thought it was my imagination, that the headlights today are stronger and brighter than yesteryear. With almost 29,000 people supporting this petition, how is it these lights are still legal. It is clear the powerful lobbyists have a strong government backing and consumer affairs are of no concern. What horrific event is going to ban these LED lights the way, the Amber alert came into play. Why will it take a tragedy for this country to create a statute to ban LED headlights. These lights are blinding, these lights cause migraines, these lights force to look away from the road. And for some, these lights cause people to blackout when they are driving. Seriously, that in itself is enough reason to ban LED headlights. The irony is when the LED headlight driver flashes me when i left my brights on, two words for those drivers and its not Happy Birthday!!! This country is ...

B.1897 January 9, 2022 — CA, United States

Im tired of being blinded at night and scared im going to hit someone or something while blinded! I cant believe these lights ever passed ANY car manufacturers safety inspections☒

B.1898 January 10, 2022 — Burnaby, Canada

The ridiculously bright headlights are SO dangerous. For everyone. Motorists, cyclists, pedestrians. PLEASE DON'T USE THEM PEOPLE.

B.1899 January 10, 2022 — Montverde, FL

Went out last night and on the way home on a narrow road the oncoming Suv's lights were blinding the crap out of me! I had to slow way down. I don't like flashing them but I did! Bas-ard had his hi beams on! Really! Even after lowering his high beams I was still blinded! Pisses me off! According to police data, accident investigators report 'dazzling headlamps' as an influence in 10 fatal crashes, nearly 70 serious accidents and more than 250 other accidents. Some drivers suffer something called 'disability glare'. Studies have shown it can take up to 10 seconds to recover from.

B.1900 January 11, 2022 — Emmett, ID

It's gotten to the point I drive at night only if I must. Jeeps and lifted trucks are the worst

B.1901 January 11, 2022 — Lomita, CA

I remember growing up in the 70's and 80's. Any off road halogen lamps, which are a lot weaker than today's modern cars' lights, being used on the road would la d you a ticket. Today corruption is evident, the motor vehicle departments and the legislature as well as the transportation department has given in to manufacturers, for profit, and prove of it is that these blinding lights are no longer considered ilegal. Enforcement against these lights is not possible because corrupted officials have turned these blinding lights "legal". Third world business in the USA of today !

B.1902 January 11, 2022 — Red Deer, Canada

I am all for banning LED's on headlights. They belong in an operating room not on the road. I really hope more people start opposing these lights as more and more are going to be seen on the road in

the next 2 years. It′s going to come to a point where you will feel like you are in the twilight zone just going for a drive! PLEASE BAN LED′S OR REGULATE THEM SO THEY ARE NOT WHITE BRIGHT AND HARD ON THE EYES! I′m not old but it′s going to become an issue for those in their 20s and 30′s eyesight will be destroyed!

B.1903 January 12, 2022 — Pompano Beach, FL

This light are hazardous and blinding

B.1904 January 13, 2022 — Columbus, OH

The intensity of the led headlights is beyond all possible reasoning. I′m 46 with no health issues and drive with 1 hand over my face for oncoming traffic. A ridiculously tall pickup that has no use other than to feed egos had 6 lights on each side of the grill, and were at least 5 feet above the ground. Additionally, a behemoth truck passed me and the lights shone sideways as well and blinded me as it was passing me. How did this pass government safety regulations.? Guess the auto lobbyist bought a few more politicians. Where is the justification in for this level of lighting? It is equally bad when one of these giants pulls up behind you at a stop light. Once again, I guess we haven′t reached the number of led light related deaths to change anything. The only people supporting these lights are the ones who drive them.

B.1905 January 15, 2022 — New Orleans, LA

Bring back yellow lights ��

B.1906 January 16, 2022 — Freeport, MI

LED headlights are way too bright and they′re dangerous. Whenever a car with LED headlights is driving past me, I can′t see anything until they′re gone, and I have 20/20 vision. Please ban LED headlights for the sake of road safety.

B.1907 January 16, 2022 — Miami, FL

I′ve been temporarily blinded by these ridiculous lights. They are dangerous to safe driving!

B.1908 January 17, 2022 — Rochdale, ENG, United Kingdom

These headlights are unnecessarily dangerous and potentially lethal.

B.1909 January 18, 2022 — Jacksonville, NC

I can’t for the life of me understand how these extremely blinding bright headlights are legal. It’s frustrating driving at night because of those headlights!!

B.1910 January 19, 2022 — Hornsea, ENG, United Kingdom

The LED headlights blind oncoming drivers. They should be banned outright.

B.1911 January 19, 2022 — Manchester, ENG, United Kingdom

The new LED headlights are too bright and very dangerous, particularly for those who suffer with photophobia migraine and other similar conditions. These new lights are not a move in a positive direction, they are a set back.

B.1912 January 19, 2022 — Totnes, ENG, United Kingdom

Since the introduction of LED lights I am noticing getting ′blinded′ at times by the brightness glare causing much difficulty for me driving at night.

B.1913 January 19, 2022 — Totnes, ENG, United Kingdom

LED Car lights are a irritation and dangerous... they are unnecessarily bright causing temporary blindness to people with sensitive eyes when driving at night.

B.1914 January 20, 2022 — Buckfastleigh, ENG, United Kingdom

I find driving at night very dangerous because the headlights are blinding

B.1915 January 20, 2022 — Columbus, OH

They′re blinding to other drivers on the road

B.1916 January 20, 2022 — Columbus, OH

Tired of blinding lights

B.1917 January 20, 2022 — Salt Lake City, UT

I fully agree. LED headlights are unsafe and need to be regulated.

B.1918 January 21, 2022 — Blackpool, ENG, United Kingdom

I have Irlen's Syndrome and walking in the dark is horrendous because of these lights, worse when I am driving in low light! They because me significant pain

B.1919 January 21, 2022 — New Fairfield, CT

We live in rural area and these lights are incredibly dangerous.

B.1920 January 22, 2022 — Ashford, ENG, United Kingdom

It's ridiculous they're legal

B.1921 January 22, 2022 — Denver, CO

Some people have astigmatism or blue eyes and there are no regulations on how bright LED headlights can be they are dangerous not to mention painful.

B.1922 January 22, 2022 — Lethbridge, Canada

No where in nature do you see lights this intense and blinding. It's un-natural and harmful. Time to reclaim the night and start living in harmony with nature.

B.1923 January 22, 2022 — Lethbridge, Canada

No where in nature do you see lights of this intensity and brightness. The whiteness and glare is harmful on all levels to people and the environment. Best way to send a message to manufactures who churn out this crap is to simply NOT buy it.

B.1924 January 23, 2022 — Montgomery, AL

LED lights can cause seizures in people with epileptic photosensitivity.

B.1925 January 23, 2022 — Philadelphia, PA

https://www.ama-assn.org/press-center/press-releases/ama-adopts-guidance-reduce-harm-high-intensity-street-lights

B.1926 January 24, 2022 — Columbia, CT

These auto lights are causing much distress to my eyes during daytime but especially at night and I know I'm not the only one. Something must be done to stop this agenda to blind American citizens.

B.1927 January 24, 2022 — East Prospect, PA

They are blinding!!! I hate them!!

B.1928 January 24, 2022 — Hastings, United States

I know very many people, including myself, that fear driving at night because of these lights. It's unsafe and unnecessary.

B.1929 January 24, 2022 — Wakefield, United Kingdom

Agree with the cause being fought here. LED lights are particularly glaring - its the directional intensity, colour temperature (if only they were at the very least a 'warmer' colour), they often have high-frequency but discernible flicker, and auto-headlight sensors in cars bring them on too early, heightening the glare at dawn/dusk when dimmer sidelights are more appropriate.

B.1930 January 24, 2022 — Washington, FL

Because led headlights have blinded me during nighttime driving therefore I cannot drive at night.

B.1931 January 25, 2022 — Oakland, MD

We need regulation on headlight luminosity.

B.1932 January 25, 2022 — United Kingdom

I have lost my confidence in my abiy to drive at night because of this and so avoid going out at night.

B.1933 January 25, 2022 — Worcester, United Kingdom

I know first hand the effects this has on my health and how it has made my life so restricted both indoors and out . People need to know the effects it has on photosensitive people and in fact non photosensitive too. The impact on health is phenomenal and it needs to be better understood & circulated to all and significant action taken to address this issue .

B.1934 January 25, 2022 — glasgow, SCT, United Kingdom

Blinding brights lights at night are a nightmare you think it's full beam that's on accident waiting to happen

B.1935 January 26, 2022 — London, ENG, United Kingdom

I struggle to drive at night with bright lights like this and almost had an accident. I had my eyes tested and they are fine, it's purely people with lights too bright

B.1936 January 26, 2022 — Saxmundham, ENG, United Kingdom

I work in lighting industry and I know the effects of blue light and think this should be addressed globally.

B.1937 January 28, 2022 — Jacksonville, NC

I absolutely cannot believe that these lights are legal! Everything about driving a car should be about safety, seat belts, air bags, etc but it’s okay to have blinding lights on your car?!?! This is reckless and inexcusable and needs to stop now!!

B.1938 January 29, 2022 — Banbury, ENG, United Kingdom

You think they are on main beam when they are on dip, you cannot help but look straight at them. So sad they have been allowed to become so common and the new "norm".

B.1939 January 29, 2022 — UT, United States

If we're having issues now and nothing is being done, it's only a matter of time before car manufacturers start increasing lumen levels in their headlights making the problem worse.

B.1940 January 30, 2022 — Elgin, IL

I drive daily. And I see people using LED light bars as headlights. Even during the day. And the light is beyond absurd and blinding.

B.1941 January 31, 2022 — Chicago, IL

Sadly, we've all seen how some people act when "it's for the good of others or the environment"... My question is when did BRIGHT lights like these become LEGAL?! I remember getting PULLED OVER & TICKETED 20yrs ago (in a mid-90s car) for having my "brights" on since 1 of my headlights was out. As DIM as those lights were, the Officer said I blinded him when I turned behind him! Now, 20X BRIGHTER IS OK?!! Like most nonsensical things, it's probably going to take someone "IMPORTANT" to get hurt because of it for anything to change...

B.1942 January 31, 2022 — Chipley, FL

These light should be banned they are blinding when you meet them head on. The glare and blinding is so dangerous While driving.

B.1943 January 31, 2022 — Pendleton, SC

These lights are blinding and dangerous. Impossible not to squint when someone has these lights coming towards you. How in the heck is that safer than the other less bright lights???

B.1944 January 31, 2022 — Westlake, OH

I can't see anymore driving at night!!

B.1945 January 31, 2022 — lawrenceburg, IN

LED head lights are blinding and very dangerous. Especially at night in the rain when you can't see the lines on the road or anything in front of you because you're blinded by LED head lights.

February 2022

B.1946 February 1, 2022 — Chipley, FL

These type lights are blinding. And I can't see good at night already.

B.1947 February 1, 2022 — Huntington Beach, CA

We're in Southern California where there's streetlights every 15 feet. You don't need these here, and we NEED to be able to see in front of us instead of using both hands to block the rear and side view mirrors when you're behind us. In backwoods Oklahoma, fine, it's dark. But we're in a very well lit part of the country. Stop it. You suck.

B.1948 February 1, 2022 — Milliken, CO

I drive in the dark in the morning a good part of the year. Usually these ultra-bright lights are on lifted pickup trucks, which is a double-whammy. It's too much and needs to change.

B.1949 February 1, 2022 — United States

Th se headlights are dangerous. They should definitely be banned.

B.1950 February 2, 2022 — Cameron, MO

hate being blinded by headlights

B.1951 February 4, 2022 — Olympia, WA

I am a professional driver and the harsh white light makes working dangerous and hard to see while driving at night.

B.1952 February 5, 2022 — Cullman, AL

These lights are dangeroys

B.1953 February 5, 2022 — Lynn, MA

They blind me when driving not safe at all

B.1954 February 5, 2022 — Lynn, MA

I wholeheartedly agree. It's dangerous! When they are coming toward me in a narrow dark road at night, some headlights are so blinding and I have to hope for the best until the other vehicle passes. When they are directly behind me, I have to fold my rearview mirror up (which is dangerous in and of itself, but still less so than not doing it) so that I can see on front of me and that only helps so much, since the glare from them are still blinding me from my sideview mirror. I don't understand why this has been allowed to become such an issue, in the first place. I hope this will save some lives.

B.1955 February 5, 2022 — Melrose, MA

Sometimes I am blinded by these headlights

B.1956 February 6, 2022 — Rostov-na-donu, Russia

Can not drive at peace anymore. Especially now, in the winter, when the glare is ever more prominent. And the worst thing is - since most cars come equipped with DRLs nowadays and it's considered "more safe" - makes my life even more miserable. Obviously, my issue won't get fixed by any sorta legislation in US. But it's a start. P.S. Did you know that in France it was illegal to have any manner of white lights until 1993 and you had to use "selective yellow" headlights?

B.1957 February 7, 2022 — Dearborn, MI

Europe already has these laws and it saves lives. We can do better in the United States. Trucks and large SUVs are the major culprits to this.

B.1958 February 7, 2022 — Toronto, Canada

It seriously is causing me harm. I drive on single lane highways often throughout Ontario and I am fearing for my life because of oncoming and even traffic following me. I cannot see, it is basically a guessing game with me praying that I do not fly off the roadway into a ditch. Blinding is an understatement.

B.1959 February 9, 2022 — Pittsburgh, PA

It's hard to see in front of you when you're blinded

B.1960 February 9, 2022 — San Antonio, TX

I get blinded by them and can't see where I'm going.

B.1961 February 9, 2022 — Stratford, Canada

I have experienced dangerous driving conditions due to LED lights

B.1962 February 11, 2022 — Palm Bay, FL

Karen Stillings

B.1963 February 14, 2022 — Franklinton, NC

As someone with an astigmatism in both eyes, these lights are quite blinding. I have driving glasses that don't even work with the LED and HID lights.

B.1964 February 15, 2022 — Belsize Park, United Kingdom

They are a danger to other road users as they are too bright and could easily cause a accident due to dazzling

B.1965 February 15, 2022 — Laramie, WY

These lights are great for seeing....if you're the one driving with them. For everyone who has to drive with these lights shining in their face, it can cause or worsen a migraine and/ or it makes everything other then the lights look black! Therefore it temporarily blinds the driver from the road ahead....

B.1966 February 15, 2022 — United Kingdom

For a long time now people have been driving with LED lights that despite the dipped position are still glaring drivers on the road. I am a learner driver and spend most of my time as a passenger in my partner and my friends car and the glare from oncoming LED lights is unbearable. Several times when I have been in the car with other people they have had to slam on the brakes because they are dazzled by oncoming LED headlights. They should be made illegal unless the bulbs or headlight casings can be tinted a pale yellow colour to reduce glare and help all road users to become safer drivers.

B.1967 February 16, 2022 — Conklin, NY

No one needs these headlights on he automobile. They are blinding.

B.1968 February 17, 2022 — Denver, CO

I am tired of being blinded by HID and LED car lights, even in day time, but especially the night time. Furthermore, The American Medical Association stated they find that increased levels of LED and blue light can cause blurriness, migraines, sleep apnea, heart disease, even cancers.

B.1969 February 17, 2022 — United States

I encountered a car today that was a pair of blinding suns moving towards me DURING DAYLIGHT. I had no idea what kind of vehicle was behind the light until it passed me, because I couldn't see anything else on the road at all. I expected something unusual, like a rescue vehicle. Nope, just an ordinary car. That can't be legal.

B.1970 February 18, 2022 — Kirkland, WA

I hate being blinded by stupid LED headlights. I have to drive a lot at night working Door Dash. We are all going to be blind in a couple of years!

B.1971 February 19, 2022 — Crewe, United Kingdom
It's so dangerous to blind someone that's driving.

B.1972 February 19, 2022 — Endicott, NY
I have good eyesight, but find the blue-white LED headlights to be occasionally blinding at night.

B.1973 February 19, 2022 — Manchester, ENG, United Kingdom
I have been blinded far too many times by these lights and have had many near misses! In the dark they dazzle you, and then you can't see properly for minutes after

B.1974 February 20, 2022 — sarasota,, FL
I have been blinded by these kinds of lights many times.

B.1975 February 21, 2022 — Hialeah, FL
Ultra-white-high-intensity lights are risk for drivers.

B.1976 February 21, 2022 — SAN ANTONIO, TX
BAN BLINDING LIGHTS.

B.1977 February 23, 2022 — Amherst, MA
I'm tired of being blinded by oncoming headlights!

B.1978 February 23, 2022 — Bangor, WLS, United Kingdom
These lights are blinding and make driving in the dark very difficult!

B.1979 February 23, 2022 — Baytown, TX
I'm tired of getting blinded by assholes when I'm driving at night

B.1980 February 23, 2022 — CA, United States
I have to pull over every time someone with led headlights comes towards me. If I look at their lights. I'm blinded for several minutes

B.1981 February 23, 2022 — Cheyenne, WY
I'm tired of being blinded

B.1982 February 23, 2022 — Gorebridge, SCT, United Kingdom
They are a danger to on coming traffic

B.1983 February 23, 2022 — Manchester, ENG, United Kingdom
Some headlights are absolutely ridiculous and certainly not required in an urban environment. This is made worse by some people who park facing oncoming traffic with their headlights full on.

B.1984 February 23, 2022 — Sugar Land, TX
I totally agree with this petition. I done like driving at night for this reason! It is so dangerous for these lights to be used as headlights.

B.1985 February 24, 2022 — Glasgow, SCT, United Kingdom
I'm no longer comfortable driving at night

B.1986 February 24, 2022 — Medford, OR
I have an astigmatism and these LED headlights make driving dangerous and nearly impossible.

B.1987 February 24, 2022 — Needham, MA
I am concerned

B.1988 February 24, 2022 — brooklyn, NY
Lights blind other drivers and cause deaths and accidents

March 2022

B.1989 March 2, 2022 — Austin, TX

These lights are blinding for those in on coming traffic, particularly on country roads where city lights do not balance their effect. Traditional car lights are just as effective for driver's visibility.

B.1990 March 2, 2022 — Fort Lauderdale, FL

This shit is ridiculous now. Enough is enough. Brighter lights help the driver behind them and then temporarily blind the oncoming drivers. This is NOT a safer enhancement!

B.1991 March 4, 2022 — Maple Ridge, Canada

I'd like to live another few years!

B.1992 March 5, 2022 — Bothell, WA

I'm 26 and can barely drive at night due to the sheer amount of cars with these lights. They blind me from my rear and side mirrors unless I hunch over the steering wheel, which is incredibly dangerous. I am also autistic and suffer from migraines so even a drive around the block is a guaranteed pain attack unless I pull over but even then I can't avoid the oncoming brights. These lights have even stunned me DURING DAYTIME! It's ridiculous that car manufactures think bright blue is better. It hurts! Please change the law and ask manufacturers to do light recalls!!! How can I hold down a job safely if I can't drive at dawn or after dark? It's beyond my control.

B.1993 March 5, 2022 — Brooklyn, NY

I hate LED lights. Bring back amber and sodium vapor.

B.1994 March 5, 2022 — Louisville, TN

Yesterday I looked in rear view and a new trucks light was so bright I was coming to a light n couldn't see ,I stopped in the middle of the road ,at a green light ,and almost got rear ended

B.1995 March 5, 2022 — Lower Burrell, PA

I am tired of being blinded by on coming bright headlights.

B.1996 March 5, 2022 — Mason, TX

These lights are a hazard to oncoming traffics ability to see while passing the person with these lights.

B.1997 March 6, 2022 — London, ENG, United Kingdom

They are fitted to appeal to the feeble minded who think they look 'cool', car manufacturers are more interested in sales than road safety

B.1998 March 7, 2022 — Leicester, United Kingdom

The breed of today's headlights especially those decorative and blue filament types dazzle and should be banned.

B.1999 March 8, 2022 — La Mirada, CA

I live in a southern CA mountain/lake resort town with very challenging road conditions. Many people from out of the area use their high intensity lights indiscriminately. This causes many accidents with people being blinded and forced off the road as well as causing a lot of wildlife accidents/fatalities. It isn't safe - let's fix it.

B.2000 March 10, 2022 — South Petherton, ENG, United Kingdom

Blinding people indicators need to be more visible not blended into break lights

B.2001 March 11, 2022 — Saint George, UT

Helen Wilson

B.2002 March 13, 2022 — Gallatin, TN

I genuinely cannot see at night due to these lights. I've caught myself in the other lane or on the side of the road because these lights blinded my vision to the point I could not see the lane lines. I have chronic migraines and any time I drive at night these induce them without fail.

B.2003 March 14, 2022 — Statesville, NC

I am so tired of being blinded by lights on vehicles! I cannot change my eyeballs, but people can certainly change their lights!

B.2004 March 16, 2022 — Peoria, AZ

I'm signing because my family friend was a severe car accident that left her hospitalized from a 6 months due to being blinded by an LED headlight and swerving off the road

B.2005 March 17, 2022 — Penzance, ENG, United Kingdom

I struggle to dive at night, avoid it as much as possible because of these blinding lights.

B.2006 March 17, 2022 — Swansea, United Kingdom

all the 5g smart grid is a slow kill technology.

B.2007 March 18, 2022 — Akron, OH

I am signing this petition because these led headlights are dangerous and can cause vision complications. I have personally experience these led headlights are blinding me at a stop light and driving on the road. It is not safe for anyone and will cause unfortunate accidents.

B.2008 March 20, 2022 — burnaby, Canada

Something needs to be done about this. It's terrible and dangerous

B.2009 March 21, 2022 — Wynne, AR

I drive approximately 1.5 hours to work in the dark and back home daily. I am so sick of being blinded by these bright headlights. I just close my eyes and keep rolling when I pass them. I go in everyday thinking this will be the day they get me. It's insane. Nobody needs headlights that bright!!

B.2010 March 23, 2022 — Corvallis, OR

Driving is a part of daily life for many Americans, and widespread adoption of LED in headlights has had a noted effect on my life. If this is true for me, it must be for millions of others.

B.2011 March 23, 2022 — sterling heights, MI

I already have awful astigmatism making night driving awful already... These headlights have made it A WHOLE LOT WORSE. They need to be banned/outlawed immediately!!!

B.2012 March 24, 2022 — Halifax, Canada

Well a win for us today! GM and Ford are recalling some vehicles that have headlights too bright! Also shows the Transportation Safety Board are useless! https://abcnews.go.com/US/wireStory/general-motors-recalls-740k-suvs-headlights-bright-83598621

B.2013 March 24, 2022 — Mount Pocono, PA

Also ban the use of LED emergency lights that blind motorists, and ironically makes the 'Move Over' law hazardous to comply with.

B.2014 March 27, 2022 — Norfolk, VA

The LED headlights are blinding

B.2015 March 28, 2022 — Rochester, MN

When that car drives towards me with led lights, I Can't See the road car etc. Led lights are dangerous for incoming traffic!!!

B.2016 March 29, 2022 — Bloomington, CA

The LED lights give me headaches and make night driving unsafe bc I can't see curbs or islands. I try not to drive at night, but have resorted to wearing sunglasses at night if I must drive.

B.2017 March 29, 2022 — Buffalo, NY

I'm tired of having to move my mirrors because of some jerk off behind me blinding me

April 2022

B.2018 April 4, 2022 — Toms River, NJ

I'm only 38. I shouldn't have to to consider not driving at night. But every night I drive home from work im blinded and the cops do nothing to help. They watch you drive by with your car lite like it's the middle of the day and do nothing. Till something is changed im driving 15-20 mph if they get behind me.

B.2019 April 12, 2022 — Lahaina, HI

Lights are so obnoxiously bright. I get blinded by low beams from the back, shining in my rearview mirror. Lights should be the lowest level necessary for safety, not a security light that lights up the road for miles.

B.2020 April 16, 2022 — Los Angeles, CA

These blinding headlights have gotten out of hand and should go away for good. There is absolutely no reason why vehicles such as pickup trucks and semi trucks need to have blinding headlights which are brighter than a car's high beams. These lights are very unsafe for oncoming and outgoing traffic, especially during heavy rain storms at night.

B.2021 April 18, 2022 — Roxbury, MA

It is bewildering that someone decided these glaring, painful lights were a good idea anywhere. They give more light, but there is less visibility, due to glare. More bewildering is that they got manufactures and a big chunk of the population to go along with it. However, using them for headlights is just… what word is strong enough for "so obviously foolish; surely they could have predicted what would happen." If they can make these lights with a more tolerable color spectrum (as they do with fluorescent lights), why don't they? They hurt my eyes and blind me if I'm caught unprepared. For self preservation I look at the line at the edge of the road, and not directly at the road. I assume others do the same.

B.2022 April 19, 2022 — Australia

These are a danger to all road users. If they cannot be correctly installed an angled by the manufacturer in the first place, ban them altogether.

B.2023 April 19, 2022 — Bay City, MI

I am affected while driving when others have super bright led headlights. It blinds me to the point that I can't see the lines on the road and have to shield my eyes.

B.2024 April 19, 2022 — Chattanooga, TN

These lights aren't just blinding they're painful; daggers stabbing into my eyes. It's gotten so bad I have to wear sunglasses at night to protect my eyes.

B.2025 April 20, 2022 — Waxhaw, NC

I'm blinded by oncoming headlights!

B.2026 April 21, 2022 — Farmington, CT

To be accurate. LED = light emitting diode. JUST Like a Laser Diode. LED "lights" are NOT LIGHTS! But dirty unfocused, un-natural LASERS! They have NO PLACE on vehicles!!

B.2027 April 21, 2022 — Hull, ENG, United Kingdom

I darent drive at night becayse of the blinding lights. I cant see a thing.

B.2028 April 24, 2022 — Takoma Park, MD

These LED lights might actually brighten a road, but their excruciating glare causes oncoming drivers to both miss markings (and signs) and to have to look completely away from a road. Installing useful lights—head or tail—that are actually possible to look at should not be even slightly difficult to manage.

B.2029 April 25, 2022 — Leonardtown, MD

I'm sick of being blinded by super bright headlights while driving at night. You can tell from a mile away which car has reasonable headlights, and which one has the newer super bright blinding headlights that are going to daze you when it passes. It's gotten ridiculous now, and NHTSA should have done something long ago.

B.2030 April 25, 2022 — Memphis, TN

The saying is to look at the painted guide line on the passenger side. However, that doesn't work for oncoming vehicles. Also, from the rear it makes you do not want to look at your dude view mirror. I can flip my rearview mirror. However, my side view mirrors didn't come with the feature of mirrors being able to reduce glare and brightness. It's not just the LEDs. It's also people with these yellow/haze oxidized headlights with high beams on. Like there's self DIY restoration kits and also pros that's restores headlights clarity.

B.2031 April 26, 2022 — Durham, NC

this has been driving me crazy and the lights are damaging my family's eyes and affecting our sleep

May 2022

B.2032 May 4, 2022 — Australia

These lights are ridiculous! Driving back home from Airlie beach yesterday so many people not only blinded me with their lights on low beam but they seem to not see you coming either. I had to flash at least 8 cars just to get them to dim their lights. You are left with light burn in your eyes for a few seconds that is so dangerous! I cannot believe it is legal.

B.2033 May 6, 2022 — Mauldin, SC

I have a very low car and they shine right into my window I can’t see anything until I pass them! I know I can’t be the only one who gets blinded.

B.2034 May 15, 2022 — Charleston, WV

My aunt has almost wrecked because

B.2035 May 18, 2022 — Laconia, NH

The blinding lights cause me migraines. I won’t drive at night now. They need to be stopped

B.2036 May 19, 2022 — Mount Laurel, NJ

I’m signing because these lights are horrible!! The LED ones (super bright white ones)... They are absolutely blinding!! Whether they are shining from the car in back of you or cars that are facing you... “They are a blinding” and I can’t see how people are able to bare them? I use a my rear few mirror dimmer to help me with cars behind me, but I literally have to hold my hand up like I’m blocking sun glare for the cars that are driving towards me. They are really hazardous. I was literally blinded by a car driving towards me with them one day and I had to pull over and let it pass because I couldn’t see! They shouldn’t be legal at all. This isn’t safe! They are too bright and there will be more fatalities if something isn’t done. I’m so happy to see this petition. After yet another blinding experience this evening I had to look for help! Hopefully it won’t take a horrible event for something to be done.

B.2037 May 20, 2022 — belleville, MI

I can't stand halogen headlights and they're dangerous

B.2038 May 26, 2022 — United States

I hate these headlights, I can't see!

June 2022

B.2039 June 9, 2022 — Philadelphia, PA

i get constant migraine and i think its from driving at night, these LEDs arent it. ive been blinded to the point that im almost driving towards the light which can cause friggin accident

B.2040 June 9, 2022 — Wynnum, Australia

The over last 10 years have become far to bright.

B.2041 June 24, 2022 — Toledo, OH

They are to bright.

B.2042 June 26, 2022 — Tempe, AZ

Yes I understand it because, certain newer cars have a tendency to blind you, it can be very very dangerous.

B.2043 June 30, 2022 — Covington, LA

I get "Blinded By The Lights"

July 2022

B.2044 July 2, 2022 — Detroit, MI

driving with double astigmatism at night was hard enough before these headlights. even in my 20s, i've almost completely given up driving at night due to these too bright headlights.

B.2045 July 10, 2022 — Brooklyn, NY

Clean headlights should be suffice. You're not directing ships to port. Your stock headlights are enough.

B.2046 July 10, 2022 — Milwaukee, WI

These lights are unsafe and need to be banned. When I walk at night I can't see a thing with these oncoming headlights.

B.2047 July 21, 2022 — Springfield, IL

These headlights are actually dangerous. If you need that much light to drive at night you shouldn't be driving.

B.2048 July 22, 2022 — Montreal, Canada

these lights are evil and they suck improve road lighting fixtures instead

B.2049 July 22, 2022 — Pembroke, Canada

As a migraine sufferer with light sensitivity, these headlights make it very difficult to drive at night.

B.2050 July 22, 2022 — Vacaville, CA

I hate those headlights with a passion

B.2051 July 27, 2022 — Toronto, Canada

The street lights have gone dimmer and car lights are so bright they literally blind you for seconds after they pass you.

B.2052 July 28, 2022 — Haverhill, MA

These lights are completely unnecessary & DANGEROUS! The human eye is not meant to constantly dilate & be flooded with blinding light one second, and then plunged into darkness the next. Your eyes cannot physically possibly adjust that fast! If someone blinds you with these horrible led headlights and then someone crosses the street in front of you in the dark, you could possibly hit them! It is insane! They give me headaches and eye aches. LED headlights WILL kill people. In fact, they probably already have

August 2022

B.2053 August 5, 2022 — Aurora, CO

I'm tired of being blinded from this style of headlights. It is dangerous to have these headlights on vehicles.

B.2054 August 8, 2022 — Corapeake, NC

LED are just dangerous. Even during the day they blind me and I'm only 47. How bad do they blind older drivers?????

B.2055 August 9, 2022 — mission viejo, CA

LED cause migraines

B.2056 August 11, 2022 — Montclair, NJ

I get blinded if driving at night and a vehicle with LED lights is coming towards me. It is incredibly dangerous. The old-style car lights never bothered me unless they'd left their high beams on.

B.2057 August 11, 2022 — Wallington, NJ

These headlights are blinding from oncoming vehicles and from the vehicles behind. The mirrors drill them into the driver's eyes.

B.2058 August 12, 2022 — La Center, WA

I've been literally temporarily blinded for a few years from extreme white and blue spectrum headlights.

B.2059 August 15, 2022 — Santa Monica, CA

This is a horrible traffic hazard --- exponentially worse when used on higher-profile vehicles like SUVs and large pickups. But even with regularly-sized cars, it's made it so that I can hardly see the road ahead, whether it's someone coming astride in the other lane, or oncoming traffic. I don't see a single benefit here. I'm not sure why these are necessary -- for safety?

B.2060 August 17, 2022 — brookline, MA

these bright lights make driving at night VERY difficult.

B.2061 August 18, 2022 — Santa Cruz, CA

These super bright HID lights that are put into reflector housing are putting out a super blast of light that is like driving directly into the sun! The purpose of these types of lights are to hopefully cause an accident in the hopes of killing a targeted person. These headlights are currently being used by hate groups, gangs, police, and by political groups who just can't think for themselves and believe the rhetoric and must go out and force their ideology and everyone else. These super bright, completely blinding headlights are being used as one of the newest killing weapons. I have personal experience with this new murder tool as it is currently being used against me as I am the current target of a local hate group which is backed by several home owner associations. My crime, I am a 63 year old disabled widow living with my dog in my van. This vigilante group has been running homeless people out of my county for a couple of years now or simply being homeless. I on the other hand and quite stubborn and will not be run out of the place I grew up in and been in for 60 years. These are some of the tactics that these groups are using in a negative way not just to brighten up the highways but to try to slaughter some of our citizens purposely. The kicker to this story is that the local police and Sheriff support and allow this actions against individuals. They have done absolutely nothing to stop this vigilante group from using these headlights against their targets. These HEADLIGHTS ARE THE NEWEST REVOLVERS! PLEASE BAN THEM!

B.2062 August 19, 2022 — Brookfield, IL

These lights seriously are blinding, they have affected my night vision. Cars are equipped with bright lights when needed. Please go back to the regular headlights.

B.2063 August 19, 2022 — Fresno, CA

Too many people swap out ther bulbs for these super bright LEDs and aiming them high. I've been blinded too many times from on coming traffic with these LEDs and have have to change my rear view mirror and side mirrors when they are behind me because its so blinding. These lights need to be illegal. Cops and highway patrol need to pull them over.

B.2064 August 23, 2022 — Glen Head, NY

Being constantly blinded by ridiculously bright headlights while driving at night is a completely solvable issue and its ridiculous that nothing has been done to address this ever-growing problem.

B.2065 August 30, 2022 — Simpsonville, SC

There's no reason for the lights to be as bright as they are. Eyes can't adjust that quickly which means that for a few seconds drivers are literally driving blind.

September 2022

B.2066 September 2, 2022 — Denver, CO

I'm sick of being blinded by these headlights their practically high beams

B.2067 September 8, 2022 — Jackson, TN

The car and truck lights are blinding and could cause an accident.

B.2068 September 8, 2022 — United States

When I'm driving at night these headlights makes difficult for me to see the cars approaching me and the Road.

B.2069 September 12, 2022 — Midland, MI

These lights are killing people

B.2070 September 12, 2022 — Nelson, New Zealand

It is very blinding driving at night and a car with these types of lights comes towards you.

B.2071 September 12, 2022 — Tumbler Ridge, Canada

LEDs are a health hazard and dangerous to drivers. They need to go ASAP.

B.2072 September 14, 2022 — Blacktown, Australia

They are genuinely dangerous to the safety of others

B.2073 September 17, 2022 — Kansas City, MO

I hate those horrible blue lights they make it SO hard to see! This is the whole reason I hate driving at night!!

B.2074 September 18, 2022 — Ankara, Türkiye

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B.2075 September 18, 2022 — Lake ozark, MO

I'm a collision survivor

B.2076 September 20, 2022 — Granada Hills, CA

I have a condition called Adies Tonic pupil which causes for one eye to be dilated. Even with special prescription glasses to drive at night, I'm still blinded by these lights because they are so bright. These new lights need to be regulated NOW! For the safety of all pedestrians and drivers.

B.2077 September 22, 2022 — Atlanta, GA

Highly distracting, lives matter more than aesthetics. Especially on a night drive.

B.2078 September 23, 2022 — Maynardville, TN

The United States is lacking in headlight control. Other countries, such as Europe, allow for ADB headlights. United States laws do not allow for the use of these adaptive headlights. Manufacturers are fitting new vehicles with these dangerously bright LED headlights, but using old methods of simply blocking off the light or angling it down to reduce glare. This works ok when on a flat road, when the headlights are properly adjusted, and the vehicle is not modified. We all know the world is not flat though, and modifying vehicles is a strong hobby. This leaves other drivers on the road blinded by oncoming vehicles simply by cresting a hill. Trucks can be towing a small load, causing the rear to squat, and angling the headlights upwards, making it seem like they are driving with their

high rams on. It's a fairly simple solution, change the laws to allow for the ADB system to be used in the United States, and outlaw the use of LED headlights without being paired with an ADB system. We need to move quickly as this is already way out of hand with manufacturers.

B.2079 September 26, 2022 — Connecticut, CT

These lights are dangerous and unnecessary.

B.2080 September 27, 2022 — Queens, NY

As someone who gets migraines from bright lights (as many people do), the bright headlights make driving at night impossible and dangerous.

B.2081 September 29, 2022 — Montreal, Canada

I can't drive at night because of HIDs. They are unsafe!

B.2082 September 29, 2022 — Shah Alam, Malaysia

Those who use blinding headlights on their vehicles are scumbags of society who are irresponsible and extremely selfish to the core, show zero respect to lives.they should be dealt severely by law of the country. Expect authority to take stern action ASAP before the innocent road users are killed by them.

B.2083 September 29, 2022 — Yakima, WA

Please for the love of God make this blinding lights illegal. A huge truck parked in front of us last night while we were pulling out of target and I am still seeing weird spots the next day. It makes me so sad honestly. Our vision is one of the most precious gifts. We are killing it with this stupid bright headlights

B.2084 September 30, 2022 — Halifax, Canada

Can we please stop this madness! At least stop putting LED lights in high trucks and jeeps which negates the cutoff shield. Please!!

October 2022

B.2085 October 1, 2022 — Minneapolis, United States

I've almost gotten into several accidents being blinded by led headlights behind me, they need to put limitations on how bright and what color they are

B.2086 October 7, 2022 — Orange City, IA

LED headlights aren't just inanimate objects. They represent a group of CRIMINALS who have unleashed an eyesight and life destroying pandemic upon drivers. Normally criminals are forced to pay for their crimes. But these criminals have been committing their crimes with absolute impunity and no repercussions. These criminals include: Ann Carlson and the rest at the NHTSA, the DOT, State DOT's, the FDA, elected officials, and local law enforcement who despite mountains of evidence that LED headlights destroy eyesight and endanger lives have refused to lift a finger to do anything to regulate this atrocity or even take legal action against those violating the law by putting illegal aftermarket LED's in semi trucks and vehicles. LED headlights have RUINED my life. They have damaged my eyesight. They have taken away my job of ten years. They have taken away my ability to make a living and pay my mortgage and bills. They have ROBBED ME of my ability to go out at night and drive when and where I want. They have DESTROYED my social life. They have DESTROYED my ability to see friends and visit family. They have DESTROYED my ability to date and chances of finding a spouse. LED headlights have at 47 years old forced me to become a recluse in my own home. And even there I am not safe. I can't even sit outside and enjoy my yard because of cars driving by blasting their LED headlights across my property, or my neighbors on both sides of the streets parking their cars facing my place and leaving them running with their cursed LED headlights shining my way. I can't even look up while mowing along the streets for fear of being blasted by those devil lights. All of this has gone on for so long, and taken such a toll on me that I am now to the point that daily I consider taking my own life. Just a few years ago my life was normal and happy. But all that has been destroyed and turned upside down by these cursed LED headlights. It's quite clear now after years of fruitlessly battling those responsible that nothing is going to change. And I'm just done

with it. But I do have one last thing to say to those guilty. To Ann Carlson and all at the NHTSA; to the State DOT's and local law enforcement; to those at the FDA; to the elected officials who have not done and clearly will do NOTHING; to Dr. Vance Thompson and the staff at Ophthalmology LTD and the Mayo Clinic who have all been dismissive of my situation and of all the LED-vision destroying evidence I have given them, and who all have refused to lend their credentials in this battle; and to all of the eye doctors and researchers who have published anti-LED papers and studies who refused to answer my cries for help: my blood will be on YOUR HANDS. You may not face consequences in this life for what you have done to me and millions of others. But there is a God and there is a hell, and you WILL pay for your crimes some day. I have read in several of these comments "It's going to take the death of someone rich and famous from LED headlights before something is done". Well I am neither rich nor famous, but maybe the martyrdom of one inconsequential person will get the attention of just the right person. Bye.

B.2087 October 8, 2022 — Astoria, United States

It's soooo dangerous, I have a very hard time driving at night!

B.2088 October 8, 2022 — Lebanon, OR

been having a hard time riding my bike for how my sunglasses and goggles cant reflect them from my eyes since i find the bright white LEDS be annoying when they should not be on in the day or night

B.2089 October 10, 2022 — Gainesville, FL

Cannot drive at night due to these LEDs.

B.2090 October 11, 2022 — Arlington, VA

I have found these lights totally blinding at night and find them dangerous! I may not see a pedestrian because of them.

B.2091 October 11, 2022 — Goleta, CA

Bigger and brighter is NOT better! Also we are suffering from Visual Overload with more and more brilliant stop lights, borders around them, neon buttons to mark the lanes, way too much Visual CLUTTER. It is getting increasingly challenging and way overboard and unnecessary!

B.2092 October 11, 2022 — Goodyear, AZ

There are so many ways to assault people, in which the effects may be felt only gradually, over time, and by degrees. In the case of driving, sudden blinding may make other road hazards not visible, leading to sudden disaster. When government agencies are captured by the companies they allegedly regulate, harms, such as these harms, may continue unless there is concerted rebellion by the public.

B.2093 October 11, 2022 — Hatfield, AR

Blinding lights kill

B.2094 October 11, 2022 — Mastic, United States

too blue are these lights horrible in fog. need to return to soft white color temp. 3000 to 4000 on the kelvin scale no higher. yellow not blue

B.2095 October 11, 2022 — United States

common sense please

B.2096 October 12, 2022 — Lehigh Acres, FL

I agree these headlights are dangerous. They are definitely blinding.

B.2097 October 12, 2022 — Magnolia, TX

You can buy a 40,000 lumen led headlight on eBay and Amazon right now. No where on Amazon/eBay is it mentioned that these items are illegal for on road use. People have already been blinded and injured by the recklessness of these sellers. A class action against Amazon/eBay would put a stop to this.

B.2098 October 12, 2022 — Mount Pleasant, United States

Extremely bright lights really bother me at night. The LED & HID headlights are extremely bright & almost blind me. This is most dangerous!

B.2099 October 12, 2022 — United States

I have post concussion syndrome. These ridiculously bright lights have nearly caused me to just pull off the road until they pass by.

B.2100 October 15, 2022 — United States

It's not all LED lights. They are called xenon lights. They are incredibly bright. This year the FTC approved pixel headlights for the regular LED lights. What this does is shade out an area where there is an oncoming vehicle or one in front of you. Many manufacturers have these features, but they weren't activated cause they were illegal. I did sign the petition, but I wanted to make sure before you sent it, that most of the issue is with the xenon lights. People will have them installed by a third party, and most of the time they aren't installed properly. The lights should be adjusted to shine on the road directly in front of the car. A lot of people install them themselves and don't do it properly.

B.2101 October 15, 2022 — Warren, MI

These lights are dangerous.

B.2102 October 16, 2022 — Raleigh, NC

My commute includes driving home after dark for about an hour and there are many cars out there that appear to have their bright headlights on. Some may not actually have them on. If they do, they are major assholes!

B.2103 October 18, 2022 — Long beach, MS

With me having epilepsy my seizures have spiked in numbers due to the effects of the lights!!! I work and I am a closing manager so the seriousness of these lights being banned would do wonders for me!!! I have had 13 plus seizures in the past two weeks!!!

B.2104 October 18, 2022 — Saskatoon, Canada

I have really bad light sensitivity and where I live it's not an option to just not drive. Here in Canada we have long nights in the winter and we also have LED car lights. I get temporarily blinded by those lights and it's a serious issue. One day I, or someone else I know may crash, get injured or die.

B.2105 October 19, 2022 — Austin, TX

Every small change matters

B.2106 October 19, 2022 — Jacksonville, FL

It's getting extremely difficult to drive at night.

B.2107 October 20, 2022 — Nashville, TN

I'm signing because these headlights are truly Dangerous. I now drive with sunglasses on as a few times, I've almost hit a pedestrian having been blinded by an oncoming LED featured vehicle. Jeeps and 18-wheelers seem to be the brightest and most offensive, hazardous. On some vehicles the daylight headlights shine Wide, spotlighting side-view mirrors AND houses on residential streets. When these lights first hit our streets, I asked a Nissan engineer WHY the new lights; his reply with a smile, "If we can save a buck...."; aka LED's are cheaper. Congress or the FHA MUST implement a mandatory, standardized low lumen as they did in the '80s with halogens. This is irresponsible private and federal sector management.

B.2108 October 20, 2022 — Nashville, TN

This 2021 NYT article is interesting. https://www.nytimes.com/2021/06/05/business/led-hid-headlights-blinding.html?smid=url-share

B.2109 October 21, 2022 — Piscataway, NJ

90001

B.2110 October 22, 2022 — Amelia Court House, VA

I am blinded every time I drive at night by the ridiculously bright LED headlights. They are dangerous and need to be banned.

B.2111 October 22, 2022 — Manchester, MO

Quite frankly I find these bright lights at night, when a car is following me sets off PSTD that I am getting ready to be pulled over by law enforcement. For years, the only time you would be exposed to these lights was when law enforcement was ready to pull you over. These lights trigger a panic response that I am doing something wrong and need to look for a place to pull over before their red siren lights came on. This is due to conditioning from decades of driving in a world where the only time we were exposed to this was for an emergency or other issue where I needed to respond to the bright light warning. Was I speeding?

B.2112 October 24, 2022 — Denver, CO

Until 2012, LEDs were classified as lasers. I don't want humanity to suffer severe eye trauma. Incandescent and halogen headlamps have served us well for many decades and the severe glaring of oncoming traffic with LED lamps is incredibly dangerous. LED is surface illumination and not point illumination, this technology on the roads was never legal to begin with.

B.2113 October 26, 2022 — Bradford, United Kingdom

These blinding lights are dangerous. They distress me when driving in the dark.

B.2114 October 27, 2022 — Canal Winchester, OH

Fuck led headlights

B.2115 October 27, 2022 — San Diego, CA

I find the LED headlights very dangerous while driving.

B.2116 October 30, 2022 — Rochester, NY

These headlights are making it harder and harder to drive at night time.

B.2117 October 31, 2022 — Lincoln, NE

Night driving is dangerous greatly in part to blinding head lights. Especially the bright bluish head lights! Are there safety studies which can identify the safest head lights for night driving?!!!!

November 2022

B.2118 November 3, 2022 — Athol, MA

These lights are ridiculously bright and blinding. If you have a vehicle with these lights approaching you and behind you, you are completely blinded. This is clearly not a safety improvement.

B.2119 November 3, 2022 — Midlothian, VA

Those light are too bright, can be dangerous, can cause sickness, headaches,rashes and aren't necessary

B.2120 November 7, 2022 — Kaup, India

HID headlights from two wheelers to hour wheelers all is a showoff for the vehicle owner. It encourages high speed at night time for the vehicle owner with hid and the same blinding lights are a hazardous for oncoming traffic. With a very high probability of accident due to combination of owners speed and blind oncoming traffic. Save life's say no to HID led headlamps.

B.2121 November 8, 2022 — Bangor, ME

I have astigmatism and bright headlights put my life at risk

B.2122 November 9, 2022 — Washington, DC

I almost hit a pedestrian in a crosswalk last week. She was right in front of me but I couldn't see her, or anything, because of the headlights on the opposite vehicle. Why are these high-lumen blue headlights allowed?

B.2123 November 9, 2022 — panama, United States
I can't see s..t!!!

B.2124 November 10, 2022 — Lincroft, NJ
i can no longer drive at night!

B.2125 November 11, 2022 — Chicago, IL
I can't drive at night and I'm having hard time changing lanes checking the mirrors and being blinded by cars behind me

B.2126 November 11, 2022 — Horsforth, ENG, United Kingdom
I'm sick of getting dazzled by stupidly bright headlights

B.2127 November 15, 2022 — Damariscotta, ME
I drive at nite a lot, and at 72, worry that my high-beam recovery time may be diminished.

B.2128 November 15, 2022 — Middleboro, MA
LED headlights are dangerous and blinding to everyone except the person who has them and should be illegal!!!

B.2129 November 17, 2022 — Alexandria, VA
I'm signing this petition because I am sick of being blinded by oncoming cars at night. It is very dangerous. Car makers should be held accountable for accidents that occur because of this.

B.2130 November 17, 2022 — Manchester, ENG, United Kingdom
So many near accidents due to blinding headlights !

B.2131 November 17, 2022 — Mitcham, ENG, United Kingdom
These are so dangerous - I would like to know how many accidents have been caused by them?

B.2132 November 17, 2022 — Orlando, FL
Rudolph Cardone

B.2133 November 17, 2022 — Saint Paul, MN
get that out of my face

B.2134 November 17, 2022 — Weston-super-mare, ENG, United Kingdom
Modern headlights dazzle and so are dangerous

B.2135 November 18, 2022 — Loveland, OH
I hate LED lights.

B.2136 November 19, 2022 — Blossvale, NY
Driving is becoming more difficult and dangerous due to blinding lights(headlights, tail lights, turn signals, daytime running lights, etc.) from other vehicles that are proliferating today. The glare from these lights makes driving even more difficult for older drivers whose eyes take longer to recover from flashes of bright light. Exposure to the blue light component of LED lighthas numerous health effects including disruption of circadian rhythms and sleep and may be a contributer to age-related macular degeneration.

B.2137 November 19, 2022 — Bradenton, FL
I am SICK of being blinded while driving. If there's even a LITTLE dirt on my windshield, the light scatters across my windshield and it makes it super hard to see at night. Plus, all the rednecks love installing the brightest, bluest lights they can on their trucks in my area. I also get migraines/nauseous if I see too much bright light. BAN ALL WHITE LIGHTS. Yellow/warm lighting only and I would argue making that so for EVERY residential use (landscaping for example). White lights just blind us and suppress our melatonin production. This is an area of technology that does not need further advancement. For the betterment of mankind, we need to plateau our headlight tech, nay our lighting in general, at warm lighting and call it a day.

B.2138 November 20, 2022 — Everett, MA

These lights are one of the biggest reasons I cannot drive at night. I already have horrible vision and will be getting LASIK eye surgery soon due to the difficulties I face. I am stunned that anyone besides law enforcement can have these lights. They are the equivalent to driving with high beams and I certainly believe that the auto accident rates have sky rocketed since this engineering failure.

B.2139 November 21, 2022 — Glidden, IA

Most semis have 4 bright LEDS headlights too!!

B.2140 November 22, 2022 — Champlin, MN

I get blinded every time I drive at night I wear sunglasses but afraid I will hit a deer a dog mailboxes or even a person, I try to drive at night without sunglasses and I get head aches every time from the new white lights

B.2141 November 22, 2022 — Fayetteville, AR

I'm tired of being blinded at night!!!! It's dangerous!!! And when it's rainy they reflect off the wet pavement!!!!

B.2142 November 23, 2022 — Bootle, ENG, United Kingdom

It's a serious hazard.

B.2143 November 23, 2022 — Perth road, Canada

It is so dangerous. Those lights are blinding for everybody but especially for seniors and more prone to night vision problems

B.2144 November 24, 2022 — Halifax, Canada

Tall SUVs, trucks, and especially Jeeps should not be allowed to have LED headlights. They are too bright and we are all below the cutoff shield. What happened to the purpose of the cutoff shield? But even smaller vehicles are guilty too. Toyota you're the worst! The reflection on rainy days is horrible. If the roads have hills one gets blinded coming over the crest. If the divided highways are not on the same level you are blinded. This is not safe! I hate driving at night now and refuse to be in front of them! I wrote the transportation safety board to express my concern!

B.2145 November 24, 2022 — Walsall, United Kingdom

I can't see, they're blinding

B.2146 November 25, 2022 — London, United Kingdom

Absolutely. No need what-so-ever for it, it's down to trendy looks NOT proper optical engineering and design. To an extent the rear light problem can be mitigated by keeping well back from the vehicle in front, unless of course the vehicle in front is being driven by an asshole who sits with their foot on the brake at stop signs and traffic lights. But headlights are a real problem as it's not practical and potentially fatal to try and avoid a numbnutz f***wit coming towards you on high beams and/or poorly adjusted main beams. Again it's in part down to poor/cheap light design for fashion, not putting light on the road in front where it IS actually needed. Rant over, I'm off to trim the wicks and top up the lamp oil on my vehicles lights.

B.2147 November 26, 2022 — Van Nuys, CA

Drivers who use bright led headlights force me to drive at night with sunglasses. It doesn't feel safe but I have no choice. I can't see otherwise.

B.2148 November 27, 2022 — Mississauga, Canada

I totaled my car because of these things.

B.2149 November 28, 2022 — Eau Claire, WI

I completely agree.

B.2150 November 28, 2022 — Maryville, TN

My eyes are very sensitive. The eye doctor said the back of my eyeball is very reflexive,and it shines back into my retinas. Ive almost wrecked many times over blinding lights. Especially jeeps.

B.2151 November 28, 2022 — Sweetwater, TN

Those lights TOO bright and they can cause accidents when you blind the driver coming towards you. Please, for the life of others, recall them and fix it and don't put any more on any other vehicles!

B.2152 November 30, 2022 — Beverly, NJ

I can’t see anything! I can’t see the road much less any pedestrians or cyclists that might be nearby.

December 2022

B.2153 December 1, 2022 — Irvington, NY

These lights are blinding, especially when driving in the rain. It's impossible to see where the road lines are, let alone if anyone happens to be crossing the road.

B.2154 December 1, 2022 — San Jose, CA

Please! I thought my eyes were going out and I wouldn't be able to drive in the dark anymore until someone told me that it's the LED lights on cars. At times it is blinding, so bad once that I had a complete panic attack on the road and had to pull over (before I knew about the lights). I'm reading up on this and I'm not the only one this is affecting. I 100% agree with this petition. Car makers should no longer be allowed to put these on cars! No one should die due to lights blinding them!

B.2155 December 1, 2022 — San Jose, CA

I might have to try this! Hope it helps!

B.2156 December 1, 2022 — San Jose, CA

The car manufacturers need to be sued for putting them on cars. I'm sure they know by now the dangers!

B.2157 December 1, 2022 — San Jose, CA

Try living in a HIGH traffic area like the Bay area where I do where you have TONS of these bright lights blinding you on your way home, I'm surprised I haven't crashed yet.....I have started taking back roads just to avoid these. This shouldn't have to happen.

B.2158 December 2, 2022 — Brooklyn, NY

It is terrifying to drive at night with these blinding lights. It is such a danger

B.2159 December 2, 2022 — Woodside, NY

I almost cannot drive at night now- it’s so disorienting. I can’t concentrate on driving safely when oncoming lights hit me in the eye- I’m blinded. And the ones coming up from the rear give a triple blinding effect in rearview and side mounts all at once. It completely alters depth perception.

B.2160 December 3, 2022 — Kingsport, TN

Yes it is..i see some led lights that aren't bad at all so i know they can be done right but most are ridiculously bright and move with the road on top of that. Not mad at the moving but when they do its usually right in my mirrors if they're behind me. I literally had to stop in the middle of the road once to motion a car around me cause i was completely blind. If you have the really bright led headlights and see me coming all i gotta say is good luck

B.2161 December 3, 2022 — Kingsport, TN

Yes cause they move as well so they not only hit every mirror and blind me they literally light up the entire inside of my car. I mean i can see their lights outshining mine in front of me and im the one ahead of them. Ive seen leds that are actually built correctly and they're not bad but most are ridiculous. I came here looking for sumn to sign to get em banned cause i just had to stop in the middle of the road and motion the car behind me around it was so bad. Like i mentioned above if anyone has those really bright ones and see me comin Good Luck is all I gotta say

B.2162 December 3, 2022 — Kingsport, TN

Yes and now they′re causing road rage…makes me wanna bright light everyone i see coming but that wouldn′t solve the problem

B.2163 December 3, 2022 — Kingsport, TN

Yes ban em…ive seen some that aren′t bad so i know they can be built correctly but most are ridiculous and we′ve dealt with this long enough and im over it

B.2164 December 3, 2022 — Kingsport, TN

Lets ban em…im gonna start fussing about em every website, every newsletter or wherever i see or hear about em im gonna fuss about em cause i just about wrecked on the way home just now which is why im here releasing all my anger on every comment i see

B.2165 December 3, 2022 — Kingsport, TN

Yea cant believe im gonna have to pull a Corey Hart just to drive now

B.2166 December 3, 2022 — Kingsport, TN

Yea and they even have the nerve to ride your bumper on top of the ridiculous lights. The lights move as well and usually right in every mirror of my car. I literally just had to stop in the middle of the road a few min ago to motion the truck behind me around cause i was blind and yes i was boiling mad but i let it go so im on here releasing my anger if anyone has those really bright ones and see me coming all i gotta say is good luck cause im not giving an inch anymore

B.2167 December 3, 2022 — Kingsport, TN

The jeeps are worst of all em. Those are ridiculous and im sick of all of em… they′re bringing out the roadrage in me. BAN THESE LIGHTS. You know they have to know how bright they are but they don′t care as long as they make the sell and their drivers can see in their vehicle. Im over it so good luck to all yall with those lights when u see me coming cause im not giving an inch anymore and not slowing down no more cause i cant see. Hope we make it

B.2168 December 3, 2022 — Kingsport, TN

Push to ban em…thats what im doing .lets all work together…ive seen some that aren′t bad so i know they can be built correctly but they only worry bout their vehicle sale and the ones driving their vehicle. If they see me coming all i gotta say is good luck cause im not giving an inch nor slowing down anymore

B.2169 December 3, 2022 — Kingsport, TN

Push to ban em

B.2170 December 3, 2022 — Kingsport, TN

Push to ban em

B.2171 December 3, 2022 — San Diego, CA

I can′t see when there′s a car with bright headlights behind me. There′s no way to get away from the light and it′s super dangerous to guess at where you′re going when you′re driving.

B.2172 December 3, 2022 — Stourbridge, ENG, United Kingdom

I had a crash not long ago all because i was blinded by another cars LED super bright headlights and couldn′t see, therefore, crashed. Luckily it was minor, no one was hurt. Big cars, small cars, it really doesnt matter, they all seem to have super bright lights that dazzle drivers and all it takes is a setting through the ECU to bring down the brightness. My car isnt bright so i can confidently say im not the reason for increase in numbers of crashes but it would be great if all other cars was the same. Why have them so bright for? This must be addressed.

B.2173 December 4, 2022 — Braintree, ENG, United Kingdom

These lights are so dangerous…far too glaring.

B.2174 December 4, 2022 — Eastsound, WA

I live on an island where there are no city lights and I am literally blinded by oncoming cars that have new headlights they are a death trap

B.2175 December 5, 2022 — Carmel, IN

I live in Chicago and have a very mild astigmatism. In the winter it gets dark at 4:30 and driving with all these unregulated, uncalibrated, unaimed high beams can make driving in the dark dangerous to the point of dissuading me entirely. They're needlessly blinding and the light pollution is ridiculous.

B.2176 December 5, 2022 — Columbus, OH

I'm afraid to look at other cars, and that's not safe.

B.2177 December 5, 2022 — Holdbrook, NY

My eye sight damage has increased faster over the last 5 years due to driving at night and being subject to excessive bright lights. This damage has been confirmed by my Optometrist. There seems to be no escaping these bright lights unless I move all three of my rear view mirrors to direct the reflection elsewhere, thus impairing my safe view of the road even further. It's only worse with Jeeps and Large pickup trucks. I live in a suburban area and there is no reason for lights this bright.

B.2178 December 5, 2022 — Wake Forest, NC

I have become scared to drive at night because I can't see from the bright lights. It's horrible. General Motors trucks are the worst offenders. Bring the auto leveling headlights to the US quickly please.

B.2179 December 6, 2022 — Emmett, MI

Its mostly because aftermarket led bulbs by Sylvania and other companies....just go in autozone/walmarts etc you will see them for sale and they will go in any vehicle except they say only for offroad or such. So people are putting those into stuff not designed for use in their headlight assembly and no way to aim them correctly. More and more people are doing this. Yes some vehicles like newer jeeps come stock with wayyy too bright leds but monkey see monkey do they all go and buy them because why not everyone else is doing it right? They ate lucky i am not like i was in my younger years i would of been hitting them back with a spotlight in return for blinding me.

B.2180 December 6, 2022 — Emmett, MI

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B.2181 December 6, 2022 — Raleigh, NC

Bright headlights are dangerous to oncoming traffic.

B.2182 December 6, 2022 — Three Oaks, MI

LED headlights are too bright. They need to be ticketed and banned. They are blinding and dangerous.

B.2183 December 6, 2022 — WALLASEY, United Kingdom

I find the bright lights coming towards me makes it difficult to see where I am going

B.2184 December 7, 2022 — Stowe, VT

It leaves burned after images in my vision even if I'm averting my eyes. Causes instant migraines. Completely ruins my ability to see the road. Impossible to use rear view and side view mirrors when an LED equipped car is directly behind.

B.2185 December 9, 2022 — Excelsior Springs, MO

I've become much more sensitive to light recently and the LED lights that were annoying and disorienting when I was first driving have become blinding. These types of headlights may make driving at night easier for those in the car but that comes by sacrificing everyone else's ability to see properly.

B.2186 December 9, 2022 — harrison, NY

I can't see what's in front of me when I am blinded by these LED lights,

B.2187 December 10, 2022 — Grants Pass, OR

I actually want to END people who drive cars with these. But it's illegal to murder so I'm signing a petition instead.

B.2188 December 10, 2022 — Shortsville, NY

Last week I ended up running a stop sign at a four way intersection because I was blinded by the lights on a pickup truck. Thank God no one was coming the other way or I might not be here to sign this. Thank you Mom and Dad for posting this!❤

B.2189 December 11, 2022 — Fishkill, NY

I drove on I95 north last night and was amazed at the number of vehicles with offensive headlights. It makes driving at night a bit scary. These high profile vehicles with unbelievably bright lights bear down on other vehicles causing blindness and disorientation. How are these allowed? This is a nightmare—literally.

B.2190 December 11, 2022 — GRAYSVILLE, AL

Those lights make it hard for me to drive at night and I used to love driving at night.

B.2191 December 11, 2022 — Phoenix, AZ

LED lights are dangerous and being sold to the public in the name of energy efficiency, despite health risks. There are better ways to conserve energy.

B.2192 December 12, 2022 — Huddleston, VA

I am signing because dont think these light do anything buy blind the oncoming cars. It is especially bad on the country roads

B.2193 December 13, 2022 — Casselberry, FL

I like to be able to see where I'm going when driving at night, but the intensity of LED headlights causes so much pain that I have to struggle not to avert my gaze when there is oncoming traffic. This is obviously a safety hazard, and after driving any distance more than a few miles at night, I often experience migraines and eyestrain headaches.

B.2194 December 13, 2022 — Collinsville, OK

Led headlights are dangerous!!!

B.2195 December 13, 2022 — Hounslow, United Kingdom

These headlights are blindingly bright and reduce the chance of seeing any pedestrians in that vicinity . Drivers will naturally close their eyes for a split second or look away which will give an opportunity to cause an accident in that split second. Also, when one of these over bright cars are coming towards you, it distorts your vision and you are unable to see any potential obstacle until it is too late.

B.2196 December 13, 2022 — Lake Orion, United States

I don't want to die because of someone else's too-bright LED headlights blinding me, my husband, or any of the drivers in front of us in the road!

B.2197 December 14, 2022 — Mantachie, MS

I've been blinded at least five times anytime I drive my18 wheeler at night-it is ridiculous and blinding for at least 15 seconds every time 勞

B.2198 December 14, 2022 — Whittier, NC

These lights are flat-out dangerous. Within the last month, I have been blinded (seeing purple spots) by three separate vehicles running these aftermarket LED's. Each of these incidents happened in BROAD DAYLIGHT. These lights are typically improperly aimed and are completely unnecessary for the safe conduct of the driver of the vehicle, day or night. To those who use them, your rights do not trump mine. While we're at it, let's ban the use of light bars, intended for off-road use, on public highways. There should be a restriction on the number of light sources, light frequency spectrum, dispersion, total lumens, etc. These people are putting others (elders, children, and others) at risk. To my rural friends. If I never see another lifted pickup truck, with its tail lowered blazing lights now blinding more people, wrecking the stability of the vehicle, and reducing the driver's visibility, it will be too soon. My state, North Carolina, has outlawed the practice of lowering the rear. Yet I continue to see these vehicles with out-of-state plates. My final word on this is that because you think it's cool, doesn't make it a good and safe idea.

B.2199 December 15, 2022 — United States

I personally am affected by LED lights, as they trigger severe migraine attacks and prevent me from rest and sleep, which males it even worse. I personally know others who are severely and badly affected by LED lights in the environment to the point where they can no longer participated in the LED dominated world, which is only getting worse. This may seem so trivial to you or others, but lighting choices can and do affect humans, animals, insects, and our environment on a scale much larger than we like to believe. Please speak up if LED lights are affecting you or anyone or anything in any negative way -whether it's small or large. Our voices are what's needed for change for all!

B.2200 December 16, 2022 — Eureka, MT

Your eyes don't recover as fast with LED lights coming at you compared to normal headlights. We have talked to other people who have problems with LEDs also. Unfortunately the snowplows in our state are using very bright flashing LEDs now facing behind them which are horrible to follow when dark. They are dangerous!

B.2201 December 16, 2022 — London, United Kingdom

It's dangerous and it affects lots of people.

B.2202 December 16, 2022 — Pascoag, RI

It's a Safety issue! If I'm blinded by oncoming vehicle I can't see any pedestrians!

B.2203 December 16, 2022 — Templeton, CA

This has become an increasing issue for me as more people get cars with these high-emitting headlights. I don't do crazy things with my eyes that make me especially sensitive. However, I have almost gotten in a couple of accidents due to the blinding light of oncoming traffic. I slump in my seat to avoid the rearview mirror lights. This is no way to live. Sometimes we just can't avoid driving at night and this is unfair to the public. Bring back the warmer but efficient lighting! If it ain't broke...

B.2204 December 17, 2022 — Center Line, MI

I want to drive safely at night without being blinded by other vehicles constantly.

B.2205 December 17, 2022 — VA, United States

These headlights are entirely too bright! When driving on the freeway, with a LED truck behind me and I need to pass the car in front I can't see behind me to safely go into the next lane. One evening I was driving through a small town, the oncoming SUV had BLINDING headlights, I couldn't see the people trying to cross the street. That scared me to death. These need to be banned for the safety of all people. Angela Aron Perkins

B.2206 December 18, 2022 — Helena, MT

I drive on two lane rural roads often. In addition to increased traffic, bright led and hid headlights are making driving at night too dangerous. I have to drive well below the speed limit just so I can stay in control when I'm blinded by a new car. This problem is even worse in the winter, when it's dark out during peak traffic hours and lights are amplified by snow.

B.2207 December 18, 2022 — Whitman, MA

As a frequent bicyclist, it can be a HUGE problem to be blinded by car headlights and tail lights. I try to buy responsible bicycle lights that aren't blinding to other people, but some car lights are so bright that I can hardly see after my eyes adjust! It is true that for healthy eyes, less light sources at night actually allow better night vision. The less light pollution we create, the better we can all see the road ahead.

B.2208 December 19, 2022 — Asbury Park, NY

This is dangerous

B.2209 December 19, 2022 — Frenchtown, NJ

These headlights are dangerous! There are times I have to pull over and come to a stop I am so blinded by them.

B.2210 December 19, 2022 — Hampton, Canada

The bright headlights are extremely unsafe.

B.2211 December 19, 2022 — Trenton, NJ

It's absurd can't even drive at night anymore!!! It needs to be changed

B.2212 December 20, 2022 — Lilburn, GA

I'm 50, with astigmatism and I've had Lasik. Even with glasses designed to cut the glare from lights at night I'm frequently blinded to a ridiculous degree by so called normal headlights. I also drive a Miata so I'm low to the ground and with newer trucks being so high up there is no way to escape it when they are behind me, it makes my mirrors useless. There is no need for this level of brightness in traffic. Yesterday's hi beams seem to be today's normal ones.

B.2213 December 20, 2022 — MI, United States

I find myself affected by these ultra-bright headlights, and I don't even have any underlying conditions for these lights to aggravate. I think we ought to invest in more streetlamps instead, which would make the brighter headlights unnecessary.

B.2214 December 20, 2022 — Port Arthur, TX

These are causing physiological damage to people, besides being absolutely blinding.

B.2215 December 21, 2022 — Grove City, OH

Getting blinded by these headlights has set up a passive form of distracted- and dangerous - driving conditions. My eyes cannot control their brightness. I can only control my driving while being blinded from behind as well as from what is coming towards me. The super brights are not sexy, not necessary, cannot be easily changed out of a vehicle for softer lights, and are stirring up road rage reactions in the eyes of the beholders.

B.2216 December 21, 2022 — Morgan City, LA

I'm sick of these blinding headlights it's Rediculous at night driving

B.2217 December 21, 2022 — Portland, OR

Driving blind is mortally dangerous even for an instant.

B.2218 December 21, 2022 — Portland, OR

Thank you Mark Baker for starting this petition along with your two friends! I was getting ready to start one myself and you beat me to it! Good for you my friend! We try not to drive after dark too much anymore because of these headlights. It is just too hard if not impossible at times to see! Not only do they need to stop making these headlights, but they also need to replace the ones that are out there on so many vehicles because if we don’t these vehicles that the lights are left in are sure to cause more traffic accidents! Due to the cost though I doubt that will happen but in my opinion, it still needs and should be done! ������

B.2219 December 21, 2022 — Traverse City, MI

Driving at night has become untenable for me because of the blinding glare of these lights. They are a hazard.

B.2220 December 22, 2022 — Portland, OR

I avoid driving at night when I need to strictly due to other's offensively bright lights. When I do drive, I place my mirrors into positions that makes them harder to use to avoid high intensity reflections.

B.2221 December 22, 2022 — Sanger, CA

I hate those lights. They are blinding not only coming toward you, but also when they are behind you

B.2222 December 22, 2022 — avondale, AZ

Car manufacturers have no brain now a day.

B.2223 December 22, 2022 — kansas city, MO

Im constantly blinded on the road by people in suv's and trucks with literal sun bright headlights. Its a real danger.

B.2224 December 23, 2022 — Belchertown, MA

the driving conditions in rural America have gotten ridiculous. There are no street lights or background light so your pupils dilate even more until these new led lights come along and are so bright that they feel like they're burning your retinas!

B.2225 December 23, 2022 — Enfield, ENG, United Kingdom

LED headlights are dangerous

B.2226 December 24, 2022 — Boise, ID

Bright headlights are awful

B.2227 December 28, 2022 — Bayfield, Canada

I'm signing this because these over bright headlights are a serious safety issue!

B.2228 December 29, 2022 — Joshua, TX

Tired of these lights blinding me to where I can't see for several minutes

B.2229 December 30, 2022 — Bakersfield, CA

Dangerous road conditions

B.2230 December 30, 2022 — Charlottesville, VA

New bright headlights are so blinding at night when they approach from behind driver can't see which lane the car is in and can't safely change lanes

B.2231 December 30, 2022 — New haven, CT

I am getting retina burnout from these headlights!

B.2232 December 31, 2022 — Atlanta, GA

These are dangerous for my family who sometimes cannot avoid driving at night

B.2233 December 31, 2022 — St Paul, MN

The more time goes on being lax on this issue the more these lights are popping up on our roads, and the more miserable it gets to drive at night.

B.2234 December 31, 2022 — Williamston, NC

I frequently drive long distances, so I do a lot of night driving. I have very light sensitive eyes and I get blinded by these headlights the way most people get blinded by high beams. We won't talk about how bad it is when I'm dealing with a driver who doesn't seem to know how to turn off the high beams on his already-too-bright lights. I've had to pull off the road to let my eyes readjust.

Comments left in 2023

January 2023

B.2235 January 1, 2023 — Johnstown, PA

Can't make our roads safer but sure can send other countries billions of dollars. We as Americans should be sick and tired of this crap.

B.2236 January 2, 2023 — Mount Vernon, OH

I'm signing because of the danger it causes for me to drive at night. The lighting needs to change, soon, before I get blinded and hit someone!!!

B.2237 January 3, 2023 — Little Stoke, ENG, United Kingdom

Current headlights are ridiculous! We are not in the desert! They are absolutely blinding and ultimately dangerous. Also, people don't seem to have the aim correct!

B.2238 January 3, 2023 — New Orleans, LA

LED headlights are fucking blinding

B.2239 January 4, 2023 — Scranton, PA

I'm a 24 year old young man with good eyesight (with my glasses on, of course), and tonight I was nearly blinded by a newer SUV with these ridiculously bright blueish-white lights. I've come across vehicles like these before, and they're always a problem, but I usually pass them by or turn soon after encountering them. Tonight was different. This driver followed me for several miles through the city and on the highway and their LED lights coming in from all of my mirrors were absolutely blinding; it was painful just trying to focus on the road in front of me. After nearly 10 minutes in traffic with this vehicle behind me, I had to take a detour and stop just to rest my eyes for a minute. There either needs to be major steps taken to lessen the impact of these blinding LED lights or they need to be banned. I'm not a driver that gets distracted easily, so I imagine other drivers with less than great eyesight might have major issues, especially if they're exposed to them over extended periods, like I was.

B.2240 January 4, 2023 — Winchester, VA

I'm signing because at night it gets bad foggy raining out. You could sit for a minute in a parking lot someone comes parking in front of you wit them stupid bright blue LED lights on high beams then next thing you know you can't see for awhile. Whomever started to put these blinded lights totally didn't analyze or think this through how the lights could blind out someone or even yet people with seizures it could effect those with seizures

B.2241 January 5, 2023 — Alpha, OH

sometimes bright headlights are more dangerous than no headlights.

B.2242 January 5, 2023 — Brampton, Canada

It's tooo damn bright and my eyes hurt!

B.2243 January 5, 2023 — Pell City, AL

I've been a truck driver for over 16 years and I'm on the road a lot at night. The led headlights are essentially like having your high beams on constantly. I'm beginning to have frequent headaches and unable to scan the road as well as before the led headlights were introduced. The excessive brightness of the "daytime" classified headlights create dangerous situations whether someone is passing me or crossing my path on the highway. In order to keep everyone safe; we need to ban these headlights.

B.2244 January 5, 2023 — Warrior, AL

I have had to stop my car in the middle of the road suddenly because I could no longer see the road and a drop off was to my right; the on coming car momentarily blinded me with their headlights. I have run off the road on two occasions because I couldn't see after passing a car with LED headlights. I have sit crouched down and toward the middle of my car if they are behind me OR position my mirrors to an unsafe place to keep the glare out of my eyes. I have had to pull off the road many times

to just let the person pass me because I couldn't drive due to their headlights. This is a huge safety hazard!!!

B.2245 January 5, 2023 — Westerly, RI

These are a danger to everyone that travels at night.

B.2246 January 6, 2023 — Covington, LA

LED lights are not equivalent or better than incandescent lights, and are especially detrimental and dangerous in certain situations (ie, automobile headlamps).

B.2247 January 6, 2023 — Dallas, GA

It is True, LED headlights Makes it Difficult to See Particularly on Dark Nights. Being an Able to See for a Second Can Cost Your Life or Someone Elses.

B.2248 January 6, 2023 — Georgetown, OH

Day or night they are blinding! You cannot tell if they are dim or high and when it rains especially at night, completely blinding literally have to come to a stop to either keep from going off road or hitting them!

B.2249 January 6, 2023 — Pittston, PA

I have epilepsy. When a line of cars drives infront of another with a set of bright LED lights, it causes my heart to race. Not only do I have to worry about emergency services hazard lights, I now have to watch for civilians ill equipped vehicles. This does not happen with a standard yellow bulb. I avoid driving at night at all costs now. Its one thing for it to be an emergency response crew..theyre there for assistance. These are civilians. It's absurd that this is okay. They're doing it with street lights too and they're always going out, resulting in a fast pulse like flicker.

B.2250 January 6, 2023 — Suckit, AP

I'm tired of being blinded

B.2251 January 6, 2023 — Tucson, AZ

There's no reason LED headlights must be a blue-tinged 'cool white' emulating the HID arc; they can be tuned to emit white light of any color temperature, and should be legally required to emit a 'warm white' (or better yet, selective yellow) spectrum, with minimal blue wavelengths that cause significant glare and other visual issues deleterious to driver safety.

B.2252 January 7, 2023 — Somerville, MA

I can't see when the bright lights hit me while driving at night

B.2253 January 8, 2023 — Bath, NY

I detest the danger that these ridiculous lights cause. I've been driving for 60 years, when people haven't dimmed their lights it was highly annoying, not blinding. With these nasty blinding LED lights,I don't dare drive at night, anymore. How about a dose of reality!

B.2254 January 8, 2023 — Lafayette, LA

Police blue lights are too bright as well.

B.2255 January 9, 2023 — Bellevue, WA

These white headlights are blinding my visibility of the road. Looking away to avoid these white headlights is very high of distracted driving. Exposure to white headlights for a few minutes driving on road causing headaches. In an attempt to look away from these white headlights, drivers may not be able to detect any sudden occurrence of person/animal on road, and delays the reaction time.

B.2256 January 9, 2023 — Hampton, VA

I almost caused an accident last week b/c an SUV with BRIGHT, cool white headlights was right on the tail of my little coupe, BLINDING me!! It wasn't just the reflection from my mirrors, which was painful enough, but it seemed like a spotlight was on my car! I was in the left lane of the end of an off-ramp, waiting for the light, to turn onto a busy three-lane, two-way street, when he pulled up (VERY close) behind me! I had to turn VERY SLOWLY, (BARELY moving at all) and still veered a little into

the next lane! I continued to drive VERY SLOWLY, in an effort to force the idiot to go around me! Even then, it took almost a full minute for my eyes to readjust! This was in a pretty well-lit area, with NO fog - this is MADNESS!! SOMETHING NEEDS to be done, NOW!!!!

B.2257 January 10, 2023 — Chiefland, FL

I cannot see at night due to the use of LED or HID headlights.

B.2258 January 10, 2023 — Åland Islands

LED headlights are dangerous on unlit rural roads - the glare completely drowns out a view of the road edges and the shape/width of the oncoming vehicle.

B.2259 January 12, 2023 — Irving, TX

Someone on the road flashes their LED lights at me rapidly fast because they were mad I was going to slow for them. People are literally using these to harm individuals because of their own uncontrollable road rage. I nearly got in a wreck trying to get away from them because I was BLINDED.

B.2260 January 12, 2023 — Seattle, WA

These new headlights are absolutely blinding at night time

B.2261 January 13, 2023 — Brentwood Bay, Canada

These lights are not necessary and dangerous!

B.2262 January 13, 2023 — Mankato, MN

Driving at night is becoming dangerous, it seems. Oncoming lights are way too bright.

B.2263 January 13, 2023 — Nelson, Canada

I avoid driving when dark because I feel blinded by the lights of oncoming vehicles. It is just too dangerous.

B.2264 January 13, 2023 — North Saanich, Canada

Bright headlights in oncoming vehicles are a safety hazard and either they must be modified to reduce glare or windshields must provide enhanced shielding.

B.2265 January 13, 2023 — Salt Spring Island, Canada

those oncoming car lights are dangerous , I am very concerned about having to slow down and becoming a hazard myself having to close my eyes until that car has passed.

B.2266 January 13, 2023 — Victoria BC, Canada

It is dangerous to be driving and have such high beam lights blinding me. I have to cover my side mirror if someone behind me has them or I can't see ahead of me. It's Very distracting.

B.2267 January 13, 2023 — Victoria, BC, Canada

I'm about to give up driving at night because of these blinding headlights, which severely limits my social life.

B.2268 January 13, 2023 — Victoria, Canada

These lights are blinding! And dangerous for on coming drivers.

B.2269 January 13, 2023 — Victoria, Canada

These lights are blinding. Why are they allowed? We have to buckle up but ok to drive blind?

B.2270 January 13, 2023 — Victoria, Canada

These are to darn Bright.

B.2271 January 14, 2023 — Burnaby, Canada

I hsbr same issues with these lights

B.2272 January 14, 2023 — Comox, Canada

Blinding headlights are dangerous !

B.2273 January 14, 2023 — Duncan, Canada

Not only are the LED headlights blinding going forward but are extremely blinding when you are followed from behind. I have to move my review mirror down in order to get my sight back. I think all cars and trucks should switch back to tungsten lighting by law.

B.2274 January 14, 2023 — Nanaimo, Canada

It's dangerous no one's lights should be that bright

B.2275 January 14, 2023 — New Westminster, Canada

These LED lights are a hazard. They are too bright. When they are calibrated poorly, they are even more blinding for oncoming traffic than driving with high beams on all the time!

B.2276 January 14, 2023 — Port Alberni BC, Canada

the new head lights are too Bright,i thought the the lights could not be over 35 watts ?

B.2277 January 14, 2023 — Saanich, Canada

I am blinded on the roadways and wonder why these lights are permitted on the roads!

B.2278 January 15, 2023 — Christina Lake bc, Canada

I have light sensitivity and vertigo both are affected by leds

B.2279 January 15, 2023 — Dracut, MA

i'm sick of being blinded by headlights every night

B.2280 January 15, 2023 — Kitchener, Canada

These lights cause a smaller field of vision to oncoming drivers and that issue is multiplied when it's dark and rainy. As a professional driver for 34 years I find these lights dangerous , especially when these lights are on the front end of todays huge pickups and SUV'S, having them behind you causes it's own issues with the blinding light reflecting into your eyes via the rear view mirror. On a separate note, why do so many people drive with their high beams on, it exasorbates the problem.

B.2281 January 15, 2023 — Lazo, Canada

I'm tired of getting a migraine whenever I drive at night, and it only gets worse when it rains and everything becomes a reflective surface.

B.2282 January 15, 2023 — Makawao, HI

Blinding headlights suck either coming at you or coming up behind. Can't see anything else but that blinding light, it's dangerous!!

B.2283 January 15, 2023 — Nanaimo, Canada

Lights are blinding at night.

B.2284 January 15, 2023 — New Westminster, Canada

I 100% agree

B.2285 January 15, 2023 — QUALICUM BEACH, Canada

Because we all need to be safe

B.2286 January 15, 2023 — Sooke, Canada

I find the new LED lights blinding. They are dangerous and keep people from driving at night thereby reducing their quality of life Please regulate the strength, type, and angle of car headlights.

B.2287 January 15, 2023 — Surrey, Canada

I drive and hate those lights coming at me. My biggest fear is the blinding effect. Please ban those darn lights

B.2288 January 15, 2023 — Vernon, Canada

more than just a distraction, tjey are dangerous

B.2289 January 16, 2023 — Armstrong, Canada

These lights are unnecessarily bright and very dangerous. Many vehicles do not have them aligned properly either.

B.2290 January 16, 2023 — Birmingham, AL

I have photophobia (sensitivity to light), and driving at night or in the rain is especially difficult when LED headlights are repeatedly shining in my eyes. Warmer and less bright lights are much preferred.

B.2291 January 16, 2023 — Port Moody, BC, Canada

They're dangerous!!

B.2292 January 16, 2023 — Qualicum Beach, Canada

Bright whites are the worst to drive against. They're blinding, dangerous, and cause horrendous glare. GET RID OF THEM NOW. I won't ever buy a car that has them, ever.

B.2293 January 16, 2023 — Squamish, Canada

LED headlights should be Banned! Absolutely blinding to oncoming traffic

B.2294 January 16, 2023 — United States

This is dead serious! The LED headlights completely blind the oncoming driver and continue to be the main reason for fatalities. Unfortunately, it's all about these car manufacturers saving money. Find a soft bulb that doesn't cause blinding glare! This has to stop!!!

B.2295 January 17, 2023 — Columbus, GA

I have had trucks and SUV's approaching from behind and in front of my car and have been totally blinded.

B.2296 January 17, 2023 — Grants Pass, OR

It's getting to the point where driving at night is more dangerous than ever. It seems like at least half the vehicles out there these days have absolutely blindingly bright headlights. Quite often the only thing I can see is the fog line when these vehicles are coming at me. It's no surprise to me that the motor vehicle death rate is on the rise. Driving at night anymore is downright scary.

B.2297 January 17, 2023 — Morristown, NJ

I drive a sedan and a hatchback.

B.2298 January 17, 2023 — Mount Pearl, Canada

Vicki Crocker

B.2299 January 17, 2023 — Newark, DE

These lights have been bothering me both when I drive, and when I walk on foot at night. They make it very hard to see. Old headlights were just fine...and there's no reason LED lights can't be just as good, they just need to turn down the brightness to the same levels as before, and softening the color temperature would also help. I have LED lights in my home that look just like old incadescent lights, so there is no reason we can't make car headlights that are the same!!! I want this fixed ASAP.

B.2300 January 17, 2023 — Tempe, AZ

There needs to be rules around bright LED Headlights. They are a hazard to Evey

B.2301 January 18, 2023 — FREDERICTON, Canada

I agree with Mac Moss

B.2302 January 18, 2023 — Miami, FL

We Thank You for Your signature & support Karen. Please Share this petition with as many people as possible & please take a look at this other petition as well. Thanks Again. https://www.change.org/p/justin-trudeau-elimination-of-bright-hid-led-headlights

B.2303 January 18, 2023 — Sacramento, CA
Catherine Nevin

B.2304 January 18, 2023 — Toronto, Canada
I agree

B.2305 January 18, 2023 — Victoria, Canada
For years, I have struggled with night driving due to the white lights. They cover my entire windshield when coming at me and my tires have gone off the edge of the road on a curve on a few occasions. The bright white lights are too dangerous to use, especially on pickup trucks which are highter than any car. I am grateful for this petition. Karen Martin, Victoria, BC

B.2306 January 18, 2023 — cold lake, Canada
I have be blinded by these lights on the highway. Not safe to be hurtling into nothingness all of a sudden

B.2307 January 19, 2023 — Albuquerque, NM
Lights that are too bright are not safe for oncoming drivers. This needs to be regulated.

B.2308 January 19, 2023 — Couridjah, Australia
I'm so sick of being completely blinded driving home from work at night on 100km country roads. And of people that think their high beams aren't on and their car came like that so it's fine. It's not fine, it's dangerous, selfish and stupid. Clean the casing and lower them before you get someone ram into you because they literally can not see.

B.2309 January 19, 2023 — Northampton, MA
We need to ban excessively bright headlights for everybody's well-being.

B.2310 January 20, 2023 — Montreal, Canada
I, like the others who sign this, experience this phenomenon every time I drive at night. In ordinary sedans and coupes, the effect of these lights is hard enough to deal with. How many pick-up trucks and SUVs are currently on the road, often with fancy secondary strings of lights. The effect is stunning and very dangerous. I find myself braking suddenly and slowing down because I have become blinded. They are a danger. Please fix this. problem. It should not exist.

B.2311 January 20, 2023 — Salem, MA
Im blinded by the lights... I can not drive at night because of these lights

B.2312 January 20, 2023 — Salt Spring Island, Canada
These headlights ARE blinding, especially at night without streetlights and proper lines on the roads. These lights should be banned!!!

B.2313 January 20, 2023 — Toronto, Canada
Those LED lights look bad. I see them on cars and they glare and throw a bad light. They are unhealthy and our Christmas tree looks sad with these lights. They are a mistake. Gov't makes so many mistakes and it costs so much...life and dollars.

B.2314 January 20, 2023 — Victoria, Canada
I'm avoiding driving or cycling at night because of the blinding led lights of oncoming new cars trucks and suv. I've had to stop and pull over to wait and get my vision back

B.2315 January 20, 2023 — salt spring island, Canada
driving at night has become impossible and dangerous so many times I have had to come to a full stop knowing there is a curve in front of me but am not able to see it.

B.2316 January 21, 2023 — SaltSpring Island, Canada
Because of the blinding lights @ night I won't drive @ night any more!

B.2317 January 21, 2023 — parsippanny, NJ
I am a parent to a teen and i am concerned about all teens

B.2318 January 22, 2023 — Manchester, NH
LED Bright lights are bright.

B.2319 January 22, 2023 — Stratford, ON, Canada
Blinding headlights makes danger.

B.2320 January 23, 2023 — Spokane, WA
The extreme brightness and angle of the LED headlights has made it so I can't safely drive at night. Even during the day I have to switch my review mirror to night driving and often flip my side mirrors to avoid the glare. and wear sunglasses day and night. Non of this is safe and has also negatively affected my activities in all areas of my life. This needs fixing.

B.2321 January 24, 2023 — Mount Laurel, NJ
I support

B.2322 January 24, 2023 — Seneca Falls, NY
I can't drive at night anymore. Blinded by headlights is dangerous.

B.2323 January 24, 2023 — Toronto, Canada
I want to improve road safety at night.

B.2324 January 25, 2023 — Billerica, MA
Elaine Crow I am blinded when driving at night and feel it is a serious problem.

B.2325 January 25, 2023 — Cheney, WA
I'm tired of having my vision messed up for 30 minutes after having bright lighted vehicles behind me. It should not be legal to have a light so bright that the driver is not able to look in their rear view mirror and side mirrors, this is a hazard.

B.2326 January 25, 2023 — Chicago, IL
led lighting is HORRIBLE...Dangerous, Ugly, Invasive, Unfriendly...while writing this many fatalities because of.....!

B.2327 January 25, 2023 — Springfield, OH
Tired of being blinded. The driver with the leds can see but the glare is blinding oncoming traffic.

B.2328 January 25, 2023 — WIldwood, MO
I had cataract surgery in 2017 at the age of 60. Driving at night is now difficult, and I'm still working so it's unavoidable. The advent of extremely bright bulbs has made it horrendous and is an accident waiting to happen.

B.2329 January 27, 2023 — Galway, Ireland
This seems to be a global issue now. We can't see where we are going. Blinded by the light!

B.2330 January 28, 2023 — Pinckney, MI
I've been blinded every time I drive after 9 pm- more times then I can count. I doubt if all these people have their high beams on, but it just as blinding!!!!!

B.2331 January 28, 2023 — Spokane, WA
I am blinded by the super bright headlights which makes driving at night very dangerous for me and I'm sure many others.

B.2332 January 29, 2023 — Houston, TX
There's no reason for those bright a$$ lights

B.2333 January 29, 2023 — Vancouver, Canada

Those type of headlights are blinding when oncoming.

B.2334 January 30, 2023 — Blakely, PA

It's so scary being intermittently blinded when I'm driving at night. I literally cannot see when a vehicle with LED headlights is oncoming and then for a few seconds after it passes. Which means when there's several cars in a row coming at me with the LED headlights, I can be completely unable to see for a minute or more. That is terrifying.

B.2335 January 30, 2023 — Huddersfield, ENG, United Kingdom

They are too bright and blinding

B.2336 January 30, 2023 — Las Vegas, NV

I can not see to drive when these LED headlights shine directly in my eyes. I seem to go blind. Very dangerous.

February 2023

B.2337 February 1, 2023 — Driftwood, TX

While driving at night I've lost the ability to see the road when vehicles coming in the opposite direction have incredibly bright headlights that blind my eyes. I don't understand why people who purchase vehicles with extremely bright headlights don't seem to grasp the reality that they are putting themselves, and others, in danger of causing head-on collisions at night because of the impact their very bright headlights have on other drivers.

B.2338 February 1, 2023 — Durham, NC

My cataract surgery resulted in more glare from lights at night, but it wasn't until the LED and Xenon lights became more common that it became a serious problem for me. Sometimes, I'm so blinded by oncoming headlights that I can't even see the lane markers for a few seconds. I need to be able to drive at night.

B.2339 February 2, 2023 — Emmett, ID

I'm sick and tired of the led lights everywhere. headlights that blind me from seeing any potential road hazards, police lights that almost have me come to a complete stop from the extreme flashing glare that only gets worse with new model squad cars. There's the neighbors who replaced their 6 outside lights with led on 24-7 so now I have to keep my blinds always closed at night. Add the new led street lights 4 blocks away, the only stars that one can see now are only the brightest. I live in a small town of 5k that 20 years ago there were lots of stars and darkness at night. No more.

B.2340 February 4, 2023 — Holly Ridge, NC

The headlight are blinding.have came close way to many times of going off the road being blinded by on coming headlights.

B.2341 February 4, 2023 — Santa Fe, NM

This is not just a health issue, but it is very much a safety issue! Blinding LED headlights cause collisions! When faced with blinding head lights, it is impossible to see the lane designations, or the vehicles that may be stopped ahead; it only takes a few seconds for the distraction and the disorientation to result in a collision and injury. There is no justification for LED headlights on vehicles or street lights. A law against them must result in a mandated car inspection that is required before a vehicle can be registered yearly, and/ or a hefty fine would stop the use of LEDs. But first, there must be a clear regulation.

B.2342 February 5, 2023 — NY, United States

I have to avoid driving at night because the glare from these LED lights is horrendous. They force me to look away from the road (does that strike anyone as dangerous?) or put up a hand in my front windshield to shield my eyes (same question). I wrote a complaint to the NYS DMV years ago but never heard back from them. These lights are someday going to drive me into a tree. They're fatally blinding. My son says the same thing when he drives - and that the light image is still in his eyes

EVEN after the car has passed, blinding him still. I already posted my enraged comments about LED lights in general on the light bulb ban opposition petition. Thank you so much for doing this petition.

B.2343 February 6, 2023 — Berkeley, CA

These lights are just awful. Ban them!

B.2344 February 8, 2023 — sb, CA

Headlights and brights have become the same. The only difference on new cars is when they turn on the brights the headlights angle up. Ill flash my brights at someone because i cant see a thing, they ignore it and ill have to stop in the middle of the road blocking traffic due to not being able to see anything but a wall of white like the photo above. Its not my fault you bought a car with headlights that bright, the owners should be required to dim them with tint or lesser bulbs by law.

B.2345 February 9, 2023 — Milford, NE

I signed because it causes eye injury, I drive at night and it makes perception of Road lines and boundaries extremely dangerous. When a bulb is over 4300 kelivin it provides no real benefit and washes out shapes and figures in the road. Making them appear to be in a different spot on the road, than they really are. With more than 68% of cars on the road being swapped to these bulbs. Its time officers enforce these rules and issue citations.

B.2346 February 11, 2023 — Clay City, KY

Yes they need to do away with the led lights . They blind me at night .

B.2347 February 11, 2023 — Kirkland, WA

Headlights are ruining my vision. If you do a bit of research you will discover that they are now using Laser technology in modern headlights? Are they trying to create a generation of blind people? This lights are ridiculous. They are not even safe! What is the point of blinding the on coming traffic? That doesn't seem to make any sense.

B.2348 February 12, 2023 — Billings, MT

I'm sick of being blinded by these lights and having to move my mirrors just because one of these people is behind me. They give me migraines and have blinded me many times while driving.

B.2349 February 12, 2023 — St. Kitts & Nevis

I hate being blinded

B.2350 February 12, 2023 — harvard, IL

They are binding and absolutely unnecessary. There's no reason someone needs to see a raccoon's butthole from a mile away and blind everyone is the process.

B.2351 February 13, 2023 — Bloomfield Hills, MI

Extremely dangerous for drivers of all ages. The car company that can solve this will sell more cars. Put some engineers on making these lights safer instead of adding more to the front and rear and inside of cars. Flying over cities now the lights on highways are extremely bright and all white. Ugly and blinding. Very unsafe. How many fatalities caused by this will the car companies say is acceptable before they solve the issue?

B.2352 February 13, 2023 — Granger, TX

I literally have to hold my hand up to block the glaring blue lights of oncoming traffic. The worst offenders are the pick-up trucks that are typically fitted with lift and light kits - which means MORE blinding blue-white LEDs.

B.2353 February 13, 2023 — Holland, MI

My eyes have been effective so bad I cannot drive safely anymore at night also when they are on standing still I get blinded.

B.2354 February 13, 2023 — United States

I know my own vehicle also blind other drivers. Had taken to the dealer to try to fix and told there's nothing they can do! So many time people high beam me thinking I have my high beam on! This is really ridiculous!

B.2355 February 13, 2023 — United States

This needs to go "viral" before these car manufacturers will do something about it! My guess is the car engineers don't even know how to drive! They probably Uber to work!

B.2356 February 14, 2023 — Atlanta, GA

I can't see at night

B.2357 February 14, 2023 — Batavia, OH

I signed because I would prefer not to be killed in an easily preventable accident caused by blinding headlights.

B.2358 February 14, 2023 — Crown Point, IN

I am legitimately afraid of crashing because I can't see with oncoming traffic.

B.2359 February 14, 2023 — Franklinton, NC

It's simply infuriating how regulatory authorities can be so blind to such a glaring health & safety issue. Ban these migraine-inducers!

B.2360 February 14, 2023 — Pittsburgh, PA

I'm only 53, but I have had to give up most driving at night. I have light sensitivity because of severe nearsightedness and migraines, and today's blinding headlights overwhelm my ability to see anything at all while driving at night. Lights are intended to help us to see our environment; when all we can see is the lights themselves, they are no longer useful or beneficial.

B.2361 February 14, 2023 — Salt Lake City, UT

I stopped driving at night not because of the deer, etc. but because of these lights

B.2362 February 15, 2023 — Bozeman, MT

Headlights are getting brighter and are blinding me while driving. Not only that, people are using illegal light bars.

B.2363 February 15, 2023 — Lincoln, IL

Hi, It's ridiculous, but it's good to know I'm not alone with the dread. You literally can't see the road in front of you, almost anything at all. Warmer yellow lights are nicer! Came across this on google articles. For the cure. Nicholas

B.2364 February 15, 2023 — Northfield, OH

I also restrict my driving at night due to the bright, blue-toned headlights located at eye-level

B.2365 February 16, 2023 — Beaverton, OR

[name removed] - Excellent observation. Please post these same comments on our petition to the FDA to regulate LED strobe lights: https://www.regulations.gov/document/FDA-2023-P-0233-0001

B.2366 February 16, 2023 — Chipley, FL

Many of these vehicles are after market equipped and there are already laws in most states requiring D.O.T. approval for all lighting but there are many false D.O.T. certifications on aftermarket equipment. A larger problem is police vehicle emergency lighting. Not only are the static lights absolutely blinding but before the evil of LED the beacons rotated and that rotation illuminated officers and others standing at or near the scene. However the LED light bars only emit blinding unidirectional light so objects other than the light source become invisible. If your are a LEO or know anyone that is a LEO please let them know drivers are not trying to run over them, they simply can't see them due to the non rotating beacon so stand behind that beacon and never near the roadway or

between the LEO vehicle and the roadway. Young drivers with healthy vision are vulnerable but those with even mild visual impairment may "follow the light" causing a collision with the source vehicle. If you wish to experiment stand in central location while someone a few feet away rotates a bright beam 360 degrees and note all objects are visible as the light is directed toward them. Next stop the rotation and shine that bright light directly in the eyes of the observer and ask if they can see any other objects in the vicinity. Setina and others should be smart enough to ascertain this situation but apparently they are not so it's up to those of us who care to enlighten them and prohibit police from purchasing these dangerous devices. Each time I hear of an officer being struck or nearly being struck at an accident scene I know these lights very likely played a part in that injury or death.

B.2367 February 16, 2023 — Dorchester, MA

I can't see shit!

B.2368 February 16, 2023 — Elgin, IL

I'm sick of being blinded on the way to work!!!!

B.2369 February 16, 2023 — La Crosse, WI

These lights are entirely too bright. I used to drive truck. On a windy 2 lace road aon a rainy night with no streetlights or other options and me weighing in at nearly 80,000 lbs, even sitting high up you are unable to see and off the driver coming at you, you may be running over them. You are not able to see anything but bright and reflection off the wet surface of the road.

B.2370 February 16, 2023 — Pawtucket, RI

Stock or aftermarket, these headlights should be illegal and possess at least a thousand dollar fine. The headlight manufacturers should be sued to hell & back.

B.2371 February 16, 2023 — San Diego, CA

It's NOT safe getting blinded by these outrageously bright lights that'll block my vision of the road, and prevent me from using my mirrors!

B.2372 February 16, 2023 — United States

I like to be able to see when I drive :)

B.2373 February 16, 2023 — Winter Haven, FL

I left the blinding rain reflection out of my comment. As one who hates night driving due to the incoming blinding lights, if it's raining, nothing is that important to risk an accident due to all the variables annoying lights have, now adding the double vision of reflective road conditions. I think at 65, I'm going to start learning how to navigate the senior assistance programs, learning at my pace, not being thrown into it, last minute not knowing what in earth I'm doing!!!

B.2374 February 17, 2023 — Bloomington, MN

many people have light sensitive eyes and this compounds the problem of bright headlights. Some drivers seem unaware that their lights are aimed wrong, directing their beams into the eyes of other drivers, while other drivers have their high beams on unnecessarily, also blinding their fellow drivers. This needs to stop. Drivers with bright beams on should be ticketed and issued fines. Headlights should be standardized to be below the eye-lines of other drivers.

B.2375 February 17, 2023 — Lewiston, ME

Getting blinded by more and more oncoming cars every night!

B.2376 February 17, 2023 — McKinney, TX

It's a serious problem, especially for those on smaller cars.

B.2377 February 17, 2023 — Newfane, VT

These headlights and tail lights are truly dangerous. They blind and distract and seem to be everywhere. Perhaps they improve the vision of the person who is driving with them but how can that justify their use when they blind oncoming traffic. They need to be banned.

B.2378 February 17, 2023 — Saint Petersburg, FL

I have been blinded by vehicle low beams that shine directly in my eyes instead of at the road.

B.2379 February 17, 2023 — Wallingford, VT

Newer headlights are way too bright - distracting and fatiguing - and on far too many trucks and SUVs, too high off the ground

B.2380 February 18, 2023 — Hudson, NY

First off this is a relief to know I'm not alone. I drive an hour home daily and this is through back country roads leaving my eyes unaccustomed to bright lights. I used to white knuckle drive in severe snow storms and now I'm doing this every time I drive after dark.

B.2381 February 18, 2023 — Lincoln, IL

Troll

B.2382 February 18, 2023 — Los Angeles, CA

It's dangerous to drive at night because of the blinding headlights - especially if you're in a sedan at the mercy of bigger and bigger SUVs!

B.2383 February 18, 2023 — McKinney, TX

Almost got fired for scratching a parked vehicle because I couldn't see due to blinding headlamps from another parked vehicle. I was in a delivery vehicle much higher than regular cars but still caught beams. This is not an alignment issue as the car companies are saying in order to shift the burden onto citizens. This problem can only be solved by banning unnecessarily bright lights on the road. You only need to see what's on the road far enough ahead to be safe. You don't need to light up everything between you an the horizon.

B.2384 February 18, 2023 — Ottawa, Canada

People have taken things too far and it will only get worse. This is just another form of reckless driving. If you can see the road with normal lights, you shouldn't be driving.

B.2385 February 18, 2023 — Port Saint Lucie, FL

Blinding lights causes accidents

B.2386 February 19, 2023 — Ottawa, Canada

*Can't see...

B.2387 February 19, 2023 — Rexburg, ID

I'm tired of being blinded and not seeing the road ahead

B.2388 February 20, 2023 — Homer, AK

Led lights are unsafe to oncoming vehicles. Anyone who has been on the receiving end of them knows this.

B.2389 February 20, 2023 — Laramie, WY

To keep my loved ones safe

B.2390 February 20, 2023 — Vancouver, Canada

I too am tired of being blinded by these lights. There used to be a "rule" when on a rural road or sans streetlights, you had to dim your high beams when you see an approaching car. These lights are far more blinding than a high beam light emitting from a "regular" headlight. Definitely Should be made illegal. Also, if you are driving a vehicle with these blinding lights, there is a risk of someone colliding with you due to temporary blindness.

B.2391 February 21, 2023 — Portsmouth, RI

We MUST BAN THESE LED HEADLIGHTS...They cause Eye Damage. They also cause accidents cuz you can't see past them like a Broadway Theatre Spotlight. Also Business Signs and Green Traffic Lightd are bad for the eyes. Let's gets these LED Lights banned before it's too late and our eyes are damaged.

B.2392 February 21, 2023 — Portsmouth, RI

LED LIGHTS ARE BLINDING and can cause accidents and eye damage. These LED LIGHT Manufacturers and Car Manufacturers need to be held accountable for the damage they are doing while making billions of dollars at the expense of our eye health and road safety.

B.2393 February 21, 2023 — United States

They need to be illegal. Yellow lights only.

B.2394 February 23, 2023 — Elk Grove, CA

Been blinded by these things while driving at night.

B.2395 February 23, 2023 — HERMON, ME

As a motorcyclist and migraine sufferer, I am acutely aware of this problem. Polarized glasses help but even then there are times when I am simply blinded by oncoming headlights - AND headlights in my mirrors. I sometimes wear sunglasses at night, fold out my mirrors and close my eyes while driving - none of which are remotely safe of course but still better than being blinded and seeing nothing for the next few moments.

B.2396 February 24, 2023 — Dursley, ENG, United Kingdom

Over bright headlights are a disaster in action. Surely the authorities can see they are dangerous to other road users. As they give a very bright spread of illumination they also can encourage drivers to drive too fast.

B.2397 February 24, 2023 — Phoenix, AZ

I'm tired of having spotty vision at night after being entirely blinded by completely unnecessarily bright lights from other vehicles. It's a safety risk AND it's permanently damaging to eyesight. Those lights should have NEVER been allowed to be installed into cars.

B.2398 February 24, 2023 — Placentia, CA

I literally can not see

B.2399 February 25, 2023 — Alexandria, VA

I am blinded by head lights .....both coming toward me and in my rear view mirrors!! It's dangerous and PAINFUL

B.2400 February 25, 2023 — Bolton, United Kingdom

My eyes are very sensitive and the head lights on cars are so bright and only getting brighter I have nearly crashed into parked cars as I'm driving past them with the glare of oncoming traffic it's very unsafe to the point I try to avoid driving when it goes dark

B.2401 February 25, 2023 — Boulder, WY

Being blinded while driving especially in our area because of living in the largest deer migration route in the USA

B.2402 February 25, 2023 — Chicago, IL

They are Uncomfortable

B.2403 February 25, 2023 — Clifton Park, NY

Honda pilot lights and pickup headlights are too bright

B.2404 February 25, 2023 — New Haven, CT

I can no longer drive at night, especially in the rain, due to the blinding brightness of led headlights. They are surely causing accidents.

B.2405 February 25, 2023 — Nixa, MO

These headlights are blinging and it makes me want to close my eyes. Instead I squint to be able to see.

B.2406 February 25, 2023 — Oakland, CA
Shauna Revelli

B.2407 February 25, 2023 — Salt Lake City, UT
The headlights blind me and I can't drive at night!

B.2408 February 25, 2023 — Seattle, WA
Driving at night, even in the late afternoon is getting increasingly unpleasant and dangerous unnecessarily.

B.2409 February 25, 2023 — South Euclid, OH
This is a serious safety issue. I can barely drive at night anymore, because I do not feel safe because I can barely see because of these absurdly bright headlights. Between this and people on their damned cell phones, it is getting less safe every day on the road.

B.2410 February 25, 2023 — Tuttle, OK
In my area, rural Oklahoma, the newer trucks lights are adjusted to high so when a trailer is hooked up they blind oncoming traffic. On many occasions I've just pulled to the side not being able to see.

B.2411 February 26, 2023 — Arab, AL
I can't drive at night anymore due to the led headlights. It hurts my eyes and I can't see, which is unsafe for everyone.

B.2412 February 26, 2023 — Barrie, Canada
I get blinded daily more and more over the last few years

B.2413 February 26, 2023 — Beaverton, OR
None of this is ok. Thank you for signing.

B.2414 February 26, 2023 — Bensalem, PA
Shining a light in people's eyes is used as torture, distraction, and to confuse them. That is what driving with these lights coming at me and from behind me does to me. It is blinding and distracts my attention from being literally able to see and pay attention to everything going on while driving.

B.2415 February 26, 2023 — Calabasas, CA
Headlights are truly blinding.

B.2416 February 26, 2023 — Chesnee, SC
I'm tired of being blinded by these lights. They are dangerous to oncoming traffic.

B.2417 February 26, 2023 — Columbus, GA
I thought it was just me that was having problems at night because of the brighter vehicle lights but now I SEE it isn't.

B.2418 February 26, 2023 — Cortland, IL
The new, super bright headlights are outrageous and need to be corrected ASAP!

B.2419 February 26, 2023 — Evansville, IN
We need change and increased safety.

B.2420 February 26, 2023 — Fuquay Varina, NC
I find LED headlights to present a driving hazard in many situations. They should be regulated to ensure they are just as safe as HID and halogen headlights. The height at which headlights are mounted on a vehicle should also be regulated?

B.2421 February 26, 2023 — Grand Rapids, MI
I am being blinded by these new lights. It literally causes me to turn my head away, thereby causing me to become a "distracted driver". If I physically cannot keep looking forward due to the pain from

bright oncoming headlights, how am I to be able to be fully engaged in safe driving? Please, please.....LOWER THE LUMENS!!!

B.2422 February 26, 2023 — Grove City, OH

I absolutely detest these lights. They hurt my eyes and make it less safe for drivers coming the opposite way.

B.2423 February 26, 2023 — Haltom City, TX

I've nearly been run off the road due to being blinded by oncoming vehicles with bright LED headlights.

B.2424 February 26, 2023 — Harvest, AL

Bright oncoming headlights are a safety hazard.

B.2425 February 26, 2023 — High Point, NC

Blinding headlights are dangerous and this important issue must be addressed.

B.2426 February 26, 2023 — Lansing, MI

Bright or righly called blinding headlights don't help anyone. It's the opposite, they can distract drivers, pedestrians and animals, and could cause accidents. Stop using them!

B.2427 February 26, 2023 — Loudon, NH

As an Optometrist, I have had a huge increase in patient complaints regarding the perceived brightness of newer headlights, and the dangerous effect on night driving.

B.2428 February 26, 2023 — Lunenburg, VT

I agree! It's a danger to everyone in the road with no real benefit for the driver.

B.2429 February 26, 2023 — Madison, OH

I've been completely blinded by these headlights. I think they should be banned EVERYWHERE. Absolutely NO reason why I should be blinded while driving, by another driver. Oh, and....the LEDs on police cruisers is JUST AS BAD.

B.2430 February 26, 2023 — Milford, OH

This is what government can do something about. This can measurably improve day to day life in the U.S.. There is an actual answer to this problem. It would be nice to see this tackled and unwinnable arguments/fights over issues like abortion (pro or con) tabled. Long enough to solve issues we can actually solve.

B.2431 February 26, 2023 — Mobile, AL

April Kasper

B.2432 February 26, 2023 — Montreal, Canada

Enough is enough!

B.2433 February 26, 2023 — Nashville, TN

This has been a problem for years now and seriously needs to be addressed! Many people just can't Drive after sunset anymore because of the newer and brighter lights. And if you're in front of a truck or keep, or suv that sits higher up, you may as well pull over and let them pass because you will be blinded if you don't. Time for a change and make it a law!

B.2434 February 26, 2023 — Nashville, TN

*jeep

B.2435 February 26, 2023 — Naugatuck, CT

I too am affected by being blinded by LED headlights. My vision while driving becomes such a hazard when a vehicle coming the opposite direction blinds me, which almost has me either almost hit the other vehicle or a sharp turn that causes me to go off road.

B.2436 February 26, 2023 — OGDEN, UT

I'm tired of being blinded. Afraid I'll end up in an accident because of it!

B.2437 February 26, 2023 — Phoenix, United States

The LED headlights are very blinding and there are to many running lights around the headlights and as hould reduced

B.2438 February 26, 2023 — Pollock Pines, CA

I'm tired of being blinded while driving at night

B.2439 February 26, 2023 — Portland, OR

I have a TBI (traumatic brain injury) from being hit head on by a drunk driver 15yrs ago. I have to wear sunglasses and a bucket hat almost 24/7 due to all of the LED lights from cars, many of which are painfully bright even in the daytime. Thats in addition to every other light in sight being swapped out for LEDs now as well, ex. street lights, buildings, buses, etc. I have to look at the ground when walking at night which puts me at risk for accidents, assaults, etc. I know I am hypersensitive due to my TBI but these lights are so far from natural I know that with time healthy folks will be having increased health issues. Already every person on the road is in danger as vehicles are in constant motion blinding them with LEDs from all different directions, angles, and heights. I remember getting tickets for leaving on high beams just 20yrs ago in cars where u switched em on with your foot. Today's running lights are brighter than those!!! How is this ok?

B.2440 February 26, 2023 — Portland, OR

I have had to stop driving at night (and on darker days!), I'm afraid for myself and others and think this is a major safety issue in our country!

B.2441 February 26, 2023 — Rahway, NJ

I'm so tired of being blinded at night. I used to live driving at night but more I dread it! Please fix these headlights!

B.2442 February 26, 2023 — Richmond, VA

It has become difficult and dangerous to drive at night.

B.2443 February 26, 2023 — San Francisco, CA

Not just the brightness level and color spectrum of these LED / HID lights but also the angle at which these are installed making a modern cars “lo-beam” act like a regular cars “hi-beam”. Add to this idiotic AI technology like automatic high beam, you end up with blinding cars in the opposite direction.

B.2444 February 26, 2023 — So. Burlington,, VT

the headlights are way too bright, and I cannot see if there is someone on the side of the road. I do not want to hit someone walking their dog because of stupid too bright oncoming hesadlamps, or a tree alongside the road on a curve.

B.2445 February 26, 2023 — Sophia, NC

Been "blinded" by these bright headlights especially when they are on taller trucks and suv. Also get blinded by emergency vehicles having blinding emergency lighting.

B.2446 February 26, 2023 — Tampa, FL

These lights are blinding and disorienting. Go back to yellow lights!!!!

B.2447 February 26, 2023 — Temecula, CA

I'm signing because I almost hit a motorcyclist while changing lanes at night. The car behind them had really bright lights and I couldn't't see the motorcycle. There's times I can't see the lines on the road. Also, it makes driving with astigmatism even worse.

B.2448 February 26, 2023 — Tisbury, MA

I want to see the stars

B.2449 February 26, 2023 — Traverse City, MI

Drive a small car and am light sensitive. Adaptive lights would be awesome and less painful.

B.2450 February 26, 2023 — Wakefield, MA

What has ever happened to DOT rules regarding automotive lights? Today's super bright blinding head lights are dangerous and are aimed too high off the road. Restore sane and reasonable headlight rules and save lives while not blinding oncoming traffic.

B.2451 February 26, 2023 — Winchester, MA

I was convinced people were just refusing to turn down their high beams, but this is worse. America has always been behind the rest of the world in headlight technology. It used to be that our sealed beams gave much less visibility than Europe's replaceable bulbs, but now our cars just spew blinding light. This is of a piece with giant pickup trucks that have head-height hoods to appeal to our reptilian brains, and at the same time mash the brains out of any pedestrians they hit. We need our laws updated to keep up with the marketing departments of the Big Three automakers.

B.2452 February 27, 2023 — Milwaukee, WI

Today a Lincoln Navigator was driving behind me. During the day with their high beams on. The light was blinding me in my rear view mirror and driver side mirror. I couldn't see to even drive. There needs to be some kind of regulation on these lights. I would think this new normal of brightness will blind people or we will have a lot more eye damage in the future for the young.

B.2453 February 27, 2023 — Reynoldsville, PA

I'm signing this because I can't count the number of times these bright headlights have almost made me drive off the road. I also have noted an increase in my headaches and migranes after driving at night and passing cars with these headlights, or having them drive behind me. I prefer the duller yellow ones, we could see and it doesn't kill my eyes to drive at night if they pass me by or are driving behind me.

B.2454 February 27, 2023 — United States

Blinding headlights are dangerous.

B.2455 February 27, 2023 — leitrim, Ireland

Since introduction of LEDs, I suffer from migraine, nausea, vertigo, difficulty concentrating, especially from excessively white blue LEDs. Also driving has become just about tolerable and a frustrating uncomfortable experience. I used to enjoy driving, now I avoid it.

B.2456 February 28, 2023 — Goodyear, AZ

Not safe to be as Bright as high beams...

B.2457 February 28, 2023 — Honolulu, HI

A lot of the newer headlights are blinding...

B.2458 February 28, 2023 — Lawrence, KS

the glare of oncoming lights is blinding at times. I actually have to block them with my hand in order to see the road!

B.2459 February 28, 2023 — London, United Kingdom

They are so dangerous and completely blinding

B.2460 February 28, 2023 — Loveland, OH

It's blinding and dangerous

B.2461 February 28, 2023 — Manhattan, IL

I'm getting blinded during the dark on way to and from work. I wonder how many people are killed in accidents caused by these lights. I noticed jeeps low beams are really blinding.

B.2462 February 28, 2023 — Marbury, AL

The new headlights are extremely dangerous I have almost wrecked several times from them blinding me. I suffer from migraines and I am very light sensitive already. They not only blind you as they are approaching but even afterwards all you can see a spots and your eyes which prevent you from being able to see to drive afterwards. I have to put my sun visor down and hold my hand up in front of my face to block the lights as I'm driving or sitting still even. Also not only the headlights but has anyone else noticed the tail lights and blinkers are terribly blinding as well when you're sitting behind a vehicle at a stoplight. I truly wish that they would pass a law Banning the LED headlights and tail lights, brake lights and blinkers! Including the colored ones, especially the blue ones! And mandate restrictions height and brightness with mandatory state inspections!

B.2463 February 28, 2023 — Portland, OR

These lights are literally blinding. I also heard cyclists are having more accidents bc of them - they can't see either.

B.2464 February 28, 2023 — hull, ENG, United Kingdom

It's dangerous!

March 2023

B.2465 March 1, 2023 — Ashburn, VA

I CANT SEE

B.2466 March 1, 2023 — Clarkston, GA

I certainly have this problem and never drive at night. Regular headlights are enough glare, no one needs to be blinded while driving.

B.2467 March 1, 2023 — Fairview Park, OH

Yes, thank you! I now have to wear sunglasses at night due to these LED headlights, making night driving even more dangerous!!! This is madness!

B.2468 March 1, 2023 — Houston, TX

I prefer to drive a smaller car as I am only one person and don't need to use a lot of gas. Lately it feels hazardous to drive at night when these taller vehicles's bright blue-wave headlights are in my eyes. Even after a brief flash, my eye sight is temporarily compromised and I am still seeing spots for 15-20 minutes. This cannot be good for our eyes. Many of us suffer from migraines as well, and this can absolutely trigger them.

B.2469 March 1, 2023 — Huntsville, AL

I can almost not drive at night because of blinding lights

B.2470 March 1, 2023 — Indianapolis, IN

I often wonder if drivers are using their bright lights that are causing a blinding glare. LED/HID don't help drivers see better and yet are dangerous in many ways. Regulation could save lives.

B.2471 March 1, 2023 — Newark, NJ

This is extremely dangerous and can cause accidents

B.2472 March 1, 2023 — Reynoldsburg, OH

I hate driving at night seeing everything alright, and some schmuck nearly causes me crash because of the dumb high beams!

B.2473 March 2, 2023 — Cape Coral, United States

Tired of unaware people driving rolling flash bangs

B.2474 March 2, 2023 — Columbia, SC

I'm signing because first of all, I care! And to be honest, my eyes are getting older too. These lights are blinding to many of us and very dangerous for that reason. Thanks for considering the facts.

B.2475 March 2, 2023 — Paris, IL

I commute to and from work. These lights blind travelers on interstates already going 80mph.

B.2476 March 3, 2023 — Lutz, FL

December 2022 I was run off the road, blided by their headlights(they were also in my lane) and ended up in a ditch with a $700 tow bill while they drove off into the night. Blinding headlights were the reason I couldn't see and swerved into the ditch

B.2477 March 3, 2023 — Mooresville, NC

I have, along with other people that I have talked to, also have complaints about these BLINDING headlights. I have suggested that we fail a lawsuit against these LED headlights. It's almost traumatizing, driving after the sun goes down or when its raining. I am afraid that I or someone driving in vicinity will wreck, causing serious bodily harm. Something need to be done, ASAP!!!!! Chrystal Flake

B.2478 March 3, 2023 — Rensselaer, NY

It is now extremely difficult to drive at night with the headlights coming at me. I drive an older taller minivan so it is not the level of my vision field coming into p,at, it is the new headlights.

B.2479 March 3, 2023 — bowling green, KY

I become completely blinded by oncoming LED lights and have to adjust all my mirrors when cars are behind me with LED lights. It has become very dangerous to drive at night because of these lights. I truly cannot believe that this is becoming the norm on new vehicles. I am in my 50's so I do have older eyes, but my 20-year-old daughter also has the same difficulty seeing in the same situations. It is even more overwhelming when driving on narrow 2-lane roads. I fear being on a narrow, unfamiliar road at night. I think they should be banned and manufacturers should be forced to recall and replace them on factory-issued vehicles. At the very least, stop rolling them off the production lines with these lights now!!

B.2480 March 4, 2023 — Modesto, CA

Saves lives I agree with the petition

B.2481 March 5, 2023 — Algonquin, IL

I have photosensitivity and astigmatism in both eyes. I seriously can’t drive for more than a few minutes without getting blinded and instantly dizzy. I come home with a mild headache at best every single time. It is VERY scary. How is this legal? I already have bad anxiety driving and this has made it x200 times worse. I’m so scared i’m gonna hit someone or something one of these days. PLEASE do something about this. It’s not just me. Too many people are having issues with it. Please take this seriously.

B.2482 March 5, 2023 — Bridgewater, NJ

Drivers are literally blinded when an oncoming vehicle is approaching AND after they've passed. And it's almost equally as distracting when LEDs shine in your eyes via the rear and side view mirrors. And so what are drivers reduced to doing in order to not be blinded? We look off to the side of the road when oncoming cars are passing, which of course is dangerous but at least we don't get momentarily blinded. We also adjust our mirrors to positions that aren't optimal so that we don't get blinded from behind. Note that I have absolutely no problem driving in the dark with warm toned halogen lights, even on country roads. But when I've driven cars with LEDs I find it harder to see long distance than with halogens. The eye is meant to adapt to low lighting, so a super bright light is counterproductive when trying to see in the dark. Halogens disperse light more naturally and the light slowly dissipates in the distance allowing for the eyes to adapt to the surrounding darkness, whereas LEDs create a stark bright/dark boundary where the light ends and everything beyond it is perceived by the eyes as pitch black and basically invisible. Not to mention that light/dark line is distracting when driving on hills. It's completely baffling that car companies are coming out with features that are supposed to make driving safer, such as lane assist and rear cameras, yet at the same time they install blinding LED headlights which pose much more dangerous consequences such as head-on collisions or running off the side of the road.

B.2483 March 5, 2023 — Bridgewater, NJ

 Way too many people on the road with their lights angled in the wrong direction. Sometimes when there's an oncoming car with high beams I'll flash my high beams to activate their car's automatic switch to low beam, or if they don't have automatic at least it reminds the other driver that they need to turn down their high beams.

B.2484 March 5, 2023 — Odessa, FL

I struggle to drive at night due to these headlights

B.2485 March 5, 2023 — Staten Island, NY

As someone with impaired vision which isn't an issue but I also have an astigmatism..all light's already look like little light explosions as..BUT LED lights!!..it LITERALLY burn my eyes ..and then having it reflect off the side and rear view mirrors is ABSOLUTELY TORTURE..GET RID OF LED HEADLIGHTS

B.2486 March 5, 2023 — Staten Island, NY

I constantly have to lower my driver side view mirror down just so I block out the light..and the rear view thank god has the little piece that I switch up which puts it in I guess like a reflective or somethin like that..but that works really good to block the lights but I'm able to still use the rear view mirror

B.2487 March 6, 2023 — Baltimore, MD

I wish I could share with lawmakers the view from my condo/high rise. Every few minutes at night a blinding light from an intersection 1.4 miles blinds me. If that level of bright light from an Led Car headlight can reach and disrupt from over a mile away, what can that be like for the person in front of them. I've tried recording it but my iPhone camera/video is terrible. I feel like it would be a great indicator of just how bright these lights are.

B.2488 March 7, 2023 — Jacksonville, FL

I am a human who drives and has eyes.

B.2489 March 7, 2023 — Philadelphia, PA

These blinding headlights are dangerous and should be outlawed

B.2490 March 7, 2023 — Silverado, CA

I have had to stop driving at night because of led headlights especially Pickups and SUVs

B.2491 March 7, 2023 — Summerville, SC

I can hardly drive at night anymore from these lights ruining my eyes.

B.2492 March 8, 2023 — Baltimore, MD

It's physical painful and emotionally exhausting to drive at night. Not only are the lights a sensory hell, they also are preventing me from seeing where I'm going. It's so dangerous.

B.2493 March 8, 2023 — New Albin, IA

I do not drive at night anymore because of the intense glare from these lights. It not only hurts my eyes it is extremely dangerous and there have been numerous accidents, injuries, and even deaths because of these lights. People over Profits!

B.2494 March 8, 2023 — Portland, OR

These lights are dangerous. I frequently get blinded at night and cannot see well for a few seconds. I can't jeopardize my family because of these unregulated lights

B.2495 March 8, 2023 — Reykjavik, Iceland

I live in Iceland and these bright headlights are terrible. They destroy our eyes and our environment. More and more cars have these bright headlights. I use sunglasses when driving in dark. The authorities are totally corrupt allowing these lights. They don't care about common people, they only care about big buisness.

B.2496 March 9, 2023 — Garden Grove, CA

Diminishing the nightvision of drivers leads to dangerous road conditions for all road users

B.2497 March 9, 2023 — San Francisco, CA

LED headlights are blinding.

B.2498 March 10, 2023 — Grand Blanc, MI

I wish they'd bring back affordable, easy to replace, glass sealed beam halogen headlights.

B.2499 March 10, 2023 — Halifax, Canada

Not yet convinced this is a problem? Check out reddit.com/r/fuckYourHeadlights to see photos/videos and read about experiences from thousands of people all over the world.

B.2500 March 10, 2023 — Smithfield, RI

Difficulty, danger and fatigue driving at night caused by blinding white LED headlights.

B.2501 March 10, 2023 — Terre Haute, IN

Needs attention.

B.2502 March 10, 2023 — Washington, NJ

This should be a no brainer. I cant believe anyone thought this was a good idea. Im tired of driving home from work, and essentially letting jesus take the wheel, because I cant see anything. The blinding light of a thousand suns burning right through my retinas causes black spots to appear in my eyes, so the blindness lingers much longer than the actual headlights. There was never a problem with the old headlights. I could see just fine before the blue lights came.

B.2503 March 11, 2023 — Mauldin, SC

I have eyes that are very sensitive to light and bright (especially white) things.. I honestly can’t see (low riding car) every single light shines right into my window. Hear me out okay, (I’m obviously not the only one who can’t see.) If someone could create having your brights on be the LED BS, then regular running lights be the warm yellow again (WHERE I CAN SEE AGAIN AND SEE PAST THE CAR AND NOT WONDER WHATS ON THE OTHER SIDE OF THE LIGHT WALL I’M LOOKING AT) I just feel like it wouldn’t just help me but a lot of other’s too.

B.2504 March 11, 2023 — Mauldin, SC

Y’all stay safe out there! Always try to be aware of ur surroundings ❤️ ❤️

B.2505 March 12, 2023 — Atlantic Beach, NY

Driving at night has become a perilous adventure, especially on winding roads. I am continually blinded by these high power lights and no longer feel safe.

B.2506 March 12, 2023 — Chennai, India

I drive too and am constantly blinded by high beam headlights at night which makes me freak out

B.2507 March 12, 2023 — Chennai, TN, India

I have many times been blinded by headlights and nearly run over someone

B.2508 March 12, 2023 — Cypress, TX

They blind me on the road. My wife almost ran off the road blinded by a truck with LED. She can't drive at night anymore. They also trigger her migraines. They are dangerous!!!! And affect people's physical health!!!!

B.2509 March 12, 2023 — Greenville, SC

They are ridiculous and unnecessary!

B.2510 March 12, 2023 — Rogers, AR

I have astigmatism and these headlights at night are so blinding and dangerous. The LEDs are not the problem, it's the glare — there needs to be some kind of luminance regulations put in place as this is life safety issue.

B.2511 March 12, 2023 — Somerset, NJ

Everyone I know, including me, are blinded by these headlights at night, making driving dangerous for everybody!

B.2512 March 12, 2023 — Williamsburg, OH

These are dangerous as they temporarily blind oncoming traffic creating a possible deadly situation.

B.2513 March 13, 2023 — Baltimore, MD

I suffer from migraines and can no longer drive at night without risking triggering a debilitating migraine.

B.2514 March 13, 2023 — Chicago, IL

The headlights are blinding and eye damaging. It's ABSURD. And who is really at fault when an accident occurs as a result of being blinded? Is the the fault of a driver or the manufacturers?????

B.2515 March 13, 2023 — Fresno, United States

I have experienced near crashes because of people either behind or coming towards me. I used to drive to work in the mountains where it is much worse.

B.2516 March 14, 2023 — Asheville, NC

Super bright LED headlights and accessory lights are not only a nuisance, but are also dangerous for the other drivers on the road. They not only cause a distraction when being confronted with them, but also when being approached from the rear. Please pass regulations to limit the brightness and color of what is acceptable for being on the road.

B.2517 March 14, 2023 — Attleboro, MA

I have TBI and it is extremely difficult and scary to drive with blinding lights coming at you.

B.2518 March 14, 2023 — Baton Rouge, LA

I don't want to be blind

B.2519 March 14, 2023 — Bogue Chitto, MS

Headlights are too bright and distracting. They are so bright that they are commonly used to blind other drivers on purpose.

B.2520 March 14, 2023 — Brooklyn, NY

I've been blinded by these newer headlights and almost crashed because of it. It's ridiculous we have got to this point.

B.2521 March 14, 2023 — Canby, OR

Blinding headlights are a massive safety hazard.

B.2522 March 14, 2023 — Haiku, HI

Im in my early 30's and I've done my best to stop driving at night solely because of the popularity of lifted vehicles with blinding lights. There are often times when I am so blinded that I can not see the road and I am driving off memory. The person blinding me is putting their life in my hands and they are doing it without my consent. It is insanity. I drive an SUV, I can only imagine how bad it is for people driving lower vehicles. And the truth is many 'lifted bright lighters' literally and metaphorically look down on people in smaller cars. It's Idiocracy.

B.2523 March 14, 2023 — Highton, Australia

I'm 45 my car is 2012 model these new cars have very very very bright leds headlights it is very very dangerous I find it very difficult to see it would be great if somehow the government could replace older headlights for a cheaper price for leds so we all can see for people in need it it is very dangerous

& scary something needs to be done just make them affordable on older cars without LED headlights just being honest it can be very scary

B.2524 March 14, 2023 — Indianapolis, IN

As an optician I have countless patients that complain about how these lights have made driving more difficult and more dangerous. The height of the lights needs to be addressed as well. Many of the trucks being sold today have headlights that are placed directly at eye level of anyone in a normal sized vehicle.

B.2525 March 14, 2023 — Rochester, IN

I drive home from work at night and I feel like my eyesight is getting worse due to being blinded every single night.

B.2526 March 14, 2023 — Stanfordville, NY

IT AGGRAVATES MY ASTIGMATISM!

B.2527 March 14, 2023 — Washington, DC

I live in an urban area and these are so unnecessary and dangerous on city streets.

B.2528 March 14, 2023 — Williamston, NC

I'm tired of being blinded for up to a minute by cars oncoming, one day it's going to cause me to wreck and hurt myself and my family

B.2529 March 15, 2023 — Dorset, ENG, United Kingdom

I can no longer confidently drive at night due to having very light-sensitive eyes.

B.2530 March 15, 2023 — Huntingdon Valley, PA

I have been blinded by new headlights

B.2531 March 17, 2023 — Fayetteville, AR

Because LED lights are illegal and I don't want to DIE. There will be death lawsuits if these blinding lights don't cease.

B.2532 March 17, 2023 — New Haven, CT

Wanda Faison

B.2533 March 18, 2023 — Austin, TX

They are so very dangerous.

B.2534 March 19, 2023 — North Tonawanda, NY

"The LEDs are not the problem...." NOOOOOO! Use your head! LED's *are* the problem!

B.2535 March 19, 2023 — North Tonawanda, NY

Inconsiderate individuals. That's the New Normal!

B.2536 March 19, 2023 — North Tonawanda, NY

I know EXACTLY what you are referring to! I see it all the time on my walk!

B.2537 March 19, 2023 — brooklyn, NY

Them shitsis too bright yo

B.2538 March 20, 2023 — Cibolo, TX

These lights has caused severe pain and migraines to myself and eleven year old son. The pain last for awhile after being blinded or waiting at a stop light. I'm a nurse and work nights. Just imagine that!!!

B.2539 March 20, 2023 — Littlehampton, ENG, United Kingdom

I no longer feel safe driving at night. I can't see properly with the blinding lights of other cars and this is curtailing my personal and family life.

B.2540 March 21, 2023 — Avondale, AZ

i'm only 22 and i had to stop driving at night as much as possible because of lights like this. i have astigmatism and driving with people who have bright lights on the road blinds me so bad. it's unsafe and our government needs to do something about it.

B.2541 March 21, 2023 — Mount Juliet, TN

These lights are unnecessarily bright making them an unsafe distraction on the road.

B.2542 March 22, 2023 — Brooklyn, NY

These headlights are a real nuisance, they leave a mark in your eyes that takes a few minutes to go away sometimes, and they're not necessary.

B.2543 March 22, 2023 — lehigh acres, FL

I CANT SEE! Literally. The New LED Headlights arent even on "High-Beam" and they're lighting up the whole inside of my car, blinding me, and now allowing me to see PAST their car On MY LANE. What if there was a pedestrian, or a stopped car on the side of the road. WE NEED A SOLUTION

B.2544 March 23, 2023 — Santa Rosa, CA

I have never had a problem driving at night until the increased use of blinding headlights became the normal. I cant believe I have avoided tinting my windows for 10 years (the sun is fine!) but am now considering it for the nigh-time?! No thank you. This is a real problem, and I cant imagine how it affects the visually sensitive or elderly drivers.

B.2545 March 23, 2023 — United States

I like to see at night

B.2546 March 24, 2023 — Orange, CA

These high intensity lights are dangerous to other drivers on the road

B.2547 March 25, 2023 — Tucson, AZ

I fucking hate those lights

B.2548 March 26, 2023 — Plymouth, IN

There is no reason for them light's to truly be that bright I truly have to stop just to make sure I'm staying safe and on the right side of the road

B.2549 March 26, 2023 — Royal Oak, MI

Screw these lights.

B.2550 March 26, 2023 — White Bear Lake, MN

I'm tired of almost crashing from being blinded by these awful things

B.2551 March 29, 2023 — Moorpark, CA

These lights are fucking ridiculous, they're literally brighter than the high beams on my car, and WHY THE FUCK are they always adjusted right at eye level? Aim them at the fuckin street not the fuckin moon!

B.2552 March 29, 2023 — Santa Monica, CA

I can't see when I drive at night any more cause these headlights are blinding.

B.2553 March 31, 2023 — Richmond, VA

I'm tired of being blinded by LED headlights at night! They are so distracting and dangerous!

April 2023

B.2554 April 1, 2023 — Lockport, IL

They come towards me and I can't see. Its awful i can't even see the road.

B.2555 April 1, 2023 — Richmond, IL

I like safe roads

B.2556 April 2, 2023 — Antioch, CA

I suffer from photosensitivity and optical migraines. The sudden blinding light in contrast to the dark surroundings is excruciating. It causes an uncontrollable flinch or squint. This translates to blurry vision, halos, and sharp pains. Headlights simply do NOT need to be this bright. A well focused light would not do this.

B.2557 April 2, 2023 — Denver, CO

I'm not trying to die on the road.

B.2558 April 2, 2023 — Morgantown, WV

When you get old, lights start to blind you. Well, regular car lights aren't a problem for me, but these LEDs are brutal. Especially on high-rise trucks, it's constant blinding even in my night-time rear view mirror, and in a hilly town I'm regularly expected to go over the top of the hill and take a turn while blinded. We have laws prohibiting using your high beams because they can blind people, and LEDs are BRIGHTER... why on earth are they legal?

B.2559 April 4, 2023 — Tampa, FL

I recently got stuck behind an ambulance whose brake lights were so bright they hurt my retinas and I had to look away from the road, endangering me and others. If they're getting so bright they cause retinal pain, this has become a national crisis. LED lights need to be banned on ALL external vehicle lights!

B.2560 April 4, 2023 — Wheaton, IL

light pollution is hazardous to everyone's health

B.2561 April 5, 2023 — Burnaby, Canada

I am tired of being blinded while driving by these headlights.

B.2562 April 5, 2023 — London, ENG, United Kingdom

My solution is to wear sunglasses while driving at night and memorise the road ahead for when blinded, but it is not ideal!

B.2563 April 5, 2023 — Portland, OR

These headlights are unnecessarily bright, and exceptionally worse when used in higher riding, or lifted vehicles. There needs to be more strict regulation.

B.2564 April 5, 2023 — Saskatoon, Canada

I hate being blinded by really bright headlights shining in my eyes at night. There needs to be a limit

B.2565 April 5, 2023 — Washington, DC

They are dangerous

B.2566 April 6, 2023 — Oakhurst, NJ

I avoid night driving whenever possible, as someone in a sedan, I am simply not able to see with these LEDs in my face. I have to pull over and wait for them to pass. And this is coming from someone with no vision issues whatsoever. These need to be regulated

B.2567 April 7, 2023 — Clinton, MD

I'm terrified to drive at night because the headlight situation is dangerous for me

B.2568 April 7, 2023 — Coldspring, TX

These lights impact my ability to see at night.

B.2569 April 8, 2023 — Gorebridge, SCT, United Kingdom

These lights blind me. I have to raise a driving hand to blank them off, which I hate doing since it's not safe.

B.2570 April 9, 2023 — Falls Church, VA

This is a significant and solvable problem.

B.2571 April 9, 2023 — Grand Rapids, MI

I have nearly gotten pushed off the road from drivers tailgating me at night. I have to pull over frequently and have intense headaches from driving at night. I've tried numerous expensive night driving glasses that do not help. I already have pre-existing light sensitivity and this has made life almost intolerable- I won't go out, go anywhere some days because I worry about dealing with eye strain and headaches. Some cars even have flashing lights that make me feel like I am going to faint. I also have ADHD and it's extremely difficult to focus. This is endangering us all. Please do something about this.

B.2572 April 9, 2023 — Oakdale, CA

I have developed a light sensitivity and LED lights absolutely hurt my brain.. it's very important to me to not have to buy these bulbs.. please lift the ban!!!

B.2573 April 9, 2023 — silver spring, MD

Im blinded by the lights.

B.2574 April 10, 2023 — Panama City, FL

I have worn glasses since I was 5, and I have blue eyes. My eyes are not super sensitive to light but these modern hid and led headlights are absolutely blinding. Making driving at night painful if not dangerous for anyone driving at them. As a hunter I can appreciate bright lights when off the main road but not on the roadway. Almost all streets are well lit these days with lights even being installed on the interstate at transitional areas for safety. No one needs lights this bright and if they do then maybe they should do what my grandmother does and do their driving while the sun is up.

B.2575 April 10, 2023 — Perth, Australia

I have astigmatism, which makes driving hard at night, even with glasses to aid me. Add in the LED lights on new cars, I avoid driving at night as much as possible as I don't want to go blind and cause of be in an accident

B.2576 April 10, 2023 — Portland, OR

So sick of overcompensating jerks blinding people at night and making the roads dangerous for everyone else.

B.2577 April 10, 2023 — new york, NY

LEDs are dangerous and harmful

B.2578 April 13, 2023 — Antioch, IL

Driving to work at 5 am it is always dark. I drive an older truck so the small cars lights do not blind me as badly but the new trucks on the road have those white leds, they are brighter than my conventional yellow high beams.

B.2579 April 13, 2023 — Ashburn, VA

almost caused soooo many accidents

B.2580 April 13, 2023 — Aurora, CO

I'm tired of being blinded by these types of headlights as I drive home every evening. Many times I cannot see the painted lines on the highway as they are so bright.

B.2581 April 13, 2023 — Bakersfield, United States

It's more dangerous to be blinded by the opposing traffic at night. The newer lights are painfully blinding and are worse than ever. They make night driving miserable and dangerous.

B.2582 April 13, 2023 — Baldwin, LA

I'm tired of being blinded by 1000 suns at night while driving anywhere.

B.2583 April 13, 2023 — Bath, PA

I'm a home health aid who drives far to work in the dark. I am concerned my eyes are being permanently damaged by the insanely bright lights of newer vehicles. I'm also worried I'm going to have an accident due to impaired vision. After a vehicle with bright lights passes me, it usually takes at least 15 seconds until I stop seeing spots and my night vision begins to return. During that time, I'm technically visually impaired. I'm really worried I'll hit a deer/animal or possibly drive off the road. I'm not old, only in my 30's. I go to the optometrist/ophthalmologist every year and I do not have anything wrong with my vision. It is simply a fact that vehicles are being made with excessively bright lights. There's also the issue of after-market lights which needs to be addressed. People using extra sets of bright lights, blue/colored lights, LED light bars, spotlights, etc. These ALL need to be regulated if they're approved for on-road use. Anything unregulated or not approved needs to be clearly labeled as "Off-road use ONLY" and give law enforcement the ability to enforce this as a matter of public safety. Years ago, part of yearly vehicle inspection was checking headlights. They used to make sure the headlights were adjusted properly so they weren't aiming directly into oncoming traffic. For some reason, this is no longer part of state inspection. It's especially important for SUVs, Jeeps and trucks to have their lights properly tilted downward, otherwise they are at eye-level of oncoming car traffic and will aim directly into those drivers' eyes. So there's several issues that need to be addressed: lights that are too bright, the color spectrum of headlights, regulation of lights and the ability to enforce these regulations, clearly labeling unregulated lights for "off-road use only" and once again making headlight specifications part of yearly vehicle inspection. There's a lot which can be done to address these problems. There are many ways we can make sure all drivers have good visibility. I hope now that you see what a big problem this is, you'll take the matter seriously and act on it. Please help make it safer to drive at night without the risk of damage to our vision and having accidents because of other driver's lights.

B.2584 April 13, 2023 — Bedford, TX

It's too dangerous for me to drive at night now due to the brightness of the headlights. Since headlights are no longer part of the inspection process for annual vehicle inspections it is only gotten worse.

B.2585 April 13, 2023 — Birmingham, AL

The amount of accidents I've narrowly avoided due to led headlights on vehicles like a Toyota camery is insane. This shouldn't even be an issue.

B.2586 April 13, 2023 — Colorado Springs, CO

I believe in this

B.2587 April 13, 2023 — Hatboro, PA

I'm SICK of blinding LED's in new cars! Especially Ford pickups with FOUR low beams!!!

B.2588 April 13, 2023 — Healdsburg, CA

Tonight, after being blinded by a jacked up truck across from me, both of us waiting for a green signal. I take my turn which there happens to be road construction on and hit some orange cones because I have big white spots in my eyes. I couldn't tell the difference of the lanes and when coming to another light I couldn't tell the distance between me and the car ahead of me. These lights are causing vision impairment to all drivers and the effects last several minutes. I had to pull over until those white spots faded enough to drive safely.

B.2589 April 13, 2023 — Healdsburg, CA

I believe it is causing eye damage. It's just like looking directly at the sun.

B.2590 April 13, 2023 — Huntingdon Valley, PA

I've been complaining about the bright lights since the halogens came out! Have had to hold my hands in front of my eyes and THAT is dangerous while driving!!!

B.2591 April 13, 2023 — IA, United States

I've HAD IT with these ******* LED headlights. I only drive in the dark now when I absolutely have no choice, which has completely destroyed my social life, family life, is risking my job, and puts my

life in jeopardy every time I meet these blinding DEVIL LIGHTS. My eyes don't just hurt after meeting them anymore, they hurt in the daytime as well now, after years of exposure. And I know I'm not alone. The NHTSA and the other government agencies responsible for this avoidable catastrophe owe me and the rest of us $$$$$ compensation for essentially destroying our lives. Everyone of us should start thinking about early retirement, cause some day these CRIMINALS are going to get sued for every dollar they have.

B.2592 April 13, 2023 — Irving, TX

Humanity need's to prevail over profits

B.2593 April 13, 2023 — Lascassas, TN

I'm light sensitive to begin with, and these obscenely bright headlights make it much worse.

B.2594 April 13, 2023 — Long Beach Township, NJ

These lights are blinding, dangerous & should not be allowed. Without regulations to prohibit, this is affecting so many people & causing so many accidents, even death.

B.2595 April 13, 2023 — Loveland, OH

LED headlights suck. I'd like to SEE when I'm driving.

B.2596 April 13, 2023 — Malvern, PA

I have been temporarily blinded by Led lights while driving, especially when it's raining.

B.2597 April 13, 2023 — NJ, United States

I don't want to drive with blindness, the blindness may only last a few seconds, but those few seconds can be a matter of life or death

B.2598 April 13, 2023 — New York, NY

I am sick of being blinded at night by these people with insanely bright headlights.

B.2599 April 13, 2023 — Ocean City, NJ

well, I thought I was just old, crazy or imagining things when I started complaining to myself about the bright lights...and cursing at drivers (windows closed)...moving my mirrors up down, in & out ...trying to actually SEE!...I have a difficult time seeing bicycles, pedestrians and the actual ROAD at times....and those damn high profile suv's and pickup trucks are HORRIBLE!...I don't know know if the owner's are aware of how dangerous their vehicles are, or even care? What makes me angry is the fact that if I have MY "brights" on to see, these drivers (of big brand new vehicles) signal me to turn my lights down! HaHaHa! I DO NOT COMPLY!! how do they like it!???

B.2600 April 13, 2023 — Olympia, WA

Many cars headlights are too bright

B.2601 April 13, 2023 — Philadelphia, PA

It's blinding and triggers migraines. Additionally, you can't see for a significant period of time after experiencing. This is a recipe for disaster!

B.2602 April 13, 2023 — Philadelphia, PA

I really can't stand those high lights on cars it's blinding and scary when u can see the road,especially for pol with night blindness,and if ur on a road that turns and winding,and head on..someone is going to get hurt or killed.

B.2603 April 13, 2023 — Pittsburgh, PA

I, too, am fed up with ridiculously bright headlights on cars at night. At first, I thought some people were driving with their high beams on, but then I thought to myself, it can't be this many people driving around with their high beams on at the same time. Too many times I have been blinded by oncoming traffic, which is extremely dangerous, not to mention, the interior of my car being brightly lit by the headlights on the car behind me while also being blinded by the flare in my rear and side view mirrors. How are these lights even legal? There's zero consideration for the safety of other drivers.

B.2604 April 13, 2023 — Shawnee, United States

Blinding headlights have been getting worse over the past several years. Blinding opposing traffic is unacceptable as it puts everyone in the road at risk.

B.2605 April 13, 2023 — Tillsonburg, Canada

Extremely dangerous - as a truck driver it greatly interferes with me driving safely on the big roads!!!

B.2606 April 13, 2023 — Toledo, MI

They need to outlaw fog lights when not needed as well

B.2607 April 13, 2023 — Van Nuys, CA

Safety should be the number one concern when driving. Headlights are bright enough when someone has their high beams on inappropriately, but the new "low" beams are too bright and are equivalent to the high beams.

B.2608 April 13, 2023 — Wildwood, IL

Edmund jorgensen

B.2609 April 14, 2023 — Albany, NY

There comes a point when energy savings or whatever reasons manufacturers are giving for using LEDs or for the safety of the driver behind those lights is negated by the Hideous Lack of Safety for oncoming drivers. Ask insurance companies how many claims there are for drivers who went off the side of the road because the road curved and the driver didn't because the driver was so blinded by oncoming LEDs they didn't see it. Ask insurance companies how many claims are for drivers who went off the side of the road because the driver flinched when suddenly hit with LEDs coming out of a cross street or driveway. I know several elderly people who will not drive at night, not because they have bad night vision, but because trying to drive safely while dealing with blinding LEDs is too high stress for their hearts. Blinded by the light makes for great song lyrics, but not for driving safety.

B.2610 April 14, 2023 — Bernville, PA

I have blue eyes which only compounds the problem..

B.2611 April 14, 2023 — Brooklyn, NY

The rent is too damn high...errr I mean the lights are too damn bright!!!

B.2612 April 14, 2023 — Clarksville, TN

Robert, Have your friends sign this petition and end this once and for all!

B.2613 April 14, 2023 — Glen Rock, NJ

The bright lights make it hard to see and create a dangerous condition

B.2614 April 14, 2023 — Gruetli-Laager, TN

Airport runway lights .. hideous

B.2615 April 14, 2023 — Guilford, CT

I have reduced visibility in low light. My eyes adjust slowly. These needlessly bright LEDs make it very difficult for me to see while driving at night especially in the rain with the reflective wet roads. It's unbelievably inconsiderate to blind others for your own minor visibility increase.

B.2616 April 14, 2023 — Haledon, NJ

It is very hard to see during night driving

B.2617 April 14, 2023 — Hamlet, IN

Denise Amendola

B.2618 April 14, 2023 — Hobart, IN

It forces me to look away until they pass which is unsafe. This has caused me a night life. I have given up driving at night unless completely necessary.. if you need lights that bright. We have always had

them. Called brights and every one knows you turn them off when another car is coming.. because it blinds them.. common sense for 100 years what the hell happened.

B.2619 April 14, 2023 — Houston, United States

Not only are headlights on trucks missmatched in hight for smaller cars but oncoming lights are too bright. Especially "blue lights" are too bright. It's not safe, there are time when you just absolutely cannot see the road. Police lights are also getting brighter it seems, along with construction workers flashing lights.

B.2620 April 14, 2023 — Indianapolis, IN

I don't know how many times I have had to pull over because I could not see due to the car blinding me. I thought maybe I'm just getting older and that's why it bothers me so but now I realize this isn't me it's the headlights getting brighter and brighter.

B.2621 April 14, 2023 — Jacksonville, FL

I have been blinded many times while driving at night and have limited my night driving because of it. It is so dangerous.

B.2622 April 14, 2023 — Lansdowne, PA

Safety first

B.2623 April 14, 2023 — Newark, OH

New headlights are way to bright. Most look like the high beams are on when they aren't

B.2624 April 14, 2023 — Philadelphia, PA

These headlight should be illegal

B.2625 April 14, 2023 — Roanoke, VA

If I can't see EVERY time a car goes by me, they should not have them. I've almost ran off the road several times because of those eyeball burning lights. It's bull. And I will run into you

B.2626 April 14, 2023 — Royersford, PA

The lights are blinding in these newer cars. It actually hurts my eyes to look at them.

B.2627 April 14, 2023 — Seattle, WA

Being blinded by high intensity light is no fun and is quite dangerous. This of us in lower sitting vehicles are particularly vulnerable. Plus, don't we have enough light pollution around us?

B.2628 April 14, 2023 — Tucson, AZ

I hace the same issue in arizona some hwadlights are soo over bright n blick the vision from seeing whats in front if uorcoming at you due to the hazardous brightness if their headlights

B.2629 April 14, 2023 — United States

Yes, headlights should be regulated by the Department of Public Safety for each State!

B.2630 April 14, 2023 — United States

Football stadium headlights are aweful.

B.2631 April 14, 2023 — Valley Stream, NY

Can't see at night with these blinding LED lights. Very dangerous.

B.2632 April 15, 2023 — Adairsville, GA

The lights blind me and also cause me to have migraine headaches. Not safe. Not good.

B.2633 April 15, 2023 — Ashland, OH

I have been in this situation many times! Its hard to see at night. These headlights need to be controlled

B.2634 April 15, 2023 — Auburn, WA

Ban these unsafe and obnoxious headlights, and pass hefty fines for a$$holes who put them on their vehicles.

B.2635 April 15, 2023 — Aurora, CO

These ultra bright headlights are a hazard to everyone on the road.

B.2636 April 15, 2023 — Bedford, TX

Some headlights are so bright you can "x-ray" flash the bones in you sheild hand trying to block em being 50k x brighter than noontime sunlight.. need welding goggles not to go blind from em...

B.2637 April 15, 2023 — Bloomington, CA

Adaptive headlights mean high beams come on if area is more hilly. We have streetlights, yet cars blind us all the time and drivers say it's the car putting them on. You don't have to use that feature, it's just lazy driving. Don't cause somebody else to crash into you and hurt your kids. Because you can't be smart enough when to turn on your high beams and not turn on your high beams, you will hurt yourself or others. If I'm on the sidewalk walking a I can see without high beams. Then you can see without high beams when driving. It's a huge problem in california too.

B.2638 April 15, 2023 — Bolingbrook, IL

Most people's headlights are aimed too high and too bright, blinding pedestrians and drivers alike.

B.2639 April 15, 2023 — Boston, MA

I have eye damage from head light glare

B.2640 April 15, 2023 — Carlsbad, CA

I've nearly crashed because of those things

B.2641 April 15, 2023 — Charlotte, NC

The bright headlights are very hazardous, leading to increased accidents and fatalities. I'm restricted from driving at night because of the bright headlights!

B.2642 April 15, 2023 — Charlotte, NC

I agree that this problem has to be corrected

B.2643 April 15, 2023 — Chatsworth, CA

I can no longer drive at night because of the new headlight. So dangerous

B.2644 April 15, 2023 — Chicago, IL

I shouldn't have to wear my sunglasses at night to drive o

B.2645 April 15, 2023 — Chicago, IL

It's not just headlights, it's also blinding LED Brakelights when you're behind a car with those at a stop light. I keep seeing them more and more

B.2646 April 15, 2023 — Cincinnati, United States

I'm an OTR truck driver and it's worse than ever on roads at night. Plus ever since I had covid, my eyes are super sensitive to light. People don't realize that they are blinding other drivers and create a huge opportunity for accidents that can kill people.

B.2647 April 15, 2023 — Cincinnati, United States

I have a strip of red LED lights taped above my drivers seat in my 18 wheeler that I turn on at night. It helps reduce the effects of bright lights from other vehicles. Not 100% but it does help.

B.2648 April 15, 2023 — Colorado springs, CO

I have a light sensitivity and work nights, I have to turn my rear view mirror up and wear tinted lenses to drive without being blinded. It isn't just brighter lights, but people running with more than two forward facing lights or with brights/fog lights on as well.

B.2649 April 15, 2023 — Conover, NC

I drive a compact car and whether behind me or coming toward me, I am blinded by these ridiculously bright lights. They are dangerous and need to be regulated.

B.2650 April 15, 2023 — Coon Rapids, MN

I literally have to wear tinted safety glasses to drive at night.

B.2651 April 15, 2023 — Dacula, GA

A few months ago I was driving home from work - an easy 14 minute drive on back roads at the time. There is one turn where I needed to see both ways before turning as there is no light there. It wasn't even dark yet. The truck behind me had lights on that were so bright I literally couldn't see to my right AT all. I literally had to make the turn hoping there was no one there. Luckily no one was there but in my life I've never wanted to stop my car, get out and address the driver of a car so badly before in my life.

B.2652 April 15, 2023 — Dallas, TX

I'm a trucker . Those headlights are dangerous at night, especially on 2way roads. They are so bright that they block 75% of my road vision. Get rid of them asap before I have a wreck and possibly kill someone or myself.

B.2653 April 15, 2023 — Detroit Lakes, MN

I hate bright headlights

B.2654 April 15, 2023 — Dothan, AL

Headlights that are currently being used are excessively bright. They make driving in hours of darkness much more dangerous as they eliminate the ability to see anything other than the light.

B.2655 April 15, 2023 — Escanaba, MI

I found this petition/drive on the CITIZEN FREE PRESS news aggregator website. Finally! LED headlights are a curse! Horrible! I avoid nighttime driving as much as possible for this reason. Beware: It is the normal course for government regulatory/safety agencies to be bought off and OWNED by the very industries they "regulate." Let's do this! Thank you, organizers!

B.2656 April 15, 2023 — Evansville, IN

It's blinding. The lights are so bright and blinding I can't watch the road because I can't see anything but the glaring lights!

B.2657 April 15, 2023 — Franklin, NY

Those headlights make it hard the on coming traffic to see as well. This is why we have high beam and low beam, but the low beams are brighter than the high beams with these bulbs, it's ridiculous!

B.2658 April 15, 2023 — Gainesville, FL

I often have to look away from oncoming traffic -- even during the day -- because of overly bright headlights. The new super bright headlights are a dangerous safety issue.

B.2659 April 15, 2023 — Gastonia, NC

I am literally left blinded and CANNOT see when those obnoxious trucks with their idiotic led lights get behind me. Those bright lights can easily cause an accident and cause long term eye issues.

B.2660 April 15, 2023 — Goldboro, Canada

I have been blinded often by brilliant oncoming headlights, mostly on the 'redneck style trucks'.

B.2661 April 15, 2023 — Grand Junction, CO

It's nice to see when you need it but not at the expense of oncoming traffic. We need to limit the lumen concentration or wavelengths somehow.

B.2662 April 15, 2023 — Hartsburg, MO

I am blinded by the brightness of the led lights on vehicles. Can’t drive at night because of it!!!

B.2663 April 15, 2023 — Haubstadt, IN

This is a real concern for my husband & myself. There should be regulations on something that blinds you while driving.

B.2664 April 15, 2023 — Independence, MO

All blinding light needs to be addressed, period! I chose to sign this petition as I've been personally affected and have known others to be affected. I feel more lives can be saved from horrific traffic accidents if limitations are imposed.

B.2665 April 15, 2023 — Indialantic, FL

I hate blinding lights because they are dangerous and annoying!

B.2666 April 15, 2023 — Latham, NY

Everyone is safer with less blinding lights.

B.2667 April 15, 2023 — Lehighton, PA

I agree that this is dangerous. It's ok that your lights are so bright that it causes a shadow of my car and you can see great but everyone else is blinded by your bright headlights and can not see safety to drive. How is this safe?

B.2668 April 15, 2023 — Lorain, OH

There's a special place in hell for people who drive vehicles with LED lights.

B.2669 April 15, 2023 — Medford, NJ

If you need extremely bright headlights while driving through neighborhoods or town streets, you are driving too fast. These lights are blinding to other drivers and pedestrians and encourage excessive speed at night

B.2670 April 15, 2023 — Melbourne, FL

These are blinding lights at night and makes it hard to see the road before and after the vehicle passes by!

B.2671 April 15, 2023 — Midlothian, TX

The lights are too bright to oncoming drivers, even on low beam, especially on two lane roads!

B.2672 April 15, 2023 — Moultrie, GA

I'm signing because I don't think anyone needs to see up a junebugs butt a mile down the road,these LED LIGHTS blind you and I'm sure are the cause of many accidents

B.2673 April 15, 2023 — Nashua, NH

I'm signing because this has started to affect me at 41 years old. I find that it takes almost a full minute to recover from being blinded and on the twisty back roads of New England, this is incredibly dangerous.

B.2674 April 15, 2023 — Newtown, PA

Constantly blinded by hrad lights

B.2675 April 15, 2023 — Oak Lawn, IL

These lights are totally unnecessary and dangerous.

B.2676 April 15, 2023 — Olympia, WA

I hate them, and it should definitely be illegal.

B.2677 April 15, 2023 — Omaha, NE

Drivers in my state - NE - consistently drive with their brights and or multi-stscked LED vehicles... I frequently can't even see the right side of the road to look away from the glare... and have to drop my speed to maneuver on out tight or curved roads...

B.2678 April 15, 2023 — Orlando, FL

I don't feel safe driving at night in fear that I may hit someone, cause an accident or drive of the road into a ditch because these lights are so over powering. I literally have to look down onto the white or yellow lines to the right side and even then I'm nervous, blinded and scared. So have to do everything before the sun set completely out here where I live. It really sucks because I have to tell my kids that I can't take them somewhere or pick them up from somewhere after a certain time because of these blinding lights. And even when I flash mine as to kindly signal them to dim their lights while close to cars coming close they completely ignore it. It's frustrating.

B.2679 April 15, 2023 — Philadelphia, PA

I cannot drive at night due to bright headlights

B.2680 April 15, 2023 — Pittsburgh, PA

This is a very dangerous problem. It's the ultra bright lights that blind oncoming traffic. Absolutely NO need in headlights being this bright!

B.2681 April 15, 2023 — Pittsburgh, PA

I do this exact thing on longer trips. I put my sunglasses on. I have to as to not be blinded!

B.2682 April 15, 2023 — Ponca City, OK

At night I get blinded regularly when I drive. While there is an incoming car I can only see the road and if a deer jumped out which happens often around here I'd probably be a fatality myself.

B.2683 April 15, 2023 — Proctorville, OH

I can barely see to drive on two-lane roads at night because of these lights! I fear I'm going to hit someone head-on!

B.2684 April 15, 2023 — Rutland, VT

The lights are blinding even in the day time-in the daytime it’s like the sun hitting your eyes.

B.2685 April 15, 2023 — Saginaw, MI

I'm a glass wearer with very thick lenses and an astigmatism. Even with my lenses shaved, anti-glare, etc. I'm still blind at night, especially if it's raining on newly paved streets. It's not always just the incoming traffic either. Sometimes my rearview and sideview bounces the light of the person behind me. At that point I'm sucking the light just to see my lines. It's horrible and had become more and more difficult to drive over the years.

B.2686 April 15, 2023 — San Jose, CA

I almost crashed once because the other car had custom lights misaimed. It was pitch black, raining and there comes the blinding sun, the whole road disappeared; I put my high beams on to see, he did the same blinding me way more.

B.2687 April 15, 2023 — Sandpoint, ID

Too many times I've seen accidents because of excessive bright headlights! Seems regulation is the only option.

B.2688 April 15, 2023 — Seabrook, TX

I thought it was just me.

B.2689 April 15, 2023 — Seymour, United States

I have been driving a semi for 28 years and the past 15 years it is crazy to see how many people have these blinding lights. Jeeps and pickups are the worst. Especially if they're hauling anything on a trailer or in the back.

B.2690 April 15, 2023 — Spring Valley, CA

I have to drive at times late at night. This has almost caused me to get into car accidents a number of times! I have been a licensed driver for 44 years. This was never an issue until the past 15 years or so.

In the past ten it has increased enormously! I don't like driving at night due to this. It has to be corrected now!

B.2691 April 15, 2023 — Springfield, MA

It's extra frustrating, especially in a small car, to have super bright white lights making it so that I can't see what's coming up on my left or right when I'm on the highway. So much of the population lives in well lit cities anyhow, wer don't need the standard bulbs to be brighter than what the brights used to be.

B.2692 April 15, 2023 — TX, United States

I have to stop until they pass me. Otherwise, I can't see what's on the road when the lights are heading in my direction. Street lights are very dim and makes driving with incoming bright lights a hazard.

B.2693 April 15, 2023 — Tinley Park, IL

Blinding

B.2694 April 15, 2023 — Toms River, NJ

Justine Ward

B.2695 April 15, 2023 — Tustin, MI

I have green eyes. This means light at night is 100% harder on them. The fact of the matter is I think these "better" headlights are causing more crashes especially with deer. If a deer is blind they are going to be disoriented thus it's more likely to run into the thing blinding it.

B.2696 April 15, 2023 — United States

They are bright and high. They need limited. New tech should not take so long to be adopted in the US.

B.2697 April 15, 2023 — Valencia, United States

Combine the lights with interment divisors on the highway and your have yourself frequent high intensity flickers that take several seconds to clear from your focus. Very dangerous.

B.2698 April 15, 2023 — Victorville, CA

I am tired of being blinded. I've almost had numeraccidents because I can't see and then people turn their high beams on too. When driving in the city, there is no need for high beams.

B.2699 April 15, 2023 — WOODBRIDGE, VA

Modern headlights are as bright as welding arcs. There are times that my vision is impaired from a mile away. Close your eyes for 10-15 seconds the next time you're driving and see if you feel safe. Sometimes I wear sunglasses to drive at night.

B.2700 April 15, 2023 — Weare, NH

It's about time Someone does something about these headlights

B.2701 April 15, 2023 — West Fargo, ND

Getting blinding, glaring light in my face while night driving is terrible

B.2702 April 15, 2023 — Williston, VT

I used to LOVE night driving. But now, it is a near-constant barrage if absolutely blinding lights! Each time, I swear the incoming driver has his/her brights in. But no! These outrageous, ludicrously dangerous lights have caused several close calls lately. I am completely astounded these blinding lights were EVER considered safe for automobiles. And side from the sheer terror of being blinded and getting into an accident, there is now the added concern to one's eye health long term. Outrageous! Stop the assault on night drivers!!!

B.2703 April 15, 2023 — burlingame, CA

These new headlights blind me while driving. They are like highbeams but aren't. Florescent should be reserved for police officers. They scare me because I can not see ahead of me and fear one day I will hit someone.

B.2704 April 15, 2023 — mccomb, MS

This petition is long overdue. The aftermarket blue headlight need to he included in this petition

B.2705 April 16, 2023 — Arvada, CO

I am literally looking to leave a job that I absolutely love because I am having so much trouble seeing against on-coming headlights on the highway I have to travel. Because I work 10-hour days, I cannot adjust my travel times so that I both go to and come from work in the daylight. I have no choice but to drive in the dark either going to or coming from work. I drive 20.5 miles each way to get to work, and the highway I travel has several very narrow areas where there are really sharp curves. I get held up at least twice a week by accidents where other people have either hit each other or run into one of the concrete barriers in these areas because they can't see any better than I can against people's blinding headlights. I know it is only a matter of time before I am the one in one of those accidents.

B.2706 April 16, 2023 — Bangor, ME

Some of these lights are too blinding and I have nearly gone off the road multiple times and to a new driver this could be fatal really quickly.

B.2707 April 16, 2023 — Bismarck, ND

It's nice of NFL stadiums to donate their lighting banks to people in need of headlights, but it is so unnecessary

B.2708 April 16, 2023 — Boulder Creek, CA

Light sensitivity without brights on, including all types of color

B.2709 April 16, 2023 — Bremerton, WA

After driving in the night and getting blinded so much as I drive a Honda fit, i see long light tendrils and can hardly drive at night anymore. Being so low to the ground there is literally no escape from assholes with super bright lights. I'll try to slow down but often times they just ride my ass and blind me more. I've been in cars with these lights and often times the driver cares very little for the people in front of them and will not pass because they would rather do the blinding than get some soft light in there eyes. This is a medical danger and needs to be addressed. Instead of making new arbitrary rules just to fine us, can you make a rule to save us. I'd have a number on speeddial just to report assholes like this and gladly call it because it's common sense and it's entirely on the driver to ensure that everyone can drive safely on the road.

B.2710 April 16, 2023 — Broomfield, CO

These lights present dangerous conditions for all those who encounter them while driving, bicycling or walking. Finally, this issue can be addressed!

B.2711 April 16, 2023 — Bumpass, VA

Ford trucks have 2 sets of headlights all the time. Very dangerous to be blinded on the mountain road I drive on every day. Please ban Ford trucks double headlights

B.2712 April 16, 2023 — Bumpass, VA

Ford trucks have 2 sets of headlights all the time. Very dangerous to be blinded on the mountain road I drive on every day. Please ban Ford trucks double headlights

B.2713 April 16, 2023 — Burns, OR

Blinding lights.

B.2714 April 16, 2023 — Clarksville, TN

Arien, Send the lights home for friends to help them sign this petition to get the right position to get to do so please

B.2715 April 16, 2023 — Detroit, MI

Yes!!!!I'm soon happy to see this I'm an uber driver and have been dealing with this problem for a few years now to the point where I even had to stop driving at night because it's just too difficult to see.i

thought there was already laws in place for this but ether way I'm just so glad someone is finally talking about it.

B.2716 April 16, 2023 — Duvall, WA

these led lights are not directional. they spray light out in all directions, whereas previous HID and projector-type headlamps had far better control of where the light goes. also, ban the automatic high beam feature, it doesn't work!

B.2717 April 16, 2023 — EAST CANTON, OH

I am naturally light sensitive due to my eye color and genetics. It is a very common problem that people suffer through and many are unaware that they are light sensitive. This has been an issue that has made me quit my job due to night drives home. I also feel that all lights should be at a standard height on all vehicles as that is ignored as well. Different heights of lights can sometimes be directly in drivers eyes due to manufacturer or after market designs.

B.2718 April 16, 2023 — Elizabethtown, PA

I hate them lights

B.2719 April 16, 2023 — Estacada, OR

Hell yeah!! I'm always complaining about this, thanks for taking a stand ☒. Especially when it's dark and rainy I often have to drive by looking at the passenger side lane line as to not be blinded!

B.2720 April 16, 2023 — Evansville, IN

As a grubhub driver, I drive at night alot. There are times I nearly have to come to a stop when passing cars with said headlights because I am blinded. I never know anymore if someone has their brights on or they just have obnoxious headlights.

B.2721 April 16, 2023 — Fontana, CA

I hate the blinding lights and every time i drive at night I have to adjust my mirrors as they become useless with the newer lights

B.2722 April 16, 2023 — Fort Lauderdale, FL

Sick of being blinded at night on the road!

B.2723 April 16, 2023 — Franklin, NC

These lights are a hazard to everyone

B.2724 April 16, 2023 — Fremont, CA

blinding headlights are unsafe and cause accidents and kill people!!

B.2725 April 16, 2023 — Fullerton, CA

I hate those overbright headlights! I drive up/down the state on I-5 and those headlights make the trip awful!

B.2726 April 16, 2023 — Gardnerville, NV

I drive significant miles and these lights present a wide range of risks including dangerous shadowing from behind and blinding from the front. They should be outlawed

B.2727 April 16, 2023 — Geneseo, NY

Brighlights are very blinding and dangerous. Whether you are driving a car or a truck. Just because people can't see animals in the dark, let's just blind everyone cause you are a moron. Emergency vehicle's should have bright lights, not a moron who wants to blind people. Thank you fir this petition.

B.2728 April 16, 2023 — Grand Saline, TX

The new headlights are very blinding & dangerous, especially the jeep products. Makes me want to take a ball bat & bust everyone of them out. But unfortunately, it will take a higher up "important person" to be affected by this issue to get anything changed.

B.2729 April 16, 2023 — Guelph, Canada

Risking lives to save a little bit of energy by allowing LED lights is disgusting. In winter they get covered with frozen slush and do not generate enough heat to melt the snow so you can't see the car.

B.2730 April 16, 2023 — Hialeah, FL

I live in a big city plenty of light. People drive around here with flood lights and bars like they are driving on country dirty roads. It's out of control.

B.2731 April 16, 2023 — Highlands, TX

I travel roads near me that have no sidewalks and deep drainage ditches. bad headlights, blind me, so if someone was walking on the road, I would not see them.

B.2732 April 16, 2023 — Honolulu, HI

Whether they're shining into someone's eyes head-on or into their mirrors from behind, sacrificing one person's ability vision in order for another to see better makes the road more dangerous for everyone, not safer. Adaptive headlight systems are not enough. It will take decades to get all of the vehicles that endanger other drivers with their blinding lights replaced. There needs to be comprehensive Federal DOT action forcing massive recalls to replace the headlight assemblies of cars currently on the road, and legislation to enforce it. Laws are supposed to protect the public good, and safe roads are about as ancient and essential a public good as it gets.

B.2733 April 16, 2023 — Huntersville, NC

In the rain, with the new led headlights, it's near impossible to see the lane lines.

B.2734 April 16, 2023 — Jacksonville, FL

I'm sick of being blinded in a city and state full of red neck trucks.

B.2735 April 16, 2023 — Jeffersonville, IN

Those head lights blind me too

B.2736 April 16, 2023 — Joliet, IL

Its horrible at night to be blinded by theseclights

B.2737 April 16, 2023 — Kansas City, MO

This happens to me everyday blinding lights in my eyes and in my rear view mirrors. I hope we can facilitate some kind of change.

B.2738 April 16, 2023 — Katy, TX

Any driver who is blind enough needing a blinding stadium projector to be able to drive is a dangerous driver and should be banned from driving. The vehicles having such headlights should also be banned. They are no good except causing dangerous and possibly fatal collisions. Sadly the count is rising. Please stop this non sense.

B.2739 April 16, 2023 — Katy, United States

The lights are so bright sometimes I can't even see if front of me. I have to turn the tear veiw mirror down and sometimes that doesn't even help! Also, I've noticed even people with older cars are now driving with their high beams are. And the big trucks woth their bright lights are very bright! This is crazy!

B.2740 April 16, 2023 — Laramie, WY

My car is a 2000 Ford car. The second those lights show up the lines disappear for me. Almost killed me multiple times actually got me pulled over once

B.2741 April 16, 2023 — Las Vegas, NV

My eyes are very sensitive and the newer headlights look like someone has their brights on. It's bad no matter what size vehicle I'm in, whether it sits high or low

B.2742 April 16, 2023 — Los Angeles, CA

These lights are killing us!

B.2743 April 16, 2023 — Los Angeles, CA
BRING THIS TO LA!

B.2744 April 16, 2023 — Los Angeles, CA
It is getting ridiculous.

B.2745 April 16, 2023 — Manlius, NY
I can't see while driving into these bright lights

B.2746 April 16, 2023 — Marietta, GA
Automatic high beams may be great for the drivers who own them, but they blind me when they come at me in my car. They're supposed to dim when another car is near, but they don't see my low-beams until I'm already blinded. These things create a hazard for other drivers and should be illegal.

B.2747 April 16, 2023 — Marietta, GA


B.2748 April 16, 2023 — Miami, FL
Yes! They neeed regulation, as much as high beams are…

B.2749 April 16, 2023 — Middletown, DE
Glad to hear I'm not alone in my frustration. I fear the truck companies will lobby against any action to restrict headlight glare caused by vehicles that are too high

B.2750 April 16, 2023 — Mohrsville, PA
I hear from many older people that the white headlights cause a temporary blindness from the newer headlights. Takes a few seconds to readjust their vision. It does the same to me. That few second adjustment could put a person off the road or into another vehicle. The old yellow color lights didn't have that effect. I feel the newer white headlamps are a hazard to driving because most vehicles don't have them adjusted properly. The dam lights burn into your brain. Don't know how the white lights can be deemed safe for use on the highways. They need to be banned and go back to the old yellow lights. Much safer.

B.2751 April 16, 2023 — Mount Pleasant, MI
I'm tired of being blinded driving at night.

B.2752 April 16, 2023 — Niles, OH
Those lights are ridiculous and turn me into a blind angry driver - instantly.

B.2753 April 16, 2023 — Ottawa, Canada
Chantal Gagne

B.2754 April 16, 2023 — Pataskala, OH
Contrary to the IIHS argument that LED lights are safer and pose no safety hazard (when properly aligned) many of us find these lights to be dangerously blinding. They not only sometimes pierce one's skull but they wash out the road making it impossible to see the driving path. Even from behind they are obnoxious. The IIHS is not asking the right questions and their defense of these lights, ad an organization funded by insurance companies, is suspicious.

B.2755 April 16, 2023 — Pelion, SC
It's absurd that it's totally legal to blast blinding light into people's eyes while they're driving.

B.2756 April 16, 2023 — Philadelphia, PA
I had a brain surgery a few years back. It is extremely difficult to see at night time due to the bright headlights. My community gets very dark and yet people are speeding with high beams on unnecessarily. The trucks and tow trucks are a major problem too. Rushing for work with these bright lights completely covering the vehicle. Someone is going to get hurt if nothing is done about it.

B.2757 April 16, 2023 — Plainfield, NH

I would like night driving to be safer

B.2758 April 16, 2023 — Plano, TX

Driving at night has become dangerous. My family is tired of hearing me complain about being blinded by oncoming traffic. Seems like it started overnight. Don't remember it being a problem before lockdown but after a couple of years WFH I started driving at night again and that is when I noticed the problem. I can't tell if everyone is driving with their bright lights on or not. When I can look it seems multiple bulbs are lit up in each lenses assembly. Whatever the cause it needs to stop. I can't believe the people who build cars and the government employees who are responsible for highways are immune from experiencing headlight blindness's themselves. Somebody in a position of authority needs to recognize the problem and take action.

B.2759 April 16, 2023 — Poolesville, MD

The lights have gotten just too damn bright.

B.2760 April 16, 2023 — Potsdam, NY

i think it is unfair to allow cars and trucks with powerful led lights. I cannot see and most people with such led lights have no respect for other drivers.

B.2761 April 16, 2023 — Reston, VA

I drive a Honda Accord, and I am blinded more and more by those SUVs with ultra bright headlights, to the point that I will only drive at night if I have to!! It's especially bad on turns when those lights hit my side view mirror!

B.2762 April 16, 2023 — Rhinebeck, United States

Headlights are too high on large vehicles. Too many people drive with their high beams on.

B.2763 April 16, 2023 — San Jose, CA

Headlights nowadays give me a headache. Way to bright, super white, causes me migraines and eye pain

B.2764 April 16, 2023 — Santa Clarita, CA

I drive a low car & makes me insane when the majority of cars around me blind me! I'm lower than most, so I'm constantly adjusting my mirrors when driving or stopped simply so I can focus on the road! Not safe at all, especially with so many rude drivers these days. I do not drive slow, but I'm in a charger, so winding roads are a huge issue. It's terrifying to be driving on winding mountain 1 lane roads with some jerk close behind me until I'm able to pull over, with their lights completely blinding me. So many more instances that I could go on about, but I'm sure everyone here already knows them.

B.2765 April 16, 2023 — Schenectady, NY

Very blinding at night, which is hazard.

B.2766 April 16, 2023 — Seabrook, United States

I'm blinded by the liggggggghttttttt! I seriously can't see driving down my main road home at night, oncoming cars lights are too bright to see the road ahead.

B.2767 April 16, 2023 — Seattle, WA

Back in the late 80's you could not run off road lights because they were dangerously bright. Today's lights are even brighter. We did fine with the lights 20 years ago. Tighter lights only help to blind oncoming drivers.

B.2768 April 16, 2023 — Sewell, NJ

There have been times where the bright white LED headlights are so bright that I struggle to see the lines and road. As someone with glasses, it sucks worse when they are slightly smudged too.

B.2769 April 16, 2023 — Spring, TX

This is a real problem! These blinding headlights trigger excruciating and debilitating migraines!

B.2770 April 16, 2023 — Stevensville, MD

I am constantly blinded by these!!!! So dangerous!

B.2771 April 16, 2023 — Taylor, MI

I'm tired of being blinded by these ridiculous headlights.

B.2772 April 16, 2023 — Tuckerton, NJ

They are easy targets for law enforcement, so let's enforce some laws.

B.2773 April 16, 2023 — Turlock, CA

I'd like to be able to drive safely at night without being blinded.

B.2774 April 16, 2023 — Unadilla, NY

I find many led style headlights to be obnoxious. That includes the OEM's. I believe it is very dangerous. When the one year old vehicle behind me using his low beams is casting a shadow of my vehicle in my high beams, its gotten out of hand.

B.2775 April 16, 2023 — Union City, CA

Bright headlights are dangerous.

B.2776 April 16, 2023 — United States

It is unsafe.

B.2777 April 16, 2023 — United States

They are nothing but painful!!!!

B.2778 April 16, 2023 — United States

Bright light do affect night drivers negatively, especially when the vehicle is behind you. It prevents you from seeing anything in rearview or side mirrors, and is prevents visual focus ahead (in front of) your vehicle due to the blaring lights that overwhelm vision; it's like the equivalent of looking directly at the sun - which any human should know is dangerous for the health of their eyes. If you flip your center rearview mirror, you still won't be able to escape it because the effect is also on your side exterior mirrors, if the vehicle remains behind you.

B.2779 April 16, 2023 — United States

Sonia yanez

B.2780 April 16, 2023 — Valencia, CA

They're blinding and a trigger for migraines!

B.2781 April 16, 2023 — Valencia, PA

I would like to start by saying, I am a good driver. I am always respectful of others on the road. My biggest complaint is the glare from bright headlights! They are so bright that I can't see the road. There have been many occasions where I had to slow down or almost come to a complete stop, because I can not see the road. These bright lights are dangerous, and are going to cause an accident. It's also blinding when they are in your rear view mirror! I have to flip my mirror up, so I can see to drive. And I have to put my hands in front of my side mirrors to block the bright light. There are high beams on cars for a reason, you can turn them off so your not blinding other drivers. I avoid driving at night because of the bright lights. I'm afraid one of these days I will end up in an accident because I'm being blinded. I hope this petition proves useful, the lights gotta go!

B.2782 April 16, 2023 — Valparaiso, IN

I found that wearing glasses that reduce blue light make a difference. It doesn't appear that way at first, but driving seems easier after a while. Look for glasses to cut down blue light emissions from computer monitors. Good luck!

B.2783 April 16, 2023 — Valparaiso, IN

I wrote my Congressman, both Senators, and the NHTSA about this issue back in December 2021. I'm tired of being blinded in my compact car. I have found that glasses that are typically used to cut down on blue light emissions from computer monitors seem to help when driving. But it really shouldn't have to come to having to use something like that!

B.2784 April 16, 2023 — Vincennes, IN

This has been a problem for years. I thought it was just because I'm getting older. I'm 40. We the people need to stand up!

B.2785 April 16, 2023 — Vonore, TN

I hate blinding lights. Get rid of it!

B.2786 April 16, 2023 — WA, United States

I work solely at night and I'm tired of being blinded my whole commute. Sometimes I have to even close my eyes because the lights are THAT bright

B.2787 April 16, 2023 — Watervliet, NY

I already have astigmatism and these lights make it dangerous for myself and others to be driving at night.

B.2788 April 16, 2023 — Whittier, CA

Please help us with this nonsense.

B.2789 April 16, 2023 — Winder, GA

So glad to see someone is trying to do something about this. These outrageously bright headlights make driving at night very difficult. Even the bright LED lights indoors are causing many people problems. My daughter is having to quit her job because of these lights. They are literally making her sick.

B.2790 April 16, 2023 — gardnerville, NV

They are a nuisance and downright dangerous

B.2791 April 16, 2023 — montgomery, TX

It's ridiculous how bright these lights are and have experienced it myself driving! Very dangerous when you can't see!

B.2792 April 16, 2023 — olympia, WA

Bright white lights blind drivers who must pass by them and that's too dangerous and must be outlawed. Call or email your legislators and congresspeople!

B.2793 April 16, 2023 — ruskin, FL

Dog thief's are disgusting creatures who do not understand that the animal they steal greaves for their home and family! They are cold hearted non humans!

B.2794 April 17, 2023 — Atlanta, GA

I choose to no longer be the driver at night time because of blinding lights. Now that Rivian has made their home in my community, this issue is much worse. The factory is very near my home and many people are driving these vehicles and hopefully it can be understood why I make a choice to not put myself in danger. I've already had my life significantly altered due to a car accident and the driving of another. How would I ever be able to explain that a vehicle's headlights is the liable party in an accident? The blame would be placed on me alone and this is WRONG. I know this because I worked in claims for a large insurer. Something everyone should think about when deciding if this petition is worth their signature. I also hope someone who has decision making capabilities on this issue sees my comment and looks into fair claim-handling practices and notices that consumers may very well be footing the bill for recovery for reasons they are not liable for.

B.2795 April 17, 2023 — Bridgeton, NJ

These lights are blinding. I hope this changed for the safety of all.

B.2796 April 17, 2023 — Chicago, IL

Trying to see at night with rude ass drivers and their bright lights is a really hard thing to do

B.2797 April 17, 2023 — Fort St. John, BC, Canada, Canada

From my experience those headlights prevented me from seeing & she possible, I slowed down & pulled offer to side of road

B.2798 April 17, 2023 — Huntsville, AL

I am signing because it is dangerous and very disrespectful to oncoming traffic.

B.2799 April 17, 2023 — Huntsville, AL

These excessively bright headlights are unnecessary; even at legal highway speeds you don't need to see 18 miles up the road. In urban environments where the streets are well-lit and traffic moves relatively slowly, headlights are mainly useful for making vehicles more visible, not for seeing what's inside the trunk of the car in front. Bottom line is that excessively bright headlights are a danger to everyone on the road and should be banned outright.

B.2800 April 17, 2023 — Jackson, TN

The lights are blinding. And for someone who has issues with her eyes it can be dangerous to drive at night with headlights like LED's.

B.2801 April 17, 2023 — La Jolla, CA

Take out the emissions regulations loophole for light trucks too so that car companies lose the financial incentive to push SUVs and pickups down our throats. It would reduce variation in vehicle height and thus make the road safer for people driving normal cars or riding bikes.

B.2802 April 17, 2023 — Leander, TX

blinding lights are dangerous!

B.2803 April 17, 2023 — Meridian, ID

On top of having eye stigma, I also have a scarred retina that, among other things, gets "burn-in" really easily from intense light, and the effect from those headlights can sometimes linger for 5 minutes at a time--not ideal as a delivery driver.

B.2804 April 17, 2023 — Newfoundland, PA

These headlights are dangerous to oncoming traffic. They blind us all.

B.2805 April 17, 2023 — Oakland, CA

They're too bright!

B.2806 April 17, 2023 — Olathe, KS

I too have problems with the bright lights on headlights. It is very disorienting.

B.2807 April 17, 2023 — Pinnacle, NC

Only ignorant people choose to blind other people at night driving with bright lights.

B.2808 April 17, 2023 — Ponca City, OK

Blinding headlights suck

B.2809 April 17, 2023 — Portland, ME

It used to be that eeeevery so often, I'd end up in front of somebody with improperly aligned headlights, but the easy solution was to let them pass when I was able. Now this problem is no longer a once-in-a-while thing, it's EVERY DAY. Every morning I drive to work, and every day I am forced to shield my eyes from the countless ultra-bright LED headlights on vehicles of all shapes and sizes. This is far beyond annoying or uncomfortable-- it's made driving at night nearly impossible, and driving during the day painful and dangerous. We need regulation yesterday.

B.2810 April 17, 2023 — Rockville, MD

My eyes are green, which means that they have less melanin to protect them with. Since I can't afford a car, I must take public transportation a lot. This means having to sit at bus stops enduring an endless stream of vehicles blazing their headlights into my eyes from the streets and parking lots. This can get physically painful after awhile. However, I have no choice, because I need to keep a steady watch for my bus, or I'll miss it. I sometimes can't even escape from these torturously bright headlights when I'm walking out of a door, or even looking out a window. As such, I even got an eye full of them while eating at a restaurant. Words can't even begin to describe how much I hate those overly bright headlights!

B.2811 April 17, 2023 — Rockville, MD

Those lights are incredibly hard on pedestrians, too.

B.2812 April 17, 2023 — Rockville, MD

Are those the yellow glasses?

B.2813 April 17, 2023 — Rockville, MD

Where I live, the government forces drivers to have their high beams on both day and night...!!!

B.2814 April 17, 2023 — San Diego, CA

I am frequently blinded by headlights

B.2815 April 17, 2023 — Santa Maria, CA

I frequently have to drive along a pass to get to work at night. Hill on one side, cliff on the other. These new car lights are just atrocious, not to mention the brights on some of these cars and work trucks. It's to the point that I have to go from 50 mph to about 25 in order to feel like I'm not going to run off the edge from blindness. Sometimes I can't even see 10 feet ahead of myself cause of this.

B.2816 April 17, 2023 — Toronto, Canada

F150s

B.2817 April 17, 2023 — Tyrone, PA

These lights blind you they are so bright.

B.2818 April 17, 2023 — United States

I have recently build up cataract and flash spot in my eyes and I am only 46 years old. White led headlight is always my problem. Sometimes I need to wear sun glasses driving regardless day or night.

B.2819 April 17, 2023 — Vineland, NJ

These headlights cause such a glare that they are blinding. I find them unsafe to drivers. I cannot see safely when driving.

B.2820 April 17, 2023 — West milford, NJ

Dangerously bright

B.2821 April 17, 2023 — bloomsburg, PA

These lights can only be used in placed where you may tint your window other wise they blind opposing drivers and its not appropriate

B.2822 April 17, 2023 — shelby township, MI

Debra Basilico

B.2823 April 18, 2023 — Cuyahoga Falls, OH

Holly Dobies

B.2824 April 18, 2023 — Indian Trail, NC

I deal with astigmatisms and these headlights make it nearly impossible for me to safely drive after dark. On a busy road with a dozen or so oncoming cars, most having these headlights now, my vision

is just bright starbursts everywhere, nearly whiting out my field of view to the point I almost can't see the lines on the road even. Eventually someone is going to wreck because of this and go after either the vehicle manufacturer or or the aftermarket headlight manufacturer and very rightfully so.

B.2825 April 18, 2023 — Mantua, OH

LED headlights are not necessary.

B.2826 April 18, 2023 — Salt Lake City, UT

Driving is dangerous enough without be blinded by careless drivers and poor automobile design!

B.2827 April 18, 2023 — Sutton, United Kingdom

Blinding headlights are potentially fatal

B.2828 April 18, 2023 — United States

The lights are too bright

B.2829 April 18, 2023 — missoula, MT

The lights we had in the 90's were perfect. They were bright enough to see everything at night but soft enough to not blind anyone. These lights are trashy and impracticaly bright. How many people are killed by being blinded by these impractical light.

B.2830 April 19, 2023 — Bismarck, ND

All aftermarket LED bulb replacement's are illegal for use on the US road ways. This is an issue of not enforcing FMVSS No. 108 by officers and also a total lack of prosecuting those who sell these lights under the guise of them being legal. Reputable aftermarket LED light producers make it very clear that the lights are designed for off road use.

B.2831 April 19, 2023 — Fayetteville, AR

Some headlights are blinding even on dim.

B.2832 April 19, 2023 — Riverside, CA

This sh*t is ridiculous! I get newer lights but these are above & beyond blinding! I can't even imagine what their high beams look like. Initially I didn't know these were the new norm in cars, so I did what anyone else would do to let a fellow driver know(in case they didn't) they had their high beams on.....many a driver either turned on & off their reg headlights to let me know that's all the got, some flashed their high beams (WOW!) to let me know they weren't using high beams. This is gonna kill a lot of ppl!!!

B.2833 April 19, 2023 — Tampa, FL

Because they cause temporary blindness in drivers whether in back of you or oncoming! Dangerous!!

B.2834 April 19, 2023 — United States

I almost ran into the car in front of me one night. The on coming cars were so close together and the 2 lanes are separated by only a stripe on the ground. What if we had a wall separating the 2 lanes?? Both sides face each other, so we are always blairing bright, bright lights at each other. Does anyone care?

B.2835 April 20, 2023 — Dumont, NJ

Mary Turner

B.2836 April 20, 2023 — Philadelphia, PA

It's beyond absurd that this has not been addressed already. There really isn't much else to say. This should be self explanatory. It's similar to driving into the sun in the morning and unable to see the road, but yet we have rules for how far your tires can be outside of the wheel wells

B.2837 April 21, 2023 — woodbridge, ENG, United Kingdom

Simply because LED lights are dangerous. Numerous times, I have been dazzled by lighrs that were no better tgan on full beam.

B.2838 April 22, 2023 — Hamilton, Canada

LED headlights continue to blind myself and other drivers even in the brightness of daylight. It is extremely dangerous to blind other drivers and against the highway traffic act. LEDs are dangerous and unnecessary.

B.2839 April 24, 2023 — Spotsylvania, VA

I'm blinded by the light.

B.2840 April 25, 2023 — San Jacinto, CA

Raised trucks that don't adjust their lights down to regulated distance and when you flash them, their lights point 45 degrees up. And tow trucks with all six headlights on high beam when regular driving, not on service call. They blind you enough that you cannot see stationary big rigs waiting to make a left turn on a one lane road. Lastly those cars and trucks that have LED light bars between their headlights always on bright and light up the inside of your car like it was an ET. So, need enforceable regulation on brightness, intensity & distance on raised vehicles. Set at the factory and/or dealers for their areas and notices to buyers from auto and tire dealers and custom shops. Lastly more roaming police light check stations. Usually, no trouble with big rig lights so why can't P/U trucks keep it down?

B.2841 April 26, 2023 — Dallas, TX

The LED headlights are dangerous to other drivers.

B.2842 April 28, 2023 — Deatsville, AL

Sometimes I'm being blinded from both ahead and behind. It's actually really scary, because I can't just slow down. People get aggressive. So I literally can't tell if I'm about to hit something. I don't even have an astigmatism.

B.2843 April 29, 2023 — Ludlow, MA

Headlights are outta control and unsafe.

B.2844 April 30, 2023 — Camarines Sur, CT, Philippines

Bright white led lights blind oncoming traffic thus posing a danger to motorists and pedestrians.

May 2023

B.2845 May 3, 2023 — Provo, UT

I care about human life

B.2846 May 3, 2023 — United States

I want to drive safe at night

B.2847 May 3, 2023 — Westwood, NJ

I like being able to see

B.2848 May 4, 2023 — Petaluma, CA

These headlight can be blinding to oncoming drivers and thus very dangerous

B.2849 May 4, 2023 — Riverhead, NY

These lights are blinding, which makes it LESS safe for oncoming drivers. There needs to be some standard for safety for both the driver and oncoming traffic.

B.2850 May 4, 2023 — Spring, TX

I can't see when these lights hit my eyes. Too dangerous!

B.2851 May 5, 2023 — Burt, MI

I remember reading years ago, when I first noticed how these very bright lights affected my ability to see well when driving at night, that part of the reason it is a problem here in the US is because our headlights are directed upward to illuminate road signs. In other countries, where signs are illuminated through other means, the headlights are directed downward so they are not shining

directly into the eyes of drivers in oncoming traffic. Barring a complete change in how our road signs are illuminated, I would like to see more regulation on the use of very bright LED lights.

B.2852 May 5, 2023 — Simpsonville, SC

This has to be changed. There is no excuse for using lights that cause injury and death.

B.2853 May 5, 2023 — Woodinville, WA

I cant see when im driving at night

B.2854 May 10, 2023 — Salisbury, MD

There have been numerous times at LED headlights have almost caused me to have an accident. HIDs we're banned for this very reason back in the early 2000s.

B.2855 May 12, 2023 — Capistrano Beach, CA

I can't see on the road or use my mirrors at times due to these headlights, which is very unsafe. They also trigger migraines for me.

B.2856 May 12, 2023 — Huntington Beach, CA

I FUCKING HATE HOW BRIGHT HEADLIGHTS ARE!!!! LIKE JUST LEAVE EM ON AS BRIGHTS WBHEN YOU TURN ON BRIGHTS, NOT NORMAL HEADLIGHTS

B.2857 May 13, 2023 — Chicago, IL

They are blinding

B.2858 May 13, 2023 — Irvington, NJ

I want to save lives

B.2859 May 14, 2023 — Grass Valley, CA

I have astigmatisms and driving at night is already very difficult.

B.2860 May 15, 2023 — Kettering, ENG, United Kingdom

The bright headlights at night have nearly caused me to have an accident. I find them to bright and a hazard

B.2861 May 16, 2023 — Victoria, Canada

I dont want to die after being blinded by someone's headlights.

B.2862 May 17, 2023 — Bloomfield, NJ

I have become uneasy driving at night due to these insanely bright headlights on newer vehicles. They cause instant night blindness preventing you from seeing who or what might be in the road in front of you. I have also suffered actual pain from encountering these lights head on. Other than aesthetics they serve no useful purpose and are making our roads, especially our local one's extremely dangerous.

B.2863 May 17, 2023 — Bromley, United Kingdom

I am fed up with being 'blinded' by these headlights - it so SO dangerous.

B.2864 May 17, 2023 — London, ENG, United Kingdom

Because they are dangerous

B.2865 May 18, 2023 — Centereach, NY

yeahhhh fuck led headlights

B.2866 May 19, 2023 — West Springfield, MA

I have these lights on my car, and I understand that they are extremely blinding, dangerous, causing accidents and injuries. They should be banned everywhere, and any car that has them should be able to have incandescent lights installed immediately for free. We do not need to make another contraption to deal with the effects of these lights. Stop making them, stop installing them, and

reinstall normal incandescent bulbs on all cars that currently have them. Common sense says this is the only way.

B.2867 May 20, 2023 — Glendale, AZ

I pulled out in front of oncoming traffic because a truck was blinding me at night. We were both making a left turn in the middle of the intersection. I just missed being hit head on. I was completely blinded. I had to get away from it so I turned in front of oncoming traffic.

B.2868 May 23, 2023 — Sydney, Australia

because i have had near misses with bright LED headlights which are temporarily blinding

B.2869 May 26, 2023 — Ashland, MA

We need to find the balance between energy efficiency and health. Corporate influences must not overrule science and common sense. Please bring back incandescents until a new safe solution is developed.

B.2870 May 27, 2023 — Port Saint Lucie, FL

why not

B.2871 May 29, 2023 — Mooresville, NC

I wish I could take back my signature. This is a petition requesting the ban of a particular technology, not the regulation of headlights.

B.2872 May 31, 2023 — Madison, WI

Not true

B.2873 May 31, 2023 — New Iberia, LA

Some of these headlights and taillights can trigger seizures and severe migraines in people with certain neurological diseases. I shouldn't have to give up driving at 38 y/o due to the risk of seizure or debilitating migraines, but I've had to do just that.

June 2023

B.2874 June 1, 2023 — Prospect, KY

Even after cataract surgery removed the halos and stars from lights at night, I am frequently blinded by oncoming headlights worse than any previous high-beams. It prevents me from seeing oncoming traffic, or blinds me from behind and prevents me from seeing anything else around me, like road hazards and other vehicles. People are supposed to dim their lights for oncoming traffic; the new LED headlights are brighter than old high-beams! So. Dangerous!

B.2875 June 5, 2023 — South Orange, NJ

The use of these ultra bright headlights is extremely blinding and distracting not only are drivers blinded from on coming traffic, they are also blinded by reflective light from all rear and side mirrors. These effects ts are worsened on anyone older or dealing with simple eye conditions like astigmatism. This a large percent of the population that drives. Bright lights from oncoming traffic also blind drivers to pedestrians and bikers on town and city roads.

B.2876 June 10, 2023 — Grand Falls-Windsor, Canada

sick of these dumb pricks with bright ass headlights on well lit roads

B.2877 June 27, 2023 — Bronson, FL

LED Headlights are dangerous to oncoming traffic, even in the daytime. Stop the assault on other drivers.

B.2878 June 27, 2023 — Peoria, AZ

I'm tired of being blinded by these dangerous lights while driving at night. They are not safe.

July 2023

B.2879 July 10, 2023 — Nalgonda, India

Definitely, there has to be regulations about what kinds of lights are good for oncoming traffic and not just for looks or something. Lights should serve the purpose and not otherwise. I wonder if there had been any discussions about bringing LED lights into usage as headlights and drls etc. This regulation should be made international for the good of mankind.

B.2880 July 22, 2023 — Dayton, OH

Because tired of being blinded at night!

B.2881 July 24, 2023 — Valley Stream, NY

I'm signing because bright headlights and tail lights have made driving at night so incredibly unpleasant that I rather not drive at night at all. I'm a 33 year old person, not in my 60s or above. The fact that people of all ages are affected should be evidence that the lights being made today fail to meet certain standards and it's causing distraction, disorientation and danger on the road for ALL.

B.2882 July 26, 2023 — Calgary, Canada

Who is responsible if accident happens when I was blinded by this head lights.

August 2023

B.2883 August 1, 2023 — Murrieta, CA

Led headlights are blinding and unnecessary and dangerous.

B.2884 August 2, 2023 — Greensboro, NC

I don't understand, do some people just not have any night vision or are they too mentally retarded to realize they're being blinded? Why are all of these new lights so f@cking bright?!

B.2885 August 3, 2023 — Ottawa, Canada

The car lights are so blindin when I drive even if I looks away from the car. I have to adjust my mirrors because the glare is so bright it's like if you're looking at the sun. Leaves a spot on my eyes when looking forward or back mirror. They are too intense.

B.2886 August 3, 2023 — Scottsdale, AZ

https://www.activistpost.com/2023/07/behind-your-back-yet-in-front-of-your-eyes-blinding-technologies-for-vision-burnout.html

B.2887 August 5, 2023 — Hammond, IN

Why? I'd like to be see why i'm flying down a highway at 75. They are literally painful and cause discomfort. EMS/Police lights too. I'm not being hyperbolic or dramatic. These need to go.

B.2888 August 8, 2023 — Pleasant Hill, CA

I'm tired of being blinded by these types of headlights. They're not safe

B.2889 August 10, 2023 — Levittown, PA

We don't have reliable or effective public transit across America and it's designed for people to rely of automobiles and I basically had to stop driving because when the sun goes down I literally can't see the street lines the second another car is driving in my direction. I imagine this is a huge problem for a lot of people and there aren't really any good alternatives other than just risking your life

B.2890 August 11, 2023 — Township of Taylorsville, NC

I do a lot of night driving and I can't count how many times that I've been blinded by these outrageous lights. There's no sense in them being that bright. It has almost caused a few accidents for me on long trips.

B.2891 August 13, 2023 — Lexington, NC

I literally cannot see at all when driving past an LED headlight car (or when in front of one). It is INSANE that they're allowed to be on the road. It's dangerous and irresponsible and has caused and will continue to cause vehicular accidents. Please fix this!

B.2892 August 17, 2023 — Winsted, CT

Which were just banned earlier this month!!!!

B.2893 August 17, 2023 — Winsted, CT

I'm going crazy every night almost getting blinded off the roads. It's so dangerous and horrible for everyone and everything.

B.2894 August 20, 2023 — Charlevoix, MI

Headlight output laws were put in place for a reason. Modern cars are built oblivious to this and the headlights are blinding and unsafe. Our eyes are still human just like before. The worst offenders for blinding lights are the modern police cars. When they're sitting there with flashing lights, there is 100% some situation going on. Your entire vision is washed out, even proceeding at a crawl. There's no reason the lights can't be auto dimming based on the amount of ambient daylight or lack of.

B.2895 August 21, 2023 — Cleveland, OH

I'd like to add this. How much WORSE is it when a psycho who happens to be a cop seems to get a perverse pleasure out of stalking and threatening innocent drivers - using her insanely bright lights as a weapon? A woman alone at night - not another car seen for almost 5 miles - when a woman cop keeps running up on the woman's car/tail/bumper, moving back and then speeding up - for over 4. 5 miles - IN HEAVY HEAVY FOG, up and down hills!!! When the innocent driver tries to move to see who is behind her and free her eyes from the blazing lights of 6 suns - the cop pulls her over for "weaving". The cop even acknowledged that the woman driver has complained before that "YOU ARE BLINDING ME" and I cannot see with your lights (later on video - TEN BLAZING, GLARING LIGHTS not counting the flashing bar turned on after stopping the woman). and the same cop has done this twice in 6 months (the driver is only in that town once a month!) So this is a HUGE issue - as is the willful life threatening behavior of that psycho cop (who had been fired from her only other job).

B.2896 August 21, 2023 — Murfreesboro, TN

These lights are extremely dangerous to motor vehicles and more. They cause a type of blindess and disorientation. These bright lights are the reason I don't drive at night. They shouldn't be used on motor vehicles of any type, including emergency vehicles and construction lighting.

B.2897 August 22, 2023 — Australia

i drive a lot at night and its becoming increasingly hard to not be blinded by these lights, especially because they are so high on the vehicle

B.2898 August 22, 2023 — Beaver Island, MI

I'm fighting light pollution!

B.2899 August 22, 2023 — United States

We should ban LED lights in general. Terrible idea with no proper testing done. They are literally everywhere now and I have to wear sunglasses during the day and night because of how strong these lights are. Even with my sunglasses, my eyes end up getting irritated with these new lights. I hate driving back home during the night because of how bright these lights are when they come by from the opposite lane. I've seen some street lights with LED bulbs and it's so distracting. I used to like driving at night but now I just have to deal with constant surprise flash bangs on the road. I want to go back to florescent and Halogen again. I miss not worrying if I'll get flashed in the face and not having to wait until the traffic is gone just to drive back home safely at night.

B.2900 August 23, 2023 — Roanoke, VA

I have given up driving at night after running off the road due to the blinding glare of LEDs and HIDs. These lights are dangerous!

B.2901 August 23, 2023 — Rome, GA

Projector lights in Forrester allow me to only visualize the bottom 25% of my windshield, much worse going over a hill. How the heck is this safe?? Cannot see street lights or anything on sides of road as well as 3/4 of regular viewing area. If using adaptive dim setting, oncoming traffic is constantly flashing brights at me as if I'm using high beams.

B.2902 August 24, 2023 — Atlanta, GA

Just had to follow an older handicapped person on the road for miles because a truck with blinding led lights was tailing them and blinding them. They drove significantly better once I blocked the light from their view. BAN LED HEADLIGHTS ESPECIALLY ON RAISED VEHICLES

B.2903 August 24, 2023 — China Grove, NC

I have sensitive eyes and LEDs blind me and make my eyes genuinely hurt!

B.2904 August 24, 2023 — Lincoln, United Kingdom

I wear glasses and sometimes at night I cannot see where I am going at all because of the glare from LED headlights coming the other way.

B.2905 August 24, 2023 — Seattle, WA

Driving at night is already difficult for many people. Older folks, and people with visual impairments alike. Bright lights make it difficult for people with light sensitivity to drive too. There is no need for cars to be so bright

B.2906 August 25, 2023 — Ocoee, TN

I'm gonna start busting headlights

B.2907 August 27, 2023 — Cedar Park, TX

Agreed

B.2908 August 29, 2023 — Orlando, FL

We have street lights in most areas. There is no need for those headlights. They are literally blinding driving toward or behind you in the dark. If behind me and cannot navigate out of their range, I'm forced to flip the rearview mirror up to help with the glare. My eyes begin to hurt. Highway driving at night is the worst.

B.2909 August 29, 2023 — West Chester, PA

The technology is there and used in high end manufacturing, it should be a minimum standard for all makes and models. At least have the option initially.

September 2023

B.2910 September 1, 2023 — Hopkins, MN

I am tired of tailgaters irritating my eyes. Even in the daytime, some headlights are absurd, as if they're competing with the sun.

B.2911 September 1, 2023 — Savannah, GA

I'm 68 years old and refuse to drive at night anymore. I am totally blinded by oncoming traffic's headlights.

B.2912 September 4, 2023 — West Chester, PA

I like to be able to see when I'm driving at night, which I can't when half the other cars on the road have two fucking searchlights for low beams

B.2913 September 7, 2023 — Amlwch, WLS, United Kingdom

LED's are starving us from a natural source called NIGHT TIME a time to rest

B.2914 September 7, 2023 — Knoxville, TN

These INSANE, BLINDING lights are a PAIN IN THE EYES!!! Especially if one drives a low-profile vehicle! Here you have these GIANT pickup trucks blinding you from behind & coming toward you! I

put my standard lights on BRIGHT EVERY time one of these INSANE lights come towards me if I'm not going to bother a vehicle in front of me! It's literally HELL to drive at night anymore & further it seems NO-ONE in the US Government cares to do ANYTHING about it no matter who gets petitioned. I think this will NEVER change!

B.2915 September 10, 2023 — Ottawa, Canada

Driving, walking, or cycling LED headlights are blinding no matter what age.

B.2916 September 12, 2023 — Brooklyn, NY

I am a driver of a sedan, and I am having a difficult time dealing with these bright car headlight beams all around me at night. My vision is suffering as a result and I fear that being blinded by these unnecessary lights will inevitably cause me to crash my car. These lights must be modified or banned for the safety of all people.

B.2917 September 13, 2023 — Stephentown, NY

I can not see when these blinding headlights are coming towards me...I no longer drive at night because of it.. Sure would be nice to go to dinner or a movie at night...

B.2918 September 16, 2023 — Lusby, MD

When I drive at night all I can see sometimes is bright blue dots. If people think these overly bright headlights make them safer they should ask themselves if making everyone else on the road bike is safer.

B.2919 September 17, 2023 — Woodstock, United States

Jill Nelson

B.2920 September 19, 2023 — Houston, TX

I can not believe these LED lights where even given the green light to begin with. They are extremely dangerous and painful. They give me headaches, make me want to throw up and give me anxiety. Throw the entire crew of idiots away that thought this was a good idea. No telling how many people have not lived to speak on how they lost they're life in an accident due to blinding lights. They probably just think they drove into on coming traffic for no reason. Get rid of the ridiculous LED headlight right now.

B.2921 September 20, 2023 — Stuart, FL

Absolutely getting out of control and readily available at online everywhere (Amazon), and stores like Napa, Walmart, etc. Some kid does an "upgrade" to their first vehicle by installing these ultra bright headlights (of course they buy the very brightest (for safety) and they are so excited about how much better they can see that they do the same for their mom, their dad, their girlfriend and the girl friends neighbor... It is at the point that I MUST SHIELD MY EYES with my hand and that becomes a distraction. I am certainly not alone.

B.2922 September 20, 2023 — Stuart, FL

I can't enjoy a walk at night in my neighborhood.

B.2923 September 20, 2023 — Stuart, FL

LED pollution. Yes, it doesn't get dark in suburbs anymore... almost dusky is the darkest it can get. I can't teach my kids about the starts and constellations unless I take them to a planetarium (and the gizmo uses LED lights)

B.2924 September 20, 2023 — Stuart, FL

Use dark green welding goggles to drive BUT you won't be able to see red traffic lights or brake lights

B.2925 September 20, 2023 — Stuart, FL

on road trip travels, I used to prefer to drive at night because it is cooler and easier on the eyes... NOW< forget about it....

B.2926 September 21, 2023 — Norfolk, VA

Can no longer drive at night, & even walking is difficult, due to these lights on cars and elsewhere.

B.2927 September 21, 2023 — Topeka, KS

LED lights are great for offroad use, but there is no reason to use them on the road.

B.2928 September 24, 2023 — Coatesville, PA

I cannot see at night

B.2929 September 24, 2023 — Daytona Beach, FL

Signed. Now, let's work on getting LED LIGHT BARS banned. Every single pick up and jeep in my town has them on full blast, and it doesn't even matter if you look away, you're still getting blinded. Ugh.

B.2930 September 24, 2023 — PA, United States

I suffer from photophobia due to a concussion it's struggling to drive on a normal basis but the car industry is interfering with the priceless to drive LEDs are seen by people with concussion and head injury as a strobe light and sometimes can set off a migraine in addition the car industry continues to fancy up the tail lights making them blink more or steam from center to left on turn signals . They need to go back to basics

B.2931 September 24, 2023 — Stuart, FL

Put on your flashing hazard lights momentarily and stop in the middle of the road until the dangerous situation ends. Block your eyes with your hand until the visual impairment hazard ends, too...

B.2932 September 26, 2023 — Beverly Hills, CA

The bright LED lights are horribly blinding and give me a headache. They are a hazard and should not be allowed on the road.

B.2933 September 26, 2023 — IN, United States

I am unable to drive at night because of these glaring, blinding lights. This much light is not necessary for any driver!

B.2934 September 26, 2023 — London, Canada

Was just driving home on the 401 and a rainstorm hit halfway. I could barely see a few meters with all the lights reflected from the oncoming lanes super bright LED's. If someone was behind me I was blinded in my mirrors. These lights are way too much, people are going to get hurt if something doesn't change.

B.2935 September 26, 2023 — Mahomet, IL

I'm a concerned American citizen who is often on the receiving end of these extremely dangerous unnecessarily bright blinding headlights from city police cruisers, ambulances, sheriff's vehicles, state troopers and any other and all first responders to semi trailers and all ordinary every day vehicles. I hit a deer and totaled my vehicle when I topped a hill and was severely, I mean severely blinded by a city police cruiser's 100% blinding headlights. The police cruiser was sitting on the side of the road facing the opposite direction. This accident could have been avoided.

B.2936 September 26, 2023 — Odessa, TX

These lights are dangerous!

B.2937 September 27, 2023 — Yes, FL

I swear people don't care if they could end up killing someone with those lights....

B.2938 September 29, 2023 — Bergenfield, NJ

I am 75 years young and have no problems driving at night until some inconsiderate person behind me insists on driving with their halogen high beams on or some oncoming traffic has their halogen high beams on blinding me! Those halogen headlamps should be illegal since they blind you and cause deadly accidents! They do more harm than good!

B.2939 September 29, 2023 — Demarest, NJ

It would s horrible.

B.2940 September 29, 2023 — Old Tappan, NJ

This is a problem that I've been experiencing also. Thought it was my age also. So glad to hear it is not just me! These bright headlights are dangerous & need to be addressed.

B.2941 September 29, 2023 — Oradell, NJ

These headlights have limited my ability to drive after dusk. They are dangerous and should be changed.

B.2942 September 29, 2023 — Piermont, NY

This is a real problem because the one with the bright headlights can't tell that the other person is blinded. The daytime running lights are horrible too, people think their lights are on at night but they are completely dark in the back waiting to get rear-ended. Police do not understand this either. The flashing lights and headlights are super bright so you can't see them waving you by or telling you to back up etc and you can't judge the distance because you can't see.

B.2943 September 30, 2023 — Old Tappan, NJ

They are blinding

B.2944 September 30, 2023 — Shoreline, WA

I hate being blinded while driving it makes me want to drive into a tree

October 2023

B.2945 October 1, 2023 — Brunswick, GA

These bright headlights are dangerous and I've almost been in car accidents from being blinded.

B.2946 October 1, 2023 — Hubert, NC

Astigmatisms only make it worse

B.2947 October 1, 2023 — Nyack, NY

Marie Venusti Dilluvio

B.2948 October 1, 2023 — Sammamish, WA

Those lights are menace to every single pedestrian, cyclist, and driver! I have Asperger's syndrome and I can't imagine how terrible it would be for those who are more susceptible to sensory overload or who have epilepsy or light sensitivity. I even got extreme sidewalk rage from inconsiderate drivers who don't dip their brights and now I can't do even night walks without worrying about being blinded by them. These things should be ILLEGAL!

B.2949 October 2, 2023 — Australia

The modern lights on cars are dangerous and will amount to more accidents

B.2950 October 2, 2023 — Gateshead, United Kingdom

Bright headlights are dangerous.

B.2951 October 2, 2023 — Philadelphia, PA

Led lights are just too intense. They need to be measured in lux and not lumens. Even during the day they are blinding

B.2952 October 2, 2023 — Private, TX

I am light sensitive. They make me sick, give me migraines and vertigo. Also, LED headlights are dangerously bright, blinding people in oncoming traffic.

B.2953 October 5, 2023 — Kailua-Kona, HI

It is very difficult driving at night with the blinding brightness of oncoming cars. It is very dangerous.

B.2954 October 5, 2023 — Livermore, CA

LEDs are blinding and dangerous. In the city and suburbs, you can literally drive at night with no lights on, much less blinding LED. Lumen should be limited to 1100.

B.2955 October 5, 2023 — Portland, OR

modern headlights have almost caused me to swerve into ditches or other people because i cannot see the road at all even after they pass me. I also cannot see road signs due to this and I have almost gone straight on curvy roads. It is extremely unsafe for everyone and it has almost been the cause of my death numerous times.

B.2956 October 6, 2023 — Ottawa, Canada

The blinding headlights of so many cars now make it very difficult for me to drive at night. And in the rain, the lights are even more blinding!

B.2957 October 7, 2023 — Brooklyn, NY

I can't tell the difference between people's brights and regular headlights. I am constantly blinded by 75% of cars coming in the opposite direction in good weather and when it's raining it's even worse. People seeing more in front of them should not come at the expense of blinding others.

B.2958 October 7, 2023 — Cudahy, CA

Because they are dangerous...

B.2959 October 7, 2023 — Detroit, MI

I cannot stand driving at night anymore

B.2960 October 8, 2023 — Rockport, ME

I HATE THEM!!

B.2961 October 9, 2023 — Bloomingburg, NY

Tired of being blinded by oncoming led headlights,also I've seen tail and brake lights that are also. THIS NEEDS TO STOP!!!

B.2962 October 9, 2023 — PA, United States

Yes these led lights are eliminating this group of people from driving due to light sensitivity, concussion, migraines, and seizures. They need to take this population into consideration. The white, strobe led light on top of school buses in Pennsylvania are significant to these symptoms as well.

B.2963 October 10, 2023 — Rio Grande, NJ

led headlights suck

B.2964 October 11, 2023 — Mount Laurel, NJ

Is there a way to automatically send a letter to our representatives in Congress?

B.2965 October 12, 2023 — Australia

Modern LED. HID and other headlights are so bright that I cannot see anything at all when oncoming cars shine them in my eyes. Nothing. I can't see the ground, let alone pedestrians, road dividers, or even other road traffic. I am one of several I have talked to who has had to shut their eyes while driving. What will you say when someone runs over a family member of yours and, thinking they have driven through a big pothole, keeps driving?

B.2966 October 12, 2023 — Canada

I work night shift. For me its real danger every night.

B.2967 October 13, 2023 — Queens, NY

I can barely see where I'm going at night.

B.2968 October 19, 2023 — Beaverton, OR

[name removed], please contact me. I am the admin of this petition: [electronic mail address removed]

B.2969 October 19, 2023 — Beaverton, OR

[name removed], I am the admin of this petition. Please email me: [electronic mail address removed]

B.2970 October 19, 2023 — Ferndale, MI

I was in a car accident because of this

B.2971 October 23, 2023 — Birchgrove, WLS, United Kingdom

Completely agree. Constantly being dazzled by these and the dipping headlights.

B.2972 October 27, 2023 — penfield, NY

These headlights need to be recalled and replaced immediately.

B.2973 October 28, 2023 — Omaha, NE

Blinding headlights are dangerous!!

B.2974 October 31, 2023 — Fort Worth, TX

I can't stand these lights coming at me or when they're behind me, even during the day they're aggravating.

November 2023

B.2975 November 1, 2023 — Bruceton Mills, WV

Because I deserve to be able to see safely too and I can't with these lights.

B.2976 November 1, 2023 — New York, NY

These lights are blinding, migraine inducing, dangerous and uncivilized. The dangers they cause should be enough to have them banned.

B.2977 November 2, 2023 — Kingsville, Canada

I know the negative effects of these headlights.

B.2978 November 2, 2023 — Washington, DC

I can't see!

B.2979 November 2, 2023 — ascutney, VT

These lights are BLINDING!

B.2980 November 3, 2023 — PROVIDENCE, RI

These are profoundly dangerous to all fellow drivers and genuinely leave me, at least, on the verge of an ocular headache each time I encounter a set. I take seriously my responsibility to avoid distracted driving, yet this is one poor choice I have no way to anticipate or escape. It stinks.

B.2981 November 4, 2023 — Birmingham, AL

I have headaches from driving home at night after experience the excessive light from car high beams. It is harder to see my surroundings with how bright they are.

B.2982 November 5, 2023 — San Diego, CA

I have great eyesight, and these lights are absolutely way too bright to handle and not be distracted and able to see the road. My wife has worse vision and literally hasn't driven at night for two years because it's so difficult to see.

B.2983 November 7, 2023 — Toronto, Canada

It's ridiculous how bright these lights are! The blind pedestrians and other drivers and cause accidents!

B.2984 November 9, 2023 — Lake Village, IN

They're illegal, they must be white and no brighter than 3000 candelas. This has been law since 1968. The majority of aftermarket lights DIYs add to their vehicles are illegal when used on public roads.

Lighting Location Color Headlamp: Front White Turn Signal: Front Amber Identification Lamps Front Amber Clearance Lamps Front Amber Hazard Lamps Front Amber License Plate Lamp Rear White Backup Lamps Rear White Hazard Lamps Rear Red or Amber Tail Lamps Rear Red Stop Lamps Rear Red Turn Signal Rear Red Clearance Lamps Rear Red Federal Motor Vehicle Safety Standard 108 (FMVSS 108) regulates all automotive lighting, signalling and reflective devices in the United States.

B.2985 November 10, 2023 — United States

I hate being blinded by blinding headlights and led daytime running lamps, and people driving with off road lights on public roads. #banblindingheadlights #bandeafeningexhaust

B.2986 November 11, 2023 — Hempstead, TX

I have an astigmatism and these lights scare me every day. I hope we can get these regulated and fixed

B.2987 November 11, 2023 — Orange, CA

LED Headlights Especially on trucks that are not originally fitted with them are causing me dangerous night time driving situations. As a combat Army vet I already suffer random migraines headaches. These LED headlights are way way to bright on coming towards drivers. These need to be replaced with lower output brightness.

B.2988 November 11, 2023 — Sydney, Australia

I'm tired of being blinded by cars at night.

B.2989 November 12, 2023 — Kansas City, MO

I'm signing because they're unsafe for the road! They're unsafe for anyone. They cannot possibly add enough additional acuity for the driver on the road to justifying making it exponentially more unsafe for every single driver whom they drive opposite of. They're blinding. I have to put my hands up in front of my eyes when I am driving opposite someone with these headlights, which clearly is NOT good for road safety. They're selfish, they're wrong, we need to outlaw these and make there be a legal limit for how many lumens headlights can be. Simple as that. Very glad to be supporting this petition.

B.2990 November 12, 2023 — Oakland, CA

I like being able to drive (or walk or bicycle) safely without being blinded by others' headlights

B.2991 November 12, 2023 — Smithfield, UT

I know how hard it is to drive with blinding lights.

B.2992 November 13, 2023 — Madison, WI

LED and Xenon headlights are blinding with a brightness that is unnecessary.

B.2993 November 13, 2023 — Vancouver BC, BC, Canada

The LED headlights are so bright that they blind me when I am driving. I have to wear sunglasses at night and they are still too bright. They are going to cause a lot of accidents. Living in the city is stressful enough and we do not need the whole city driving around with their high beams on blinding oncoming traffic. For that matter if a large truck is behind me it blinds me in my rear view mirror as well. This has got to be reversed immediately! So do the LED Street lights!

B.2994 November 14, 2023 — Gilbert, AZ

You guys are not aiming your reform at the true problem... LED headlights are fine, when implemented and used CORRECTLY! The problem we have is all the D-bags in lifted vehicles who have their headlights aimed higher than they should be. And also the guys who simply put LED bulbs into headlights that were designed for halogen beams, which causes glare unlike properly designed LED lights.

B.2995 November 14, 2023 — Swansea, United Kingdom

It's extremely distracting and it is painful f9r the eyes they should be kllegal

B.2996 November 15, 2023 — Baguley, ENG, United Kingdom

Tonight I almost smashed a rear door into a child who was existing on a narrow road, be ause I could not see pass the pissing lights of their car. They are dangerous enough when driving nevermind parked on narrow roads full blazing so you can't see what's going on past the car! They need banning

B.2997 November 15, 2023 — Baguley, ENG, United Kingdom

Tonight I almost smashed a rear door into a child who was existing on a narrow road, because I could not see past the pissing lights of their car. They are dangerous enough when driving nevermind parked on narrow roads full blazing so you can't see what's going on past the car! They want to thank their lucky stars I'm not one to rally around the place...They need banning

B.2998 November 15, 2023 — Columbus, OH

Lights above a certain brightness are a danger to oncoming drivers

B.2999 November 15, 2023 — Los Angeles, CA

I hate those dumb ass bright lights!! Shits dangerous

B.3000 November 15, 2023 — Lynchburg, VA

These lights are so dangerous! They are worse than regular lights on high beams! I don't know who thought these lights are safe! Companies who manufacture them should be sued, for the accidents they cause!

B.3001 November 15, 2023 — Milwaukee, WI

fuck these god damn lights

B.3002 November 15, 2023 — Palatine, IL

LED car headlights are way too bright during nighttime driving. It becomes even worse when people use high beams when they're ABSOLUTLY NOT NECESSARY. Legally, you are only allowed to use high beams when it is difficult to see and there is no approaching traffic (not just cause you feel like it). LEDs create extreme glare, which blinds all incoming traffic and from the back if they are behind you. This makes it way more dangerous to drive at night than it should be.

B.3003 November 15, 2023 — San Antonio, TX

This is dangerous for other drivers.

B.3004 November 15, 2023 — Seattle, WA

I care about people not crashing

B.3005 November 15, 2023 — United States

Brian Miller stated a few comments ago: "You guys are not aiming your reform at the true problem. LED headlights are fine, when implemented and used CORRECTLY! And also the guys who simply put LED bulbs into headlights that were designed for halogen beams, which causes glare unlike properly designed LED lights". So Brian, all of the hundreds of thousands of people on here, Facebook, Twitter, Tik Tok and other social media complaining about these headlights are wrong, and you are right? And all of the medical studies and government agencies condemning LED headlights as poisonous, photo-toxic and dangerous are also wrong, but you are right? How absolutely laughable. I drive for a living and I see headlights all day long, every day. I see them on in the daytime as well as on overcast and raining days, when it is light out. So I can clearly see that the majority of these problematic headlights ARE factory installed LED headlights on newer vehicles. Only about 20 percent of them are LED bulbs in halogen housings or aftermarket LED retrofit kits (easily identifiable). EXCEPT for semi-trucks. For them the rate of illegality is near 95 percent. As for the naysayers who continue to claim that the problem with LED headlights is merely that they are all misaligned, and that all of these vehicles with LED headlights are leaving the factory that way: that as well is absolutely laughable. And even IF that was true, that only PROVES that LED headlights are dangerous. Because any PROPER headlight would NOT be blinding or dangerous even if they WERE misaligned. In my 35 years of driving I have met many vehicles with one or two halogen headlights obviously misaligned, either pointing too high or too far into my lane. Even misaligned, no halogen headlight has EVER forced me to close my eyes, or almost made me have an accident because I could

not see anything, caused me eye pain, or given me a pounding headache. But that's a regular occurrence for me (and many others) with these so-called "correctly implemented and used" factory LED headlights. This is simple logic, Brian. Try using it sometime. The only properly designed LED headlight is one that has been smashed to shards with a baseball bat. PS: I have been typing this with a belly full of pain killers which I took to try and cope with ANOTHER ocular headache brought on by exposure to FACTORY LED headlights on my drive home from work in the dark.

B.3006 November 16, 2023 — Houston, TX

I have astigmatism and the headlights are way too bright at night which causes difficulty to see ironically.

B.3007 November 16, 2023 — Silver Spring, MD

Headlights are too damn bright nowadays, and something needs to be done about it!

B.3008 November 16, 2023 — Tampa, FL

My eyes are light sensitive, and these headlights appear to me as if they are on the 'bright' setting. They are essentially blinding for someone like me....I've had many terrible experiences trying to navigate, particularly with narrow and/winding roads, with drivers of vehicles with LED headlights. The jacked up trucks are the worst, due to where their headlights hit the side & rear view mirrors of smaller vehicles.

B.3009 November 17, 2023 — Portage, PA

Boy,the mentality

B.3010 November 18, 2023 — Ashburn, VA

I'm tired of being blinded every night

B.3011 November 18, 2023 — Bicester, ENG, United Kingdom

Just because EV cars have longer range with LEDs it should of never been passed to be allowed into production, I remember 10+ years ago when people were modifying there cars with HID and getting pulled for it, now its the norm! Is this another reason they are having to reduce speed limits because everyone is dazzled by the lights?! It needs to change.

B.3012 November 19, 2023 — Fort Worth, TX

I almost ran off into the ditch because of these light - twice (from a big truck). Was coming home from class - roads are marked but blinded me big time. Scared me.

B.3013 November 20, 2023 — Plant City, FL

It is time to make driving safe for everyone again.

B.3014 November 20, 2023 — Vancouver, Canada

They are indeed blinding for other drivers, pedestrians & animals, both pets & urban wildlife.

B.3015 November 21, 2023 — Dallas, GA

As somone eith astigmatism driving home at night has become something I dread.

B.3016 November 23, 2023 — Calhoun, GA

I believe in saving lives and agree with what this petition is saying. Plain and simple all these bright lights do indeed cuase a bright blinding to the other drivers on the road.

B.3017 November 24, 2023 — Columbus, GA

I have an astigmatism in both eyes, and am very prone to migraines and driving at night is so stressful. I wish I could just not drive at night, but it's simply not feasible. Please limit the lumens on headlights so we feel safer driving at night

B.3018 November 24, 2023 — Fort Lauderdale, FL

Safe driving

B.3019 November 28, 2023 — Martinez, CA

Not only are these lights blinding and dangerous but it is triggers migraines to people, such as myself. I was so blinded driving last night that I woke up with an excruciating migraine! These lights need to be band!!

B.3020 November 28, 2023 — Tacoma, WA

I almost hit a guy because someone else's headlights made it impossible to see the road

B.3021 November 29, 2023 — New Albany, OH

LED headlights feel like someone shining a spotlight directly in your eyes. Painful, distracting, and dangerous. Please ban these awful lights from the market!

B.3022 November 29, 2023 — Port Chester, NY

Suzanne Dolgetta

December 2023

B.3023 December 1, 2023 — Eugene, OR

I'm a senior, nearly 70, and have had cataract and DESEK surgery. So, the latest super-bright headlights really glare and bother my night vision.

B.3024 December 2, 2023 — Glasgow, SCT, United Kingdom

I be find driving home at night terrifying as I have to drive on a fast road with bends in the country and sometimes find it hard to see

B.3025 December 2, 2023 — NANTWICH, ENG, United Kingdom

I've had experience of these dazzling headlights. I have to really slow down as I can never see my surroundings

B.3026 December 3, 2023 — Hickory Hills, IL

the new headlights are to bright! They are blinding!

B.3027 December 3, 2023 — Johnson City, TN

These new LED lights are so bright!!!

B.3028 December 3, 2023 — London, KY

I was almost killed cause I was blinded by the LED headlights on a vehicle. Please do something about these headlights. No one needs headlights as blindly bright as they are.

B.3029 December 3, 2023 — Marshall, WI

LED lights are blinding and make night driving a dread. I often cancel plans or leave before dark to avoid vehicles on the road that have LED lights.

B.3030 December 4, 2023 — Moira, ENG, United Kingdom

I've had to slam my on breaks on on numerous occasions simply because I couldn't see anything ahead other than the dazzling headlights, they are very dangerous. Even more so in the rain when you are trying to avoid potholes. Plus, having such bright lights can make drivers less cautious when driving along unlit roads, making them even more of a hazard.

B.3031 December 5, 2023 — West Chester PA, PA

I am sick of being blinded and rendered unsafe by cars in the other lane. It's incredibly unsafe and inconsiderate.

B.3032 December 6, 2023 — Atlanta, GA

My eyes are highly sensitive to light, and the intense brightness, akin to high beams, illuminates my entire vehicle, blinding me. Consequently, I have to turn all my mirrors away to divert the light from my eyes, which poses a safety risk as I lose the functionality of my mirrors. In such situations, I find it necessary to pull over to the side of the road and allow the vehicles with bright lights to pass. This can

be perilous, and it's crucial for people to comprehend the impact these bright lights have on the driver ahead, surpassing even the disturbance caused by emergency blue flashing lights.

B.3033 December 6, 2023 — North Adams, MA

This shouldn't even be needed. These things are dangerous, whether you're going toward them or if they're in your rear-view. They need to GO AWAY!

B.3034 December 6, 2023 — North Haven, CT

It's so dangerous to drive at night when you are literally blinded by oncoming cars constantly!

B.3035 December 6, 2023 — Philadelphia, PA

The new lights are brighter than a high beam, making it very dangerous. Specially at night, we can't even see the roads because of these lights. Please just STOP.

B.3036 December 6, 2023 — Rocky Point, NY

Led headlights are dangerous

B.3037 December 6, 2023 — West Palm Beach, FL

These extremely bright headlights - especially on these huge trucks and SUVs are dangerous.

B.3038 December 7, 2023 — Saint Petersburg, FL

It getting is increasingly hard and uncomfortable to drive at night with more and more cars having blinding headlights. I worry that it could affect my safety, or safety of others.

B.3039 December 7, 2023 — Siloam Springs, AR

The new LED headlights have gotten out of hand. They make driving at night especially hazardous.

B.3040 December 8, 2023 — Anchorage, AK

Tired of being absolutely fucking blinded on roads

B.3041 December 8, 2023 — Long Beach, WA

Get rid of the blue headlamps completely, please.

B.3042 December 8, 2023 — San Antonio, TX

i see lights like this all the time and it never gets old. there's been multiple times i haven't been able to see because a huge truck was behind me with their lights blaring. it's unsafe, and it can cause wrecks and dies cause wrecks all the time. nobody is going to stop using them, so we should definitely ban them. i get the appeal of wanting to be able to see better at night. but over the safety of others? no

B.3043 December 9, 2023 — Los Angeles, CA

I'm 28, with no vision issues, and I still hate these blinding headlights.

B.3044 December 11, 2023 — Arlington, VA

I want to be safe in the roads at night when I drive my kids in our low to the ground station wagon!

B.3045 December 11, 2023 — Auburndale, MA

Of course! And postal delivery trucks are the worst offenders

B.3046 December 11, 2023 — Birch River, WV

I have been blinded by these lights also and have nearly been into accidents. I think people are able to see just fine with our old headlights and if they can't then maybe they should not be driving at all.

B.3047 December 11, 2023 — Clermont, FL

These lights are blinding to other drivers, incl me, which makes driving more dangerous than it already is.

B.3048 December 11, 2023 — Hinesburg, VT

The "new" headlights are too bright. When confronted w them, my eyes do not adjust to nighttime normal light levels. This is a particularly serious issue when driving through unlit places such as rural

roads and many town streets. Also, w the driving field lit so brightly in front of drivers who have these lights, a cave effect is created, thereby they cannot see to the left or right where there could be an animal, a person, a stalled car.

B.3049 December 11, 2023 — New York, NY

The blinding light is unbelievably dangerous and creates unnecessary hazards for all on the road.

B.3050 December 11, 2023 — Oakland City, IN

I agree. They say its safer for people because it allows them to see but what about those are blinded. Someone said that it looks like everyone has their brights on. There's the point when you are in traffic your lights aren't on bright and away from traffic on bright to see better. We don't need brighter lights for the low beam. Make the high beam bright to see better when your in the dark not in traffic.

B.3051 December 11, 2023 — Orlando, FL

Regulation & enforcement needed.

B.3052 December 11, 2023 — Richland, WA

I agree!

B.3053 December 11, 2023 — West Islip, NY

Too much glare at night.

B.3054 December 12, 2023 — Northampton, MA

I have almost sworn off driving at night due to the dangers of glare.

B.3055 December 12, 2023 — Norwood, MA

Blue/ super white lights make very difficult to drive at night

B.3056 December 12, 2023 — Roanoke, VA

Safety issue…I can’t see when I’m driving and cars coming at me blind me.

B.3057 December 12, 2023 — Shreveport, LA

It's ridiculous I have to wear sunglasses at night and it's still too bright. I can't file suit against them since I'm in a ditch…dead.

B.3058 December 13, 2023 — Albuquerque, NM

It’s becoming impossible to leave my house at night…I live off a two lane highway and often have to pull off the road.

B.3059 December 13, 2023 — Ashland, KY

Too many bright lights not properly aimed, but blinding me from front or rear. I travel on twisty road, and lots of deer roaming about.

B.3060 December 13, 2023 — Desert Hot Springs, CA

These lights are so dangerous at night when someone has a light case of night blindness these bright lights make things a lot worse.

B.3061 December 13, 2023 — Huntsville, AL

These lights blind you and keep you from seeing correctly.

B.3062 December 13, 2023 — New york, NY

Safety of my family

B.3063 December 13, 2023 — Otley, ENG, United Kingdom

Halogen lights on other vehicles make driving dangerous for other road users. My child is AUTISTIC and she gets distressed in the car, when we are driving in the Winter, or in low light conditions, when other road users have these blinding headlights. They are unnecessary and dangerous.

B.3064 December 13, 2023 — adrian, MI

I'm tired of being blinded

B.3065 December 14, 2023 — Ashford, ENG, United Kingdom

Every day I am blinded driving on dark country lanes by these lights that are too bright. It is seriously dangerous

B.3066 December 14, 2023 — Chelmsford, MA

They need to be banned. They are blinding when driving. Not safe at all.

B.3067 December 14, 2023 — Falls Creek, PA

If ANYBODY Needs THAT BRIGHT Of Blinding Headlights To See The Road When Driving At Night, They Shouldn't Be Driving AT ALL In The First Place. People Need To SLOW DOWN When Driving At Night, Especially In High Traffic Areas, Or ANYWHERE For That Matter. Simply OUTLAW The Bulbs And Have Them Replaced With The Traditional Yellow Bulbs At Safety Inspection Time, Or The Driver Gets Ticketed. Problem Solved REAL FAST...

B.3068 December 15, 2023 — Brooklyn, NY

I agree. They are blinding both coming at you and when behind you. I see these lights for sale everywhere. Why?!

B.3069 December 15, 2023 — Danvers, MA

It's outrageous. And I can't see at night

B.3070 December 15, 2023 — Lymington, ENG, United Kingdom

They are absolutely blinding & make it unsafe to drive.

B.3071 December 15, 2023 — North Walsham, ENG, United Kingdom

I wholeheartedly agree. These ridiculous LED car lights NEED to be banned. So dangerous and so unnecessary. They also cause long term damage to our eye sight, damaging the retina. I've often had to break sharply as the road ahead can't be seen because of oncoming cars with these blinding lights. Even cars behind blinding me with their LEDs shining into my rear view mirror. And driving far too close on country roads, being so impatient... but that's for another petition!

B.3072 December 15, 2023 — Rhinelander, WI

I would rather hit a deer than oncoming traffic! I cannot see, both when traffic is coming at me and when a car with these lights is behind me! The idea that now there will be glass that dims the glare on these lights is ludacris. When does it end? Insane. Nobody is landing a freaking 747 and testing these on an empty track? Come on. Get rid of these LED lights.

B.3073 December 16, 2023 — Flushing, MI

I have a car and have experienced this "blinding", especially when I approach a truck or SUV coming toward me in the opposite lane. I have had several near misses. This needs to corrected ASAP. What were the car manufacturers thinking?????

B.3074 December 16, 2023 — Orlando, FL

I'm tired of the recent trend toward blinding oncoming headlights!

B.3075 December 16, 2023 — Toccoa, GA

I'm tired of being blinded constantly at night because of these overly bright headlights. Also some of the drivers of cars with these headlights are inconsiderate to others when parking in lots by leaving them on while parked in front of you. Many of them also tailgate you and the lights are so bright in your mirrors it makes driving very dangerous.

B.3076 December 16, 2023 — West Newton, MA

I hate the blinding blue led lights especially!

B.3077 December 17, 2023 — Allegany, NY

I feel that the trend of ultra white bright headlights are a serious safety hazard.

B.3078 December 17, 2023 — Dallas, TX

I'm a trucker and I don't want to kill anybody because of overly bright headlights. It's so sad that the. FMCSA and the DOT are playing games with you and I and refuses to testify in front of the world and in front of bright blinding headlights with their eyes wide open staring into the beast they unleashed upon the world. I would gladly make a mobile light system with the maximum limit they allowed which is 75,000 luminous power just to see how long their eyeballs last as they testify.

B.3079 December 17, 2023 — MCMECHEN, WV

They are blinding to oncoming traffic.

B.3080 December 17, 2023 — Portland, OR

Personally tired of being blinded by these lights while driving.

B.3081 December 18, 2023 — Canmore, Canada

I like to be able to see where I'm driving at night. LED headlights are the worst

B.3082 December 18, 2023 — Kihei, HI

Road fatalities, dead birds, eye stabbing lights. Enough is enough!

B.3083 December 18, 2023 — Sterling, VA

These headlights have been a problem for me, also. I support this effort.

B.3084 December 18, 2023 — United States

The brightness makes it quite difficult to see anything else.

B.3085 December 19, 2023 — Miami, FL

Hi Annette, Halogen on Low Beam is actually Much better than LEDs as far as being safer for Everyone. The nature of LEDs being such a dense and directional form of light is the reason that we're up in arms.

B.3086 December 19, 2023 — San Diego, CA

Those lights hit you right in the face and make it impossible to see!! Please fix this!!!

B.3087 December 19, 2023 — Tooele, UT

I can't stand the halogen headlights! They give me a headache and make my night blindness so much worse.

B.3088 December 20, 2023 — Acushnet, MA

I feel that I can't safely drive at night. This impacts my social life greatly. I used to go to meetings and was involved in the community and events.

B.3089 December 20, 2023 — Brooklyn, NY

Those headlights make it so I can't see shit. That's why

B.3090 December 20, 2023 — Milford, CT

I stand for this!

B.3091 December 20, 2023 — Narberth, PA

I have astigmatism in both eyes and driving at night is brutal due to the headlights.

B.3092 December 20, 2023 — Pittsburgh, PA

{"videoUrl":"https://stream.mux.com/JwVw3OlJkRA302As4pDefGWdDI02dRwd1f00pXJnu5u2Xw","cloudflareUid":"4abfad0cf843df61086012d7df42b1e2","muxAssetId":"isZbA6u7IepSQVxnO3r01QotGvI3GSAxOjduy8rpA02Ko","muxPlaybackId":"JwVw3OlJkRA302As4pDefGWdDI02dRwd1f00pXJnu5u2Xw","muxPlaybackUrl":"https://stream.mux.com/JwVw3OlJkRA302As4pDefGWdDI02dRwd1f00pXJnu5u2Xw","muxThumbnailUrl":"https://image.mux.com/JwVw3OlJkRA302As4pDefGWdDI02dRwd1f00pXJnu5u2Xw/thumbnail.jpg"}

B.3093 December 20, 2023 — Springdale, AR

I have noticed over the last 10 years or so a lot of extra bright, blue tinted headlights. They cause pain in the eyes since blue is a color the eye is sensitive to and they are dangerous since after car has passed your eyes have shrunk the amount of light allowed into the eye so it takes a minute or so to regain your normal night vision.

B.3094 December 20, 2023 — Wall Heath, ENG, United Kingdom

Headlights are so incredibly intense these days, especially on dark country roads. I am scared to drive at night now.

B.3095 December 20, 2023 — Woburn, MA

Let's go back to when we cared about the other people on the road. Also must band auto adjust as it doesn't work fast enough. Been getting blinded by these ultra bright lights that exceed my high beams. It's dangerous. How did the USDOT miss this??? Negligence on there part to the highest degree!

B.3096 December 21, 2023 — Austin, TX

I am constantly blinded at night by these new headlights! And i am young with good vision except for some astigmatism.

B.3097 December 21, 2023 — Brookville, IN

Xenon headlights are extremely bright and blinding, if you can't use your cellphone while driving because it is a distraction from the road, then why are these headlights allowed when they distract/blind other drivers?

B.3098 December 21, 2023 — Gateshead, ENG, United Kingdom

The lights are blinding and darken visibility around us. We don't need these lights!

B.3099 December 23, 2023 — Richmond, VA

Duh!

B.3100 December 23, 2023 — Saddle Brook, NJ

Blinding headlights are simply dangerous. We need regulation to limit how bright headlights can be.

B.3101 December 24, 2023 — Dorval, Canada

Unsafe.....what if a bicycle is in front of me and I'm dazzled by these led lights

B.3102 December 24, 2023 — Jacksonville, FL

This is very dangerous gives me massive headaches. I feel like car inspections should come back and testing headlights should be one of the items that drivers either have to fix or no be allowed to have those cars on the road.

B.3103 December 25, 2023 — Casco, ME

Donna Shaw

B.3104 December 25, 2023 — Indianapolis, IN

I can barely drive at night anymore.

B.3105 December 25, 2023 — Oakdale, PA

In the last year alone, I have noticed an upturn in being blinded by overly bright headlights or high beams. I'm exceptionally tired of having to adjust my rear view mirror or side mirrors to stop being blinded.

B.3106 December 27, 2023 — Frimley, ENG, United Kingdom

It is interest of safety

B.3107 December 27, 2023 — Nanticoke, PA

It's crazy. I counted six headlights on a truck the other day. Maybe these are meant to be pavement princesses, but this amount of light suddenly can literally stun you if it comes over a hill fadt.

B.3108 December 28, 2023 — Hillsboro, OH

I'm tired of being blinded at night my extremely bright headlights. And my eyes are not overly sensitive.

B.3109 December 28, 2023 — North Bennington, VT

I am signing because I have eyes and wish not to be blinded and driven off the road after staring at two, small orbs which cast light so boiling hot that they may as well be two small suns.

B.3110 December 28, 2023 — Nottingham, MD

I just drove the most horrific night drive of my life with blinding headlights and rain making me worry if we would make it home alive. Tons of accidents on the interstate. These blinding lights make it so much more difficult to see the lines.

B.3111 December 29, 2023 — Bent Mountain, VA

I was forced to stop in heavy traffic when I was blinded by a truck with very bright headlights. Others were forced to stop as well. I feel lucky to have avoided an accident. This is not the first time.

B.3112 December 29, 2023 — Brooklyn, NY

These headlights are unsafe and unnecessary.

B.3113 December 29, 2023 — Olyphant, PA

These bright headlights make it difficult for me to drive at night. Blinding!

B.3114 December 30, 2023 — Oceanside, NY

I know LED's are better, however they need to be checked for brightness and blue light. Make them less bright and more yellow/orange.

B.3115 December 30, 2023 — United States

I cannot see for these headlights coming at me. I fear for my life and the lives of others.

B.3116 December 30, 2023 — Vancouver, WA

I can't see when hit full on with those brights.

B.3117 December 30, 2023 — Wakeman, OH

New car's and SUV's and Truck's are a very blinding and distracting intensity and color…Make's me want to put my sunglasses on but as we know this can be Deadly.

B.3118 December 31, 2023 — Atlanta, GA

Im tired of being blinded for seconds on end while driving at night. It is a safety hazard and just unnecessary road bullying in my opinion.

B.3119 December 31, 2023 — bloomingdale, NJ

he aint lying!!!!!!!!!!!

B.3120 December 31, 2023 — washington, MO

I can't see when led headlights come toward me at night.

Comments left in 2024

January 2024

B.3121 January 1, 2024 — Belmont, CA

I have astigmatisms in both eyes as well as chronic migraines that are triggered by bright lights so this is an issue that is very important to me. Bright LED lights negatively affect me almost every day of my life. Additionally, these headlights have made my ability to drive on rainy nights virtually inaccessible to me due to their ability to essentially blind me.

B.3122 January 1, 2024 — Concord, CA

Driving in towards or in front of bright blinding lights is so dangerous, and my aging eyes can not adjust quickly enough to safely drive. BLINDINGLY bright headlights should be illegal. Aftermarket modifications should also be illegal.

B.3123 January 1, 2024 — Paauilo, HI

I can no longer drive at night due to the blinding headlights LED and Halogen headlights. This has curtailed my social life and employment hours and have led to social isolation and financial instabilty. How are these lights not illegal?

B.3124 January 1, 2024 — Portland, OR

For the love of god, we need something like this

B.3125 January 1, 2024 — Sapulpa, OK

I can't see when I drive at night because selfish people drive cars with unregulated headlights that blind others while lazy government officials do nothing to correct a public safety hazard.

B.3126 January 1, 2024 — Seattle, WA

These ridiculously bright headlights leave me partially blinded and I'm worried it will lead to me hitting a pedestrian. I feel like I'm being assaulted everytime I drive at night, and sometimes even during the middle of the day by vehicles 2-3 blocks away. The attempts to refine headlight adaptive technology is a waste of time for anywhere that isn't perfectly flat at all times, such as in Seattle where I live.

B.3127 January 1, 2024 — Victoria, Canada

These super bright lights are blinding me so much as to making my driving at night very scary and dangerous to me and others

B.3128 January 2, 2024 — Beverly Hills, CA

Ok listen up everyone reading this. I have some cold hard facts to say and what I have resorted to doing First the cold facts A petition won't do anything this is a company that does what it wants. Which brings me to fact 2 Contrary to what anyone thinks or says, LED's are actually not legal on headlights. The companies just went ahead and did it as there is no recourse. Just like cops do things that aren't legal, they just go ahead and do it anyway. What are you going to do? Oncoming isn't the real problem either. The real danger is from behind you which impairs all vision. Oncoming is still dangerous but behind is completely lethal Here is what I have resorted to doing. I encourage everyone else to do the same. Because this problem is so bad I have resorted to keeping a pretty large highly polished 2-way mirror in my vehicle which I put up any time some idiot with this hazard is behind me. I'm also on the verge of covering the outside of my vehicle with mirrors

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B.3130 January 2, 2024 — Cheltenham, ENG, United Kingdom

I no longer drive very far at all at night due to these oncoming glaring headlights; some are not merely 'individual' headlights but ones which light up most of front AND rear of newer cars! Yes, I am an older driver but I know of many people considerably younger than I am who feel the issue of oncoming glaring/blinding headlights is not just annoying but downright dangerous!

B.3131 January 2, 2024 — United States
These lights can suck my dick

B.3132 January 3, 2024 — Holley, NY
HID's don't help the driver see better, they're only more blinding to incoming traffic. Gotta go.

B.3133 January 3, 2024 — IN, United States
Blinding headlights are really blinding in the night making me scared to drive.

B.3134 January 3, 2024 — Irving, TX
Save lives

B.3135 January 3, 2024 — Phoenix, AZ
It is blinding and dangerous to have head on traffic have these bright lights on.

B.3136 January 3, 2024 — Salt Lake City, UT
Solutions exist. We have the technology for safer roads and saving lives! For example, european headlights are safer. https://www.automotive-fleet.com/329713/europes-adaptive-beam-headlights-rate-highest-aaa-says

B.3137 January 3, 2024 — San Francisco, CA
I could no longer drive at night because of these blinding lights. Please ban them now.

B.3138 January 3, 2024 — San Francisco, CA
It’s difficult to drive at night with these blinding lights

B.3139 January 3, 2024 — United States
When blinding LED headlights are coming toward me, or any other driver, it makes it harder to see things like bikes or pedestrians, or animals. If all I see is the glaring headlights I may not know if I need to slam on the brakes for something else. Think about it! Just because you can't see something does not mean it's not there. #banblindingheadlights #banledandotherblindingheadlights

B.3140 January 3, 2024 — United States
I've literally had to stop my car in middle of St because I was blinded so bad and continue to be blinded by tree lighs

B.3141 January 3, 2024 — Washington, DC
My husband cannot go out at night anymore due to the blinding lights. I cannot see to drive in the dark. It is insane that I cannot drive at night. I will do whatever it takes to help get car manufacturers to return to sane lights. What do you suggest?

B.3142 January 4, 2024 — Calgary, Canada
LEDs area absolutely NOT needed

B.3143 January 4, 2024 — Granby, CT
I have always noticed that bright LED lights cause eye pain and make it harder to safely see the road at night. I'm glad to support this petition!

B.3144 January 4, 2024 — Irving, TX
Living in the country with no street lights, I can not stand these LED lights! I have to look at the solid white line on the side of the road in order to know where I am going when I pass someone with these lights. There is no way of knowing what is in front of me and it is terrifying! If police can pull you over for not turning your bright lights off, LED lights shouldn't even be available!

B.3145 January 4, 2024 — Monroe, WA
This affects us every day. I have to look away from the road or take a hand away from what I'm doing to block my eyes. It is painful, it is dangerous, it is very common. Fix this dangerous frustrating issue.

B.3146 January 4, 2024 — San Francisco, CA

It's past time someone did something about this! Thank you for this petition.

B.3147 January 4, 2024 — Seymour, IN

I like to be able to see while driving.

B.3148 January 4, 2024 — Sun Valley, NV

There is also the issue of people with fog lights that have been upgraded to the brighter lights and having them on along with regular headlights. Also headlights that are not adjusted or aimed correctly.

B.3149 January 4, 2024 — sanfrancisco, CA

They are dangerous to other drivers coming toward them. They are blinding.

B.3150 January 5, 2024 — Camden, NJ

I am personally so tired of driving at night and then being blinded by someones LED headlights. Its to the point where some of them are so bright that it momentarily blinds me and I am unable to see the road. Like do you want me to crash ??? I might if these damn headlights still exist.

B.3151 January 5, 2024 — Columbus, MI

This is not only prevalent on vehicles but is prevalent on buildings now especially gas stations party stores in large stores they're putting on these large LED panel lights versus what they had prior claiming probably being sold on the fact that they're saving money and get more lighting. Every city has lightning laws and they're not being followed everybody should be calling their engineering department we're planning commission or city console complaining on these lights. Ignorance is playing a big role here we have too much light pollution as it is it's really way out of control!

B.3152 January 5, 2024 — Gretna, LA

I'm tired of being blinded every time I drive.

B.3153 January 5, 2024 — Irving, TX

yes, near accident after lifted truck head lights bounced back from every rear view mirror at a Y-intersection at highway speed. I made the corner by feel alone and missed going onto shoulder, into concrete piers.

B.3154 January 5, 2024 — Knoxville, United States

I have an astigmatism and these lights BLIND ME. I'm tired of driving and feeling unsafe.

B.3155 January 5, 2024 — Oklahoma City, OK

I am very disappointed in the relatively uncaring attitudes among lawmakers and law enforcement agencies. Article after article tells us that the era of bright LED headlights is coming to an end. Really? I say it is only getting worse. With politicians sitting around on their hands, not doing anything to help their constituents, and local police forces not enforcing safety violations, it's no wonder citizens are not only concerned, we are boiling mad.

B.3156 January 5, 2024 — Ottinge, United Kingdom

I've had to stop driving at night due to being blinded by these ridiculous bright lights, due to a bad experience, which means my life is severely curtailed and affecting what I do for my family. It's far too frightening to attempt any night driving, and anything I do has to factor in getting home before it gets dark.

B.3157 January 5, 2024 — Portland, ME

I've felt blinded by on coming trafic on highways

B.3158 January 5, 2024 — Warrensburg, MO

First and foremost, driving at night has become a truly dangerous experience. I have been driving for over 20 years now and there is an absolutely noticeable difference in night time driving. Headlights are absolutely blinding. Additionally, anyone living on a street now have to deal with this blinding

lights assaulting them at all hours of the night. Aside from the existential threat that headlights pose to drivers we are creating a type of pollution that affects all life on this planet. Migration patterns are disrupted, the beautiful lightning bugs of my childhood are disappearing, and humans can no longer look up at the night sky and see the stars. All of this adds to an increasing feeling of disconnection from each other and our universe. This is no small issue. It needs to be taken serious. Even selfish interests could argue that the death toll from vehicle accidents alone detract from consumers spending money. Do something about this now.

B.3159 January 6, 2024 — Boise, ID

I'd like to avoid dying! Super bright headlights coupled with jacked up vehicles equals disaster for normal motorists.

B.3160 January 6, 2024 — Fargo, ND

Fuck your bright ass headlights, nerd

B.3161 January 6, 2024 — Fargo, ND

LED lights, especially high intensity, blind everyone on the road except for those lucky enough to have a 12in lift kit. You're supposed to look at the white line for those guys, but their lights are so bright the rays, halos, and fogginess takes up my whole field of vision. Just keep driving straight and pray

B.3162 January 6, 2024 — Garner, NC

Driving at night no longer feels safe, and I'm far from elderly.

B.3163 January 6, 2024 — Glendale, AZ

These LED lights are blinding to people/cars coming the opposite direction. It's all you can see is the glare from their headlights and not much of anything else. Please go back to traditional headlights!!

B.3164 January 6, 2024 — Knoxville, TN

{"videoUrl":"https://stream.mux.com/V5P01gPAxm2VMrmY02zoE3rvP1umjtqPIghBjmnnJRFaY","cloudflareUid":"a84ab46824a896f3f4682f9ba1eb88f1","muxAssetId":"GlNgCrrhE01vLWTLRdaCOugSeG2S33R01j1aIvuIJd21U","muxPlaybackId":"V5P01gPAxm2VMrmY02zoE3rvP1umjtqPIghBjmnnJRFaY","muxPlaybackUrl":"https://stream.mux.com/V5P01gPAxm2VMrmY02zoE3rvP1umjtqPIghBjmnnJRFaY","muxThumbnailUrl":"https://image.mux.com/V5P01gPAxm2VMrmY02zoE3rvP1umjtqPIghBjmnnJRFaY/thumbnail.jpg"}

B.3165 January 6, 2024 — Louisville, KY

It's not just the LEDs it's the people who don't turn their brights off for traffic in front of them or on coming traffic! Y'all need to learn to drive!

B.3166 January 6, 2024 — Minneapolis, MN

The proliferation of blinding, too-bright, poorly-adjusted headlights is clearly making travel more dangerous. Not only for the sake of drivers, but also for cyclists and pedestrians, who are being killed with increasing, alarming frequency on American roads. I can hardly go out at night anymore without being blinded by oncoming traffic.

B.3167 January 6, 2024 — Spokane, WA

These lights are hazardous and drivers who use them should be ashamed

B.3168 January 6, 2024 — St. Cloud, MN

I live in the north where it gets dark by the time I get off work. With these headlights blinding me I essentially can't run errands after work for half the year. This was never an issue before these blinding lights made it impossible to see, both oncoming traffic blinding my left and from behind where it removes an ability to use my mirrors and destroys my night sight.

B.3169 January 6, 2024 — St. Cloud, MN

{"videoUrl":"https://stream.mux.com/02ga6eb1XK4Xr2moPQLRSDRPdN9iVIbryOERvuUHpjAk","cloudflareUid":"d4ddd62a3dfadcb5f1

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B.3170 January 7, 2024 — Georgetown, OH

These taller vehicles even leave their brights on when passing other vehicles because lights from other cars dont affect them due to them being lower. When driving a smaller car, it makes hitting deer or other unexpected objects unstoppable. It’s a serious issue and I feel like nobody talks about it.

B.3171 January 7, 2024 — Naugatuck, CT

Headlights need to be regulated again. Wouldn't mind seeing seal beam headlights reintegrate into modern cars.

B.3172 January 7, 2024 — Normal, IL

PLEASE MAKE THIS FEDERAL. THE LIGHTS ARE TOO BRIGHT AND CAN DAMAGE THE EYES.

B.3173 January 7, 2024 — Saint Petersburg, FL

Testing headlight aim used to be part of the emissions inspections in Florida. When they dropped the emissions testing they should have kept the headlight aim test and brake tests. No telling how many lives could have been saved.

B.3174 January 7, 2024 — Yucca, AZ

Yet another GLARING example of how inept the fed gov is, total disregard for the well-being of the people

B.3175 January 8, 2024 — Worcester, ENG, United Kingdom

I daren't drive at night with these blinding lights.

B.3176 January 9, 2024 — AR, United States

Even with night driving glasses, I am still blinded by the extremely bright LED headlights. I have sensitive eyes and literally cannot see the road as they pass by.

B.3177 January 9, 2024 — Clio, MI

The LED lights are seriously dangerous they need to be banned sooner than later! I become completely blinded as one is approaching me on the road until it's past me. During that moment I can't see the road I don't know if anything's in the road, I feel like my car swerving to avoid the lights. This you're not even be a factor anyone who thinks this is ok is delusional! It's a fixable problem! Let's get it fixed!

B.3178 January 9, 2024 — London, United Kingdom

I want to make driving safer for people.

B.3179 January 9, 2024 — North Augusta, SC

I love to drive, but hate to at night because of newer vehicles that have these ultra bright headlights.

B.3180 January 10, 2024 — Brentford, United Kingdom

When I drive across a steep bridge, I have to slow down drastically because the light from the oncoming vehicle blinds me

B.3181 January 10, 2024 — Hinckley, ENG, United Kingdom

I can no longer drive at night due to being blinded by these lightd

B.3182 January 10, 2024 — Irvine, SCT, United Kingdom

The lights are blinding and dangerous

B.3183 January 10, 2024 — Isle of Wight, ENG, United Kingdom

These lights are so bright they are dangerous.

B.3184 January 10, 2024 — London, United Kingdom

These lights are dangerous

B.3185 January 10, 2024 — Pittsburg, PA

These lights are terrible, they blind you when the car is oncoming and they blind all of your rearview mirrors when this monstrosity is behind you.

B.3186 January 10, 2024 — Rochester, NY

I can't see the road when these lights are coming at me. Some of them physically hurt.

B.3187 January 10, 2024 — Sheffield, ENG, United Kingdom

I want these LED headlights banned because they may cause fatalities on our country roads or any other roads. The cars are higher now and the lights blinding to incoming traffic.

B.3188 January 10, 2024 — Solihull, ENG, United Kingdom

It's dangerous driving in the night with lights blinding you as to cause an Accident. Urgent action should be implemented

B.3189 January 10, 2024 — london, Canada

I too have been blinded by the light

B.3190 January 10, 2024 — st John, ENG, United Kingdom

I think this is a growing problem, especially with the increased use of after market replacement bulbs. Accidents due to dazzle remain largely unprovable and hidden.

B.3191 January 11, 2024 — Cape girardeau, MO

I live in a larger city and many people have switched to blinding blue/white lights. I also struggle with astigmatism and night blindness. I have begun to completely avoid driving at night because of the amount of people that use these lights. There are huge amounts of oncoming traffic all with bright LED headlights that make it so I can't even see the lines on the road. I've almost gotten into multiple wrecks because of these lights and I'd like to be able to drive at night again.

B.3192 January 11, 2024 — Sherwood Park, Alberta, AB, Canada

Far to Bright ! Can't see at night !

B.3193 January 11, 2024 — Steeple View, ENG, United Kingdom

It's dangerous to drive and I've nearly had an accident due to not being able to see

B.3194 January 11, 2024 — Tucson, AZ

I'm sick and tired of being blinded while trying to drive at night.

B.3195 January 12, 2024 — Cardiff, WLS, United Kingdom

These lights are damaging and hurting my eyes

B.3196 January 12, 2024 — Kansas City, MO

I've read some of the studies that show humans need shadows and light contrast in order to see well. Other species are severely impacted by these too bright lights. These lights disrupt migratory birds, disturb mating, interfere with navigation, and cause numerous other health problems.

B.3197 January 12, 2024 — Mesa, AZ

Extremely bright headlights are literally the most dangerous thing on the road above intoxicated driving. It's come to the point where manufacturers are literally using lasers and other ridiculous technologies to make the brightest possible light that blinds everyone else but the driver, people with stigmatism and other eye problems can be left blinded for literally minutes. Manufacturers and people need to be held accountable so this can't stop

B.3198 January 12, 2024 — Poulsbo, WA

I am blinded daily! They need to change the headlights!! Meg Shaw

B.3199 January 12, 2024 — Sheffield, ENG, United Kingdom

They are blinding towards drivers travelling in both directions it should be made illegal

B.3200 January 12, 2024 — Woodstock, CT

I only drive at night if I have to. The increase in the LED lights has directly affected how much I patronize any business, especially in winter when it is dark all the time. Perhaps lawmakers care about the economic ramifications of horrendous travel conditions?

B.3201 January 12, 2024 — aylesbury, ENG, United Kingdom

Fed up of being blinded

B.3202 January 13, 2024 — Chicago, IL

Sucks driving through mountains and getting blinded by pickup trucks that feel to light the whole place up including my whole interior of my car. I'm surprised there isn't a ban on these yet knowing that even law enforcers most likely experience this too.

B.3203 January 13, 2024 — Dayton, OH

They blind me

B.3204 January 13, 2024 — Eureka, CA

It's absurd that these aren't outlawed already. WAY worse than brights, which ARE illegal to have "always on".

B.3205 January 13, 2024 — Fort Myers, FL

LED headlights are horrible. They Blind oncoming drivers even pedestrians or bicyclists. It takes seconds for my eyes to readjust. Also. If you have a LED headlight vehicle the color of light is not idea. I have bright white halogen bulbs in my personal vehicle and they light the road better in dry and wet conditions than BLUE led lights do. Everyday driving I always questioned who allowed these bulbs to be installed in vehicles. the HID- high intensity discharge headlight days were a time of bright lights but LED lights are FAR WORSE than the HID lights were

B.3206 January 13, 2024 — Kelvedon Hatch, ENG, United Kingdom

I'm beginning to be very concerned about night driving. The glare is so dazzling that the total ability of seeing clearly compounds the problem of avoiding pot holes at the side of the road

B.3207 January 13, 2024 — Marshfield, WLS, United Kingdom

I have been blinded many times by bright lights. I believe they cause too many accidents on our roads.

B.3208 January 13, 2024 — Scranton, SC

These lights are very blinding.

B.3209 January 13, 2024 — Sheffield, ENG, United Kingdom

I often struggle driving when it's dark due to other vehicle headlights

B.3210 January 14, 2024 — Chingford, United Kingdom

It's gotten to the point where I avoid driving at night completely because I find it so dazzling and cannot see. It's so unsafe!

B.3211 January 14, 2024 — Eden Prairie, MN

I am also having trouble driving at night. The new car headlights blind me

B.3212 January 14, 2024 — Little Hocking, OH

Those headlights are not only dangerous, but it is also stopping probably THOUSANDS of us frm going out at night, thus leading to ALSO damaging the economy, family ties, and MANY small businesses! I personally know at least 10 people who will no longer go out at night! They are even a drag in the daytime!

B.3213 January 14, 2024 — Llanidloes, ENG, United Kingdom

I find these lights really hurt my eyes, even in my mirrors when the car is behind me. This is bot only very distracting when I′m driving home after a 12 hour care shift, but, I believe, damaging to the eyes as well as stressful and unnerving for other road users. I believe this affects our safety and our wellbeing. Please please ban their use. Their benefits to the driver with this lights is far outweighed by the detriment they cause to others.

B.3214 January 14, 2024 — Logan, UT

You are correct, this is the reasons why people get blind.

B.3215 January 14, 2024 — Newtown. WALES, ENG, United Kingdom

I am finding it very difficult to cope with these very bright headlights which do not seem to bother to dip until the last minute

B.3216 January 14, 2024 — Waco, TX

I hate blinding lights like the song by The Weeknd

B.3217 January 14, 2024 — Wellingborough, ENG, United Kingdom

They are a menise and blinding

B.3218 January 15, 2024 — Downingtown, PA

It creates a hazardous nuisance, driving at night to be exposed to so much of this extreme brightness, especially on rural roads that are winding and narrow. Furthermore, it is predominantly well off people driving vehicles with these harmful lights, and this amounts to class warfare against all of us who cannot afford new cars, or have to drive at night for livelihood. It is disgusting, unjust, and needs to be corrected immediately. Please introduce and/or support some measures to eliminate this unnecessarily perilous trend in automobile design. Please make it a standard of a car being street legal to have below a threshold of brightness, as recommended and approved by eye doctors, as people with astigmatism are further harmed by this intense LED brightness. There is no legitimate reason car headlights need to be as bright as they are, and the auto manufacturers should be held responsible for the hazardous nuisances they are promoting. Make mandatory recalls for headlights above proposed safety thresholds. The accidents that could be prevented with updated headlight standards are reason enough to put this on your agenda.

B.3219 January 15, 2024 — Litchfield, ME

I am getting old and these light are blinding, I have to drive home around 8:30 every night and the lights make driving almost impossible

B.3220 January 15, 2024 — Northampton, MA

for a no. of years I have inreasingly been aaffec=ted by the many factors mentioned n this petition. I kept thinking these things would immediately be changed in the next year′s car models or not permitted by federal agencies that ,monitor safety in our cars, on oour roads, etc. But it is only gotten worse on a daily basis. This petition speaks to a terrible danger among us throughout the country as proven by our growing death toll. It is already too late for many but will help everyone if some of the suggested actions are implemented now and by federal law.

B.3221 January 16, 2024 — Desoto, MO

These lowbeams, are brighter than my highbeams, and highbeams aren′t supposed to be used within 500 ft of another car, weather meeting head on, or following. Some drivers have more sensitive eyes. They should be illegal, and tickets should be handed out like candy. It′s also very disrespect and causing road rage!

B.3222 January 16, 2024 — Niceville, FL

I want to be able to drive at night without guessing where the painted lines start and end because all I see is blinding light

B.3223 January 16, 2024 — Pataskala, OH

There has been to many nights, especially in snow or rain where I have almost driven off the road due to the LED headlights. They are too bright! The fact that I can't tell between their brights and normal headlights is so dangerous. They need to be illegal before they cause more accidents.

B.3224 January 17, 2024 — Frisco, CO

I like being able to see.

B.3225 January 17, 2024 — Gig Harbor, WA

Have been affected myself by this issue

B.3226 January 17, 2024 — Minneapolis, MN

Someone had led lights coming the opposite way from me, I couldn't see the road only the headlights in front of me. It was icy and snowing really bad and I ended up crashing with my 4 year old niece in the car.

B.3227 January 17, 2024 — Nashua, NH

The too bright headlights are dangerous!

B.3228 January 17, 2024 — Panama City, FL

very dangerous for people like myself with macular degeneration. it's already difficult to see at night, add these headlights and all one can see is just a white out view. I also believe part of the reason for these headlights is the addition of electronics inside the cab of the vehicle. Large infotainment displays make it difficult to see at night so auto makers compensate by making the headlight brighter. These high intensity lights are absolutely dangerous.

B.3229 January 17, 2024 — Portland, OR

I'm a rideshare driver and I get headaches from driving long hours at night with all the LED headlights. Not to mention that there are times when I can barely see the road because of oncoming or tailgating vehicles with blinding headlights. There's no reason for a vehicle to have the equivalent of high beams by default.

B.3230 January 17, 2024 — Seattle, WA

I am effected by this every night

B.3231 January 17, 2024 — Tomball, TX

As someone with Visual Snow and resulting light sensitivity, the new LED's are extremely painful and have made driving at night a terrifying experience. Please do something about this. I know states like Maryland could easily incorporate this into their already strict vehicle inspection processes.

B.3232 January 18, 2024 — Fairborn, OH

I can't drive at night anymore without being blinded. This is dangerous and needs to change.

B.3233 January 18, 2024 — Fox Lake, IL

If you drive with bright LEDS at night that can blind people I hope you get struck at night by a car and see all your family members breathe their final breaths you beta cucks.

B.3234 January 18, 2024 — Lockport, NY

Driving is hard enough. These headlights are out of control and make something most of us must do so much more difficult and dangerous than it needs to be.

B.3235 January 18, 2024 — London, ENG, United Kingdom

I'm finding night driving almost impossible Have some anti glare glasses that help a bit

B.3236 January 18, 2024 — Mendota, IL

I don't drive at night because when I do I literally almost go off road when being blinded by these intense head lights. I drive an svu (bulb lights) and still am blinded. Please do something before people start dying because of them.

B.3237 January 18, 2024 — Paignton, ENG, United Kingdom

I avoid driving at night if I can because of these cars .

B.3238 January 18, 2024 — Winchester, United States

I have a huge sensitivity to light and can barely drive at night without getting into an accident because of bright headlights.

B.3239 January 18, 2024 — Yarmouth, ENG, United Kingdom

I live in a rural community, without street lights, and am frequently dazzled by these bright lights, especially coming over a hill. On occasion I have been so blinded I′ve almost had a ln accident! I′ve had to apply emergency brakes and stop entirely until my vision cleared. In addition there are so many potholes locally, I am blinded every time an incoming car hits one,!

B.3240 January 19, 2024 — 29 Palms, CA

This is a real danger every time we drive.

B.3241 January 19, 2024 — Collingswood, NJ

These headlights blind me, making it hard to see the road while they approach me, and after they pass, as my eyes readjust. In my small town with pedestrians, if one were step out into the street to cross, I wouldn’t see them because of these headlights. It’s a disaster waiting to happen.

B.3242 January 19, 2024 — Duluth, MN

LED lights have triggered so many migraines and negatively affected my ability to work because of it.

B.3243 January 19, 2024 — Fortuna, CA

The wide spectrum of light allowed for use in headlights need to be addressed with scientific studies to verify the safety of headlights that are in the blue(UV) shifted light. They are blinding and make it incredibly unsafe on the road, with an emphasis on members of the community that wear glasses. The safety rules I′ve used in the past no longer work as the beams of light from UV-shifted LED headlights leave floating blind spots in an instant. It creates dangerous road conditions and some limitations should be instituted for safety reasons.

B.3244 January 19, 2024 — Halifax, Canada

This is getting ridiculous. I′m not for banning LED lights all together but they can′t allow the truck headlights, at eye level of the average car, to have these bright lights. The average car is below the cutoff shield of the tall trucks. I now carry a piece of cardboard covered in tape to hold up to these lights and have pointed my mirrors away from the other vehicles. All of this is making things more unsafe. I′ve wrote the safety board many times but always get the same response back.

B.3245 January 19, 2024 — Jasper, AL

I can′t see at night when the lights are so bright. Behind me an oncoming.

B.3246 January 19, 2024 — Palmer, AK

I ALMOST DIE DAILY DUE TO THE BRIGHTEST HEADLIGHTS IN THE WORLD.

B.3247 January 19, 2024 — Twentynine Palms, CA

These lights are blinding! It is a serious safety issue for oncoming drivers, especially on the dark, rural roads that we drive on to get home.

B.3248 January 19, 2024 — Twentynine Palms, CA

Those lights are dangerous!!

B.3249 January 19, 2024 — Williton, United Kingdom

I hate being blinded by such lights

B.3250 January 20, 2024 — Berkhamsted, ENG, United Kingdom

Headlights should be limited by lumens and brighter bulbs banned from sale. They dazzle, and retinal afterglow at night still makes driving unsafe for several seconds after being seen.

B.3251 January 20, 2024 — Burlingame, CA

There's no need for LED lights. The old ones were good enough for all those years.

B.3252 January 20, 2024 — Milwaukee, WI

I want to be able to use my eyes properly on the road

B.3253 January 20, 2024 — Seattle, WA

Factory installed binding lights is reckless and should be outlawed and car manufacturing corps sued. Blinding lights cause crashes and deaths. Recall all cars with such lights and ban them!!!

B.3254 January 20, 2024 — Wellington, New Zealand, New Zealand

LED headlights are blinding for other drivers and this can get people KILLED.

B.3255 January 21, 2024 — DC, VA

I definitely hate driving at night because of these bright lights. Once it hits my eyes while driving I can't see for a couple of seconds. Which is bad because I could get into an accident. I've had to even get anti-glare glasses to see at night because my vision has gotten worst due to the bright lights blinding me.

B.3256 January 21, 2024 — Las Vegas, NV

I live in the city and gave to use my hand to block unwanted glare and try to focus on the ground ahead of me to be able to see and continue driving. This happens several times a day in the dark winter hours. It's blinding and I barely can see and have my eyes hurt while trying to get past those lights. It's a cost-saving measure from manufacturers and not worth it! They need to STOP being cheap!

B.3257 January 21, 2024 — Seattle, WA

Ban Blinding Headlights and Save Lives! Auto makers have been putting dangerously bright lights on cars. They cause accidents and deaths!!!nIt is a great risk to drive at night any more!! Let's change that!!

B.3258 January 21, 2024 — Seattle, WA

I drive home at night in very secluded/wooded areas where there is little street light. If there are cars behind me (even from a great distance) it is difficult for me to see what is ahead. Or if a car with LED lights is passing me, I'm literally blinded for a few seconds, and so many people keep their brights on as well!!! It is becoming dangerous to drive at night, it is giving me headaches driving with all this excessive light exposures, and makes me anxious.

B.3259 January 21, 2024 — Seattle, WA

Blinding headlights are getting out of hand recently and are causing an active danger to ALL drivers on the road. A lack of regulation for blinding headlights is a problem for ALL drivers.

B.3260 January 21, 2024 — Staten Island, NY

It's hard to see anything when oncoming traffic and the other side of the road has these lights, which makes a very blind and indificul To see in order to drive safely .

B.3261 January 21, 2024 — Watervliet, NY

I am someone with some neuro issues, these LED lights are so massively dangerous, they blind an entire road so when coming at you, you can't see the road ahead, and when behind you, it floods your whole car with lights. Ban these lights, bring back regular lights which are safer and more effective!

B.3262 January 21, 2024 — Yuma, AZ

I live in a city and on the way to the gym, giant trucks with LED lights frequently blind me. It's hard to see what what's in the adjacent lane and if I make a ill timed turn, I'm dead and who's at fault? The driver who had the bright lights

B.3263 January 22, 2024 — Lake City, PA

its really dangerous to keep those LED headlights on the road, its blinding!!

B.3264 January 22, 2024 — Liberty, MO

I've nearly been in accidents from blinding headlights

B.3265 January 22, 2024 — Liverpool, ENG, United Kingdom

It is Awfull trying to drive safely on the roads/motorways with these ridiculous unwelcome unneeded bright lights that blind you whilst trying to drive safely for yourself & others! Unessasary! Something needs to be done about the problem it's causing !!

B.3266 January 22, 2024 — Moncton, Canada

Led/hid head lights should be illegal

B.3267 January 22, 2024 — Oceanside, CA

If you can drive without the power of the sun strapped to your car then you're a crappy driver. Go back to the old headlights that aren't blinding people and causing accidents

B.3268 January 22, 2024 — Phoenix, AZ

Ban LED in headlights, regulate the amount of light that can be emitted or the angle of all lights so no light shines above a certain point, do something to prevent the dangerously bright lights on so many vehicles

B.3269 January 23, 2024 — Billericay, ENG, United Kingdom

It's dangerous and it will kill someone

B.3270 January 23, 2024 — Elgin, TX

Astigmatism already makes nighttime driving difficult, but the brightness of LED headlights especially when combined with their height in modern truck and SUV designs makes it blindingly dangerous. Even people with whom I have spoken without astigmatism agree that impairs their ability to drive at night. Headlights should not be full-spectrum and should instead focus on the more mellow yellow, orange, and red end of the light spectrum that are softer and more conducive to seeing at night. Their height in automobiles should be limited, and their angle should be standardized so that they are less prone to shining directly into other cars while behind them, passing them from the side, or driving in the opposite lane. This is a safety issue, and manufacturers will not fix it so long as it is not mandated and they can excuse it as simply doing what the customer wants.

B.3271 January 23, 2024 — Gainesville, FL

Fuck your Headlights.

B.3272 January 23, 2024 — Haughton, LA

I have trauma(iritis) to my eyes due the lights on these cars and trucks! We need to back to the old lights.

B.3273 January 23, 2024 — Syosset, NY

I need to hold up my left hand to block the super bright oncoming lights. So annoying and dangerous!!

B.3274 January 23, 2024 — Toledo, OH

I'm appalled at the brightness of LED headlights? WHY are they even legal? If a law is passed that would control the intensity that can be admitted, how will the existing vehicles that have them controlled?

B.3275 January 24, 2024 — Austin, TX

I've personally experienced being blinded by these headlights and the unsafe situation it puts many of us in while driving atnight.

B.3276 January 24, 2024 — Bangor, NIR, United Kingdom

There needs to be a minimum surface area for headlights, and a maximum lumen rating. Fancy adaptive tech is not the answer.

B.3277 January 24, 2024 — Louisville, KY

The headlights are blinding!!

B.3278 January 24, 2024 — Oakland, CA

I can't drive comfortable with these headlights .. they almost blind me! A rear hazard for night tine driving

B.3279 January 24, 2024 — Quakertown, PA

I am a good driver and I obey the traffic rules, much to the annoyance of other drivers . The headlights have me at times not knowing what is in front of me.

B.3280 January 24, 2024 — Summit, NJ

The increasing brightness of car headlights has gotten totally out of control. Just require lights with lumens over 2k to have adaptive technology to mitigate the effect on oncoming traffic

B.3281 January 24, 2024 — United States

Monster trucks behind my Prius are blinding even with the rearview switched to night view. It's gotten insane.

B.3282 January 25, 2024 — Avondale, AZ

I don't want to crash over some Ram truck tailgating me and blinding me with their LED lights

B.3283 January 25, 2024 — Charlotte, NC

Save lives.

B.3284 January 25, 2024 — Greeley, CO

I no longer drive at night unless absolutely necessary because of the blinding headlights that seem to be in the majority these days. It's great that those drivers can see, but those of us who are blinded by them have no choice but to not drive at night.

B.3285 January 25, 2024 — Houston, TX

Chevy pickups have 6. THATS 6 LED HEADLIGHTS ,ALL ON AT THE SAME TIME. HOW DOES THE DEPT OF PUBLIC SAFETY ALLOW THIS,???

B.3286 January 25, 2024 — Lanark, IL

Headlights now are brighter than the brights on the old incandescent system. I'm tired of being blinded and getting headaches just driving myself home after work. Please find a better way!

B.3287 January 25, 2024 — San Francisco, CA

I can't see!

B.3288 January 25, 2024 — Uniontown, OH

Headlights this bright both make driving more difficult and actually harm eyes

B.3289 January 26, 2024 — Cable, OH

I work third shift and driving to and from work every night is nightmarish. I've hit the shoulder so many times because I literally can't see the road due to how bright the headlights in the oncoming lane are. If it's foggy, I cannot see anything around these oncoming cars except this bright, white cloud.

B.3290 January 26, 2024 — Concord, NC

I just want to see the road.

B.3291 January 26, 2024 — Dartford, ENG, United Kingdom

The bigger the car the bigger the lights !! Bad enough on large roads but impossible on country lanes. I've been driving over 40 years and never needed Led lights before. Might be cheaper but with the overall cost of vehicles its hardly a reasonable excuse to blind half the nation

B.3292 January 26, 2024 — Fleming Island, FL

iv literaly cant see the road at night with these blinding lights, it hurts

B.3293 January 26, 2024 — Kutztown, PA

As someone who suffers from migraines, these lights are particularly awful. They have both induced migraines and exacerbated ongoing ones. There have been times where I've felt completely incapacitated and had to stop and park to close and rest my eyes for a while. If there are regulations on window tint or other additions to cars, then why not this?

B.3294 January 26, 2024 — Lansing, MI

Due to having an astigmatism in my right eye the led lights have literally made it nearly impossible to drive at night.

B.3295 January 26, 2024 — Longview, United States

Blinding on coming traffic is way more dangerous for the general public then the softer styles we have been using for decades.

B.3296 January 26, 2024 — Monterey Park, CA

I feel unsafe around cars driving with ultra bright lights

B.3297 January 26, 2024 — Montvale, NJ

I almost exclusively drive at night, And it's awful.

B.3298 January 26, 2024 — No, IL

I'm so sick of driving down the road with spots in my eyes from being blinded by every single ridiculously bright headlight that is perfectly eye-level in my car. It's ridiculous, painful, and more dangerous in the long run.

B.3299 January 26, 2024 — Olalla, OR

Safety

B.3300 January 26, 2024 — Rancho Cordova, CA

I'm so tired of being blinded on the road!

B.3301 January 26, 2024 — West Bend, WI

If I can see my cars' shadow because the car behind me's headlights are THAT bright then there is a massive problem. My astigmatism no longer allows me to drive due to these headlights. Even during the daylight they still blind oncoming traffic when on. Im going to start throwing rocks at oncoming cars headlights.

B.3302 January 26, 2024 — Weybridge, ENG, United Kingdom

Killing people

B.3303 January 27, 2024 — Albuquerque, NM

LED headlights are a blatant danger to the public, and the brightness levels of these headlights need to be regulated.

B.3304 January 27, 2024 — Atlanta, GA

It is hard to see at night when passing cars have their LED lights on. It is not safe and more accidents will occur. STOP MAKING LED LIGHTS!!!

B.3305 January 27, 2024 — Elma, WA

Even tail lights are leaving long lasting streaks in my vision. Streaks that I can't see through or around, leaving my vision impaired and myself distracted. These lights are dangerous.

B.3306 January 27, 2024 — Leechburg, PA

I have almost been in accidents multiple times due to being blinded by dangerously bright headlights. This is a very serious safety issue.

B.3307 January 27, 2024 — Longmeadow, MA

This is disruptive to night vision and dangerous

B.3308 January 27, 2024 — Phoenix, AZ

Headlights have been getting worse and worse as manufacturers try to make “cooler” headlights for their new car designs. It’s become so bad that I HATE driving at night these days. I try to focus on the white line on my side of the road, but still end up blinded momentarily…and as we all know, we’re traveling hundreds of feet during this momentary blinding. Regulate headlights - NOW!

B.3309 January 27, 2024 — Providence, RI

These headlights are dangerous. I am do relieved i am not alone.

B.3310 January 27, 2024 — Providence, RI

blinding headlights are dangerous!

B.3311 January 27, 2024 — San Francisco, CA

I'm consistently blinded by LED headlights, especially on Teslas. Please issue a recall to make these lights reasonable.

B.3312 January 27, 2024 — Xenia, OH

I can’t see at dusk, dawn and at night! It’s out of control!

B.3313 January 28, 2024 — East Longmeadow, MA

Ellen Bousquet

B.3314 January 28, 2024 — Mobile, AL

These headlights are extremely dangerous at night even on low beam. They need to be banned IMMEDIATELY!!

B.3315 January 28, 2024 — Muskegon, MI

I wish I could smash those lights with a baseball bat! Stop making them!

B.3316 January 28, 2024 — Phoenix, IL

Let me tell you how not good my vision is already I have 20/25 on my left side and a 30/25 on my right it's not real bad but my lenses are thick thick magnifying thick and my right eye actually used to be 20/25 but due to LED headlights is has worsened over the years mind you being 22!!!!!!!! I get floaters and black spots in my right field vision and my left eye is completely blinded by the lights I literally have to wear night driving glasses to make it at least 10% safer for me to actually be able to drive at all during the night. I have almost side swept guard rails or have slammed on my breaks because I am unable to see and in both scenarios have the potential of fatalities if it ain't me it's the driver behind me and I hope this finally gets pushed through quickly I don't want to see 500+ more fatalities before this is taken seriously.

B.3317 January 29, 2024 — Brooklyn, NY

I am So tired & annoyed by the blinding lights of oncoming cars at night,.whose owners are so inconsiderate to not bother adjusting the intensity.. and if that’s not the case there should be a way of adjusting them rather than putting peoples lives at risk! The lights are seriously blinding & can cause accidents!

B.3318 January 30, 2024 — Detroit, MI

As someone with an astigmatism I fear driving at night because it’s so blinding

B.3319 January 30, 2024 — Eugene, OR

These light re dangerous for pedestrians and other vehicles.

B.3320 January 30, 2024 — Gilbert, AZ

These lights are dangerous.

B.3321 January 30, 2024 — Midland, MI

I already have a difficult time with night vision, especially when headlights are coming toward me. The super bright headlights make it impossible to see anything, its very dangerous and completely unnecessary.

B.3322 January 30, 2024 — United States

There no reason you get to see everything when other drivers only get to see your headlights.

B.3323 January 31, 2024 — CLIFTON PARK, NY

Anyone who needs headlights so bright as to see a hair on a frogs ass 3 miles away DEFINITELY doesn't need to be on the road at night.

B.3324 January 31, 2024 — Northfield, VT

I agree

B.3325 January 31, 2024 — Wilton, CT

I get chronic migraines and because of that I am very sensitive to bright light. Modern LED headlights make driving at night a painful experience for me. The lights themselves hurt my eyes and seeing them over an extended period while driving is enough to trigger a migraine. If I'm in the car and not driving, I'm wearing sunglasses. I never used to have this problem with the old style halogen bulb lights, but these new bulbs have gone too far. They are causing me, and many others with my same and similar conditions, physical distress.

February 2024

B.3326 February 1, 2024 — Altadena, CA

High glare blue LED headlights blind drivers especially on dark roads. Night vision is blown as one comes around a curve into those glaring lights. Overly bright blue lights are a dangerous safety hazard. Too many years have passed without DOT or other agency action. Outlaw blue headlights ASAP!

B.3327 February 1, 2024 — Cedar Lake, IN

I am a retired guy who can no longer drive safely at night because of LED headlights coming at me.

B.3328 February 1, 2024 — Lexington, NC

LED headlights are danger to the road and hazardous. they're not needed and they're not appreciated

B.3329 February 1, 2024 — Queen Creek, AZ

I drive at night due to my work schedule. Oncoming lights are bad news

B.3330 February 1, 2024 — Toronto, Canada

I suffer to and from work each and every day. I see people blinding others at crosswalks and even near schools. I find it unbelievable that it is standard practice. School buses use high beams as well. Vehicles are using highbeams even before my night time running lights go on automatically. It is extremely dangerous for the safety of children. I hope you can make a difference. According to Academies of Opthamology, they are damaging to our eyes as well. The long term damage is unknown, but it is painful to the eye indicating the possibility of damage. Insurance companies should demonstrate interest in this issue, giving the rise of fatalities and aging drivers who have incurred concussions throughout their lives.

B.3331 February 2, 2024 — Bengaluru, India

It's a health hazard and safety hazard to not only human beings but all living beings

B.3332 February 2, 2024 — Birmingham, AL

I am a young woman and it has become so difficult to drive at night because of bright headlights. I even have a higher sitting car and it is still difficult, it has made driving at night anxiety inducing and something needs to change.

B.3333 February 2, 2024 — Bowie, MD

It's astounding that there's no regulation on brightness when these headlights literally put drivers in dangerous situations. I hate driving at night when it feels like everyone has their highbeams on and I can't see the road much less an animal, pedestrian, or cyclist in my vicinity. Will laser beams in headlights be ok too or will that finally cross the line?

B.3334 February 2, 2024 — Roswell, GA

Safety matters.

B.3335 February 2, 2024 — Sauk Rapids, United States

It's not fucking safe, Period.

B.3336 February 3, 2024 — Baraga, MI

My 36 yr old son Peter died in a car accident from L E D lights on wrong side of highway. He has 2 children. When is enough ? They should be recalled in every vehicle. I wont quit fighting till they are.

B.3337 February 3, 2024 — Camborne, ENG, United Kingdom

I want to be able to drive at night without being blinded by headlights. Either ban them or position them lower.

B.3338 February 3, 2024 — Frederick, MD

I try not to drive at night anymore because the overly bright headlights almost always bring on a migraine

B.3339 February 3, 2024 — New York, NY

It's a safety hazard. Those lights are blinding, causing me to momentarily be unable to see what's going on around me ,it's even worse in the fog, and in hazy rain, which is very common where I live.

B.3340 February 3, 2024 — Rochester, NY

I can't stand being blinded by an increasing number of headlights.

B.3341 February 4, 2024 — Austin, TX

The new headlights from multiple car brands and manufacturers actually angers me to a point where I am now an aggressive driver at night because I feel it is the only way I can be. It is RIDICULOUS to think these headlights are even necessary for the majority of the population who drive them in well-lit urban areas and large cities. There absolutely MUST be stricter regulations in place. The human eye is unable to filter and process blue/white lights. The recovery time to adjust sight back is too long; especially when operating a giant metal weapon.

B.3342 February 4, 2024 — Brunswick, OH

I'm tired of blinding lights and tailgating with said blinding lights trying to run me off the road. It's obnoxious and absolutely a danger to drivers. Nobody needs lights on their car bright enough to see into the future.

B.3343 February 4, 2024 — Chelsea, MA

I have given up driving at night because I am unable to see the road. I have asked multiple doctors about night blindness and have always been told it's the lights not my vision.

B.3344 February 4, 2024 — Minneapolis, MN

Some of these headlights are so bright that it causes me to see spots! This is not safe for driving. It even happens when the headlights are reflecting in my side and rear view mirror!

B.3345 February 4, 2024 — Newberg, OR

I'm scared for every time I drive at night, my drive home from work typically consists of 3 or more blinding moments by LED headlights. It's not safe. There so much else to worry about on the road, please take blinding lights (LED headlights) out of the mix.

B.3346 February 4, 2024 — Ramsgate, ENG, United Kingdom

These really are dangerous and I can only hope they get banned.

B.3347 February 4, 2024 — San Diego, CA

Instead of Banning Blinding headlights, why not try to raise awareness for blinding headlights and suggest tinting or nighttime worn glasses.

B.3348 February 4, 2024 — Seattle, WA

Ive almost killed a pedestrian . It is unbelievably dangerous and needs to be recalled , just like airbags or dangerous seatbelts!!

B.3349 February 4, 2024 — Woodbridge, VA

This an important petition. Headlights DO NOT need to be bright enough to light up a stadium for you to travel safely!

B.3350 February 5, 2024 — Dublin, OH

It is absolutely out of control in Ohio. So many accidents over this law enforcement and local governments just ignores the problem, I guess their body count must not have met its quota yet ! Do better

B.3351 February 5, 2024 — Edmonds, WA

the lights are just too bright, and it's unsafe for other drivers!!

B.3352 February 5, 2024 — Salt Lake City, UT

Driving with astigmatism has become even more challenging for me since the production of these headlights I genuinely fear for my safety and other when I'm driving. These headlights are a bad decision on all parts.

B.3353 February 5, 2024 — Sandpoint, ID

These lights are too bright for on coming traffic. I try to look away, at the right paint strip, but once you glance into these lights, it's spots for several seconds. I believe risk to other drivers outweighs benefits of being able to see into the next county. Thanks.

B.3354 February 5, 2024 — Springfield, OR

They hurt!!!!!!! It is truly painful! I should not have to stop night driving because some companies will not fix this mistake.

B.3355 February 5, 2024 — Sylva, NC

driving HWY 471 a 2 lane truck route the blinding LED lights in the rain is the worst the rain makes the fog line disappear and that is the only way you can stay in your lane with these bright lights is to focus on the fog line. There are many pickups with the lights elevated and they have 4 headlamps that make it nearly impossible to see the road. BTW there is no paved shoulder on this road you are in the grass at 60+mph these lights are going to lead to many fatal accidents if they are not banned/recalled

B.3356 February 5, 2024 — Westford, MA

I HATE those headlights. I can't tell you how often I'm blinded by them; it's like people are driving around with their brights on. And, that auto-dimming feature doesn't work well at all.

B.3357 February 7, 2024 — Bar Harbor, ME

High power white headlights are bad for road safety as they make it difficult for drivers on the opposite side to see the road. These headlights should be banned.

B.3358 February 7, 2024 — Chandler, AZ

the extra brightness of new lights may seem to be safer for the driver of that vehicle but is in fact more dangerous for all those around that vehicle. Safety inspections should be more important than emissions inspections with headlight alignment being a critical part of them. vehicle ride height should also be fined as lights are now above the rear windows of most cars. All unsafe and need to be controlled.

B.3359 February 7, 2024 — Dallas, TX
there doing it on purpose just like everything else to decrease the population...

B.3360 February 7, 2024 — Harrisburg, PA
LED lights are dangerous and strain drivers eyesight while in a vulnerable state in darkness to be "blinded" by bright lights from all directions.

B.3361 February 7, 2024 — San Diego, CA
LED halogen headlights are dangerously bright; exceeding even brights of many cars.

B.3362 February 7, 2024 — Springtown, TX
Headlights are way too bright for on coming vehicles to clearly see the road in front of them. There is no reason normal headlights need to be so extremely bright that other drivers are literally blinded. Vehicles also do not need to have an abundance of lights on the vehicle also blinding other drivers. Drivers managed roads just fine when vehicles only had 1 set of lights in the front for ages.

B.3363 February 8, 2024 — Derby, ENG, United Kingdom
I am regularly blinded by new Xeon headlights. They are dangerous

B.3364 February 8, 2024 — Dorking, United Kingdom
I am always being blinded by headlights that are too bright.

B.3365 February 8, 2024 — Doune, SCT, United Kingdom
Some headlights are so dazzling that they are a danger to all motorists. It's particularly bad when the oncoming vehicle is a SUV and also when it's raining. I have been driving behind vehicles where the driver has slowed to a really low speed because the driver is dazzled by headlights. This can be a secondary risk outcome of such bright oncoming headlights.

B.3366 February 8, 2024 — Exeter, ENG, United Kingdom
I find it very difficult to see the road when I am being blinded by oncoming traffic and sometimes traffic behind me, I have to avoid looking in my mirrors and checking behind me like I normally would for that reason.

B.3367 February 8, 2024 — Fareham, ENG, United Kingdom
These lights are dangerous

B.3368 February 8, 2024 — Hognaston, ENG, United Kingdom
I have been dazzled so many times by these grossly inappropriate and unnecessary headlights that I frequently fear driving at night. They are the product of arrant stupidity on behalf of car designers who have limited understanding of what they are doing.

B.3369 February 8, 2024 — Ipswich, ENG, United Kingdom
I'm often blinded by oncoming headlights I'm 66 and I know my eyes are not perfect, but this is a real problem for me.

B.3370 February 8, 2024 — King's Coughton, ENG, United Kingdom
Bright headlights are an increasing danger on our roads.

B.3371 February 8, 2024 — Lincolnshire, ENG, United Kingdom
LED headlights are not cleanly focused downwards hence glare to oncoming drivers even when "dipped". Also LED light colour is cold-white, whilst incandescent are warm-white, hence less glare.

B.3372 February 8, 2024 — London, ENG, United Kingdom
I'm only 60 and already struggling to drive after dark safely due to the glare from LED headlights and high vehicles

B.3373 February 8, 2024 — Pill, ENG, United Kingdom
As I get older I'm finding it much harder to drive at night, despite having good eyesight and being an experienced driver. Some car headlights are simply dangerous.

B.3374 February 8, 2024 — Sheffield, ENG, United Kingdom
These excessively bright LED lights are stopping me going out in the evening. They are almost blinding.

B.3375 February 8, 2024 — Southampton, ENG, United Kingdom
Headlights are way too bright now

B.3376 February 8, 2024 — Sunderland, United Kingdom
Headlights are too bright or badly adjusted.

B.3377 February 8, 2024 — Westbury, ENG, United Kingdom
Fed up being dazzled all the time,

B.3378 February 8, 2024 — Weston by Welland, Mkt Harborough, ENG, United Kingdom
Some of these Led lights are dangerous. Everything around them appears black and I have to slow down - sometimes to almost a stop in order to feel safe.

B.3379 February 9, 2024 — Baraga, MI
Our son was killed in a car crash because of these blinding lights, a man parked his F-250 on the side of the road towards oncoming traffic to get his mail, he had these bright led lights pointing towards my sons vehicle, my son swerved thinking it was it was a passing vehicle, hit the ditch, rolled a couple times breaking his neck in 2places

B.3380 February 9, 2024 — Baraga, MI
These lights are a hazard for all oncoming traffic at night, if you do not look for the whiteline to the right of the road you do not know where you are while driving

B.3381 February 9, 2024 — Belfast, NIR, United Kingdom
Driving in the dark has become extremely dangerous. Risk like this would not be allowed in any work place never mind driving a killing machine around a bend or over a hill and just hoping for the best! Should be banned immediately.

B.3382 February 9, 2024 — Bexhill, ENG, United Kingdom
I find it increasingly difficult to drive at night because of glaring headlights

B.3383 February 9, 2024 — Bexleyheath, ENG, United Kingdom
Blinding lights are dangerous

B.3384 February 9, 2024 — Bristol, ENG, United Kingdom
I rarely drive at night now as find the lights too dazzling

B.3385 February 9, 2024 — Burston, ENG, United Kingdom
It is very dangerous to be blinded by incoming headlights - and scary as well!

B.3386 February 9, 2024 — Camberley, ENG, United Kingdom
I'm fed up with being blinded by headlights in my rear view mirrors.

B.3387 February 9, 2024 — City of Westminster, United Kingdom
Blinding and very dangerous, shocking that these lights have been allow on the road.

B.3388 February 9, 2024 — Coulston, ENG, United Kingdom
I find modern headlights too bright, sometimes blinding!

B.3389 February 9, 2024 — Crickhowell, United Kingdom
If nobody has lost their life because of these dangerous headlights yet, it's only a matter of time.

B.3390 February 9, 2024 — Dagenham, United Kingdom
These new headlights are really dangerous and need changing

B.3391 February 9, 2024 — Farnham, United Kingdom
They are dangerous as blind on coming drivers.

B.3392 February 9, 2024 — Ferring, ENG, United Kingdom
I am an older driver and find that many car headlights are dazzling, making driving more dangerous at night. For that reason I try to avoid driving at night.

B.3393 February 9, 2024 — Hatfield, ENG, United Kingdom
Veronica ouchabane

B.3394 February 9, 2024 — Loughborough, ENG, United Kingdom
I've always been against these car LED lights because of glare. Hope something gets done to ban them.

B.3395 February 9, 2024 — Lynnfield, MA
Sick of being blinded

B.3396 February 9, 2024 — Mill Hill, United Kingdom
The lights are blinding as if people have full beam on

B.3397 February 9, 2024 — Milton Keynes, United Kingdom
Driving at night is becoming increasingly difficult due to being dazzled by oncoming vehicles

B.3398 February 9, 2024 — Newport, ENG, United Kingdom
Living in the countryside with no street lights the brightness of car lights has stopped me going out in the evening as they blind me

B.3399 February 9, 2024 — Northwood, United Kingdom
The lights are dangerous in my opinion

B.3400 February 9, 2024 — Norwich, ENG, United Kingdom
Headlights are intensely bright, with an almost blue colour. I avoid driving long distance at night because of safety concerns.

B.3401 February 9, 2024 — Oak Lawn, IL
These newer bright headlights are THE worse aspect of newer cars. They temporarily blind you ! Please stop their use. Aggressive drivers use the brights on purpose!!

B.3402 February 9, 2024 — Rochdale, ENG, United Kingdom
Manufacturing needs to be addressed this is dangerous and killing people

B.3403 February 9, 2024 — Swindon, ENG, United Kingdom
I am being blinded by headlights it has become a real problem driving at night in the last few years. I don't feel safe.

B.3404 February 9, 2024 — West Horndon, ENG, United Kingdom
Modern headlights are far too bright. It's alright for those behind the wheel, but for those facing the lights it's far too dangerous. It's an unnecessary hazard that's putting lives at risk. Modern drivers are so used to driving motors fitted with such dangerous lights that they just won't be able to cope if there's another war and we have to restrict our lights.

B.3405 February 9, 2024 — Westminster, United Kingdom
This is a real problem on country roads

B.3406 February 9, 2024 — london, ENG, United Kingdom
The lights are blinding and dangerous

B.3407 February 9, 2024 — wakefield, ENG, United Kingdom
New bright LEDs are worse than old high beams

B.3408 February 10, 2024 — Brighton, United Kingdom
LED lights can be dangerous - and blinding to many Drivers

B.3409 February 10, 2024 — Cape Town, WC, South Africa
the lights are blinding & disconcerting!

B.3410 February 10, 2024 — Dagenham, United Kingdom
I am affected by LED lights. I see colours, makes my eyes burn and I get dizzy from them

B.3411 February 10, 2024 — Donna, TX
Janet Grano

B.3412 February 10, 2024 — Dunmurry, NIR, United Kingdom
New LED car lights are blinding, making driving extremely risky, especially on minor and country roads

B.3413 February 10, 2024 — Durban, South Africa
What happened to the yellow light, which is much better.

B.3414 February 10, 2024 — Forest Grove, OR
These lights give me migraines, and I am not talking about a mere headache. I mean full on nausea, vertigo, brain fog, fatigue, a horrid stabbing pain in my eye, all of it. An attack can last for days. For many migraine sufferers, LEDs are bad for our health, and we have just as much a right to go out at night as anyone.

B.3415 February 10, 2024 — Gourock, SCT, United Kingdom
Over-bright headlights lights are unnecessary and a genuine safety hazard.

B.3416 February 10, 2024 — Greenock, SCT, United Kingdom
I absolutely think they will cause accidents and the brightness of them induces me to have a migraine where I get an aura at the corner of my vision .

B.3417 February 10, 2024 — Liskeard, ENG, United Kingdom
They′re outright dangerous & should be banned.

B.3418 February 10, 2024 — London, ENG, United Kingdom
It’s blinding

B.3419 February 10, 2024 — PONTEFRACT, ENG, United Kingdom
It is dangerous to other road users

B.3420 February 10, 2024 — Petersfield, ENG, United Kingdom
LEDs are bad for our eyes!

B.3421 February 10, 2024 — Petworth, ENG, United Kingdom
They are a danger to drivers

B.3422 February 10, 2024 — Petworth, UK, ENG, United Kingdom
Terribly difficult to drive when you are blinded by strong headlights of an approaching car

B.3423 February 10, 2024 — Snohomish, WA
They are seriously a cause for fatalities that could be prevented.

B.3424 February 10, 2024 — Summit, NJ
It is getting increasingly difficult to drive safely at night. I am constantly being blinded by the ultra bright lights of oncoming traffic. There needs to be legislation to limit the intensity of headlights.

B.3425 February 10, 2024 — Swadlincote, ENG, United Kingdom
Glaring headlights, side lights, hazard and bicycle lights are dangerous.

B.3426 February 10, 2024 — United Kingdom

Living in a rural location, I have to drive home from work in middle of road to avoid numerous potholes on side of country roads and I literally have to stop if another car comes towards me with their oncoming blinding headlights with fear if I don't, I face a puncture from a pothole .....I can't win either way!

B.3427 February 10, 2024 — witley, ENG, United Kingdom

I have really struggled driving in the dark because of these lights!

B.3428 February 11, 2024 — Austin, TX

These excessively bright lights are a danger to all road users, especially cyclists and pedestrians.

B.3429 February 11, 2024 — Beckenham, ENG, United Kingdom

I want to stay safe on the road.

B.3430 February 11, 2024 — Canmore, AB, Canada

I can no longer drive at night because of these lights. It's a problem for many people.

B.3431 February 11, 2024 — East Brunswick, NJ

I can't see at night when I drive and it's very dangerous!

B.3432 February 11, 2024 — El Cerrito, CA

This new crop of bright headlights are seriously too bright for me at night. I struggle every time I need to change lanes on highways and multi-lane streets because I cannot avert my eyes or ignore the bright lights in my side or rearview mirror. What used to be an occasional annoyance is now becoming a more substantial threat to my safety (and everyone who shares the road with me).. they're even brighter than my high beams! They also pose a safety threat for pedestrians, especially the elderly and visually impaired who are light sensitive.

B.3433 February 11, 2024 — Hitchin, ENG, United Kingdom

I'm constantly being blinded by these over-bright headlights.

B.3434 February 11, 2024 — Lowestoft, ENG, United Kingdom

Making driving in the dark more dangerous

B.3435 February 11, 2024 — Midvale, UT

They are dangerous. Something that impairs other drivers has no business being on our roads.

B.3436 February 11, 2024 — Miners Rest, Australia

There's no recognition of the dangers of driving light that are to bright, both at night and also during the day, for cars trucks and motorbikes, due to government stupidly encouraging daytime use of head lights and daytime running lights (a marvellous safety innovation) that are too bright. The inept policy of wired on motorcycle headlight causes multiple deaths due to other road users not being able to judge motorcycle speed and acceleration.

B.3437 February 11, 2024 — New Bern, NC

I drive a semi truck, and the new headlights, especially on the pick up trucks, are insane. They are as bright as brights. I have a large manilla envelope I hold up to block the lights in the side view mirror. I have to slow down when lines of cars are in the on-coming lane because I can't see anything in my lane. My eyesight is 20/20. It's not safe for these vehicles to have such bright lights, and am 100% opposed to them.

B.3438 February 11, 2024 — Oakhanger Crewe, ENG, United Kingdom

These headlights are dangerous, the glare reduces the ability of oncoming drivers

B.3439 February 11, 2024 — Sammamish, WA

Seeing is important while driving. It's common sense.

B.3440 February 11, 2024 — San Antonio, TX
I'd like to be able to see.

B.3441 February 11, 2024 — Sheerness kent, ENG, United Kingdom
I really am blinded by the lights

B.3442 February 11, 2024 — United Kingdom
Constantly being blinded by on coming traffic or from cars behind me. Wuth LED lights. Ita a disgrace. Accidents waiting to happen. Government must do something about this

B.3443 February 12, 2024 — Chessington, ENG, United Kingdom
Night time driving has become a nightmare for me due to blinding, misaligned and confusing lights.

B.3444 February 12, 2024 — Cordova, AK
Industry needs safety supervision for the protection of all of us.

B.3445 February 12, 2024 — Fort Bragg, CA
Led headlights are too bright

B.3446 February 12, 2024 — Mendocino, CA
The amount of light that is produced from headlights is absolutely blinding and makes me feel like I'm going to crash all of the time. There is nobody who needs that much light in order to drive well. However, we do need less light in order to drive well and be safe. Light pollution is an underappreciated problem. This is why I'm signing this petition.

B.3447 February 12, 2024 — Norwich, United Kingdom
LED lights are dangerous to all on the road. How did these lights pass the standard...

B.3448 February 12, 2024 — Pulborough, ENG, United Kingdom
Reducing risk on the roads is important

B.3449 February 12, 2024 — San Diego, CA
Marcia Lowrey

B.3450 February 12, 2024 — West Sussex, ENG, United Kingdom
LED headlights are blinding

B.3451 February 13, 2024 — Benicia, CA
Headlights as well as red break lights as well! When I'm at a red light I feel I could melt, due to the intensity of those red break lights!

B.3452 February 13, 2024 — providence, RI
I will literally no longer be able to drive at night because of this I'm only 48 years old. These lights literally blind me and I'm afraid I'm going to crash.

B.3453 February 14, 2024 — Abergavenny, WLS, United Kingdom
I have experienced dazzle both from headlights and over bright tail lights. There is light pollution of all sorts damaging peoples eyesight and it should be addressed v

B.3454 February 14, 2024 — Kent, ENG, United Kingdom
I hate the glare at night it blinds me

B.3455 February 14, 2024 — Latham, NY
The extra bright lights blind on coming vehicles and can result to an accident, or striking a person walking along the roadway because of the bright lights. Bright lights can kill people and pets. RECALL BRIGHT LIGHTS

B.3456 February 14, 2024 — London, ENG, United Kingdom

This is a real problem, the lights are far to bright and makes it dangerous when dazzled by bright lights!

B.3457 February 14, 2024 — San Francisco, CA

I've almost gotten into a number of accidents and almost hit someone because of being blinded by ridiculously bright oncoming headlights. Bright headlights are obviously needed but not to the point where they impact other people's ability to drive safely. They are a nuisance that jeopardize people's lives. It's a no brainer that they should be made illegal.

B.3458 February 14, 2024 — Sherwood, AR

I FUCKING HATE LED HEADLIGHTS

B.3459 February 14, 2024 — Spring Hill, FL

I am a 32 year old man. I've lost confidence and the will to drive at night due to the blinding headlights of other vehicles. These are people's low-beams that are blinding me, especially the newer trucks that seem to have a headlight stack 1' tall. It's infuriating that nothing has been done about this issue. It also disadvantages the poor who cannot afford newer vehicles with dimming Sideview mirrors or other mitigation technology. This will eventually cause me to have an accident, and I doubt the person who caused the momentary blindness will have the decency to even look back at what they've caused. If a class action lawsuit arises, count me in. The loss of enjoyment of traveling at night is something I feel a good lawyer could successfully litigate, as well as the documented additional eye strain these lights cause. Until then, I will continue to use my middle finger to show these offending drivers what I think of their vehicle choices, and will not be considering any new vehicles that contribute to this problem.

B.3460 February 15, 2024 — Lawndale, CA

whenever I drive at night, I basically can't see from behind and from the opposite lane. It's scary and a danger to all.

B.3461 February 15, 2024 — Lewisham, United Kingdom

I live in the country driving down back roads then meeting a vehicle coming towards you with LED headlamps is blinding, they are so powerful that they don`t see the glear from your headlamp's so they round the corners on full beam, you latterly have to stop because of blindness then you are there for a few minuets to get your eyes refocused. worse when the vehicle has Auto Dip Mode. Something needs to be done!

B.3462 February 15, 2024 — Scranton, PA

I have noticed more vehicles on the highways with blinding head lights. I've found it difficult to drive at night as I've gotten older, but now it's becoming dangerous. It seems like these vehicles all have their high beams on all the time. If I were to drive with my high beams on consistently at night, would that be illegal? So I'm not sure how these new head lights are considered legal, when so many people are being blinded by them! Please banned these horrible blinding halogen/misaligned/led constant high beams and save lives. Please recall and replace these now!

B.3463 February 16, 2024 — Fort Collins, CO

It's scary driving at night anymore. Peoples led lights are blinding. Especially trucks being higher up. How are lights this bright even legal? It's ridiculous and uncalled for. It's like all led lit vehicles have a free pass to use brights, but they're normal. Drivers also intentionally mess with you all the time. There needs to be state laws to dim these lights. Only so many lumens and the right spectrum for safety. Accidents are waiting to happen and are happening all the time from these.

B.3464 February 16, 2024 — Lompoc, CA

White headlights are very problematic for me while driving at night.

B.3465 February 16, 2024 — MIAMI, FL

The current LED headlights cause me to temporarily see white, and flashes, and affects my ability to navigate safely at night. I have altered plans to avoid driving at night solely for this reason.

B.3466 February 16, 2024 — Smyrna, DE

LED headlights are blinding and dangerous fpr other drivers

B.3467 February 16, 2024 — Van Nuys, CA

I can no longer drive at night because of these dangerous LED headlights. Let's get them off the road now!

B.3468 February 17, 2024 — Roswell, United States

There's a simple solution to safely being able to drive at night and deal with bright headlights and street lighting along with the glare they produce. Just wear polarized eyewear while driving or anytime you're out in the evening. I have been doing so for years and have no issues with bright lighting. The polarized eyewear does make a huge difference in dealing with the glare. I use lenses that clip on to my driving glasses. They are available in different shades to use in the evening or daytime; bronze or amber for evening or rainy weather and shades of grey for daytime use. The polarized lenses also sharpen your vision when driving on the highway during rain and fog. Just be smart about it and don't wear too dark of a lens in the evening.

B.3469 February 18, 2024 — Braintree, United Kingdom

Dazzling Headlights are dangerous.

B.3470 February 18, 2024 — Leamington spa, ENG, United Kingdom

I am 73 and have my eyesight checked regularly. But when driving I find many headlights are far too bright. I don't think it is necessary to have such bright lights and I think they are dangerous, as they dazzle you so much it is difficult to see the road ahead.

B.3471 February 18, 2024 — N Bennington, VT

I might hit you head-on if you blind me. I might hit a pedestrian or biker, as I swerve away from your blinding lights to the edge of the road. So your overly bright and high lights are a safety hazard, even to YOU.

B.3472 February 18, 2024 — Washington, WY

These new vehicles and their headlights and the aftermarket headlights are OUT OF CONTROL. It's way too bright, and will cause many accidents. This needs to be changed, and heavy fines.

B.3473 February 19, 2024 — Leicester, NC

Dear god please dont let me die because some one in a giant vehicle is blinding me while I drive the winding mountain roads where I live!

B.3474 February 19, 2024 — Leominster, MA

I do support the ban on LED headlights from vehicle manufacturers and the aftermarket conversion kits also available for almost every make, model and year of vehicle today. I am a truck driver my self and if it's something that I hat the most during my driving time is the led headlights from other vehicles, specially on the pickup trucks. I understand that night visibility when driving is very important and requires extra attention versus day time driving; but how good and safe it is if in order for you to have a more clear visibility from the road ahead your vehicle headlights need to blind other drivers, pedestrians, bikers and everything else that is in your direction no matter if is a vehicle ahead of you or an income traffic vehicle. How many times did some one had a semi truck turn a highbean followed by a led light bar on the highway as an income vehicle or after you past by the semi truck. See, the driver of the semi truck is me, I'm tired to deal with these led's headlights during night time on the open road and to make things even worse a lot of truck drivers are converting the factory headlights with led kits and that become a big problem. Pickup trucks when load on the bed tend to lower the rear end making the nose of the vehicle point higher and that gives a impression to have a highbean on it instead of a lowbean. Let's go back to the old fashion headlights and that's it.

B.3475 February 19, 2024 — Louisville, KY

High intensity headlights are a safety issue that needs to be addressed!!

B.3476 February 19, 2024 — Minneapolis, MN

I drive between Minneapolis and Chicago often and with my smaller car I am often blinded by those in trucks with LEDs. It's quite frustrating and dangerous since it hurts my ability to see the rest of the surroundings

B.3477 February 20, 2024 — Auckland, New Zealand

Because every time I look at oncoming traffic I get flashbanged

B.3478 February 20, 2024 — Glasgow, SCT, United Kingdom

As one of the millions suffering from migraines, the lights not only completely blind me they make me want to vomit. If that happened maybe I'd end up on top of the oncoming headlight abuser.

B.3479 February 20, 2024 — Harwood Heights, IL

cmon bruh fix the lights

B.3480 February 20, 2024 — tallmadge, OH

I drive a small car and I am short, when i'm driving at night I can't see the road when passing LEDs or high beams. It hurts my eyes

B.3481 February 22, 2024 — Fort Lauderdale, FL

The headlights in all new and recent SUV's, trucks and especially the new Cadillac Escalades are absolutely blinding! It seems the majority of all the cars on the road now have these blinding headlights. I can barely drive at night anymore due to the fact I am constantly being blinded by oncoming traffic and these vehicles coming up behind me, and I know it is only a matter of time until I get in an accident. How can the motor vehicle department allow these lights to be legal? They must be banned or people are going to die!!

B.3482 February 22, 2024 — Westminster, MD

I am tired of car manufactures trying to cram as many LED's and other HID headlights that are intense in lumens, in such a way that it poses a real risk for everyone who has to be on the road with them. Especially when you factor in different heights of many of these vehicles, all the way up to big rig trucks, those of us in cars are absolutely getting wrecked by bright lights boring holes in our retinas. Many eye doctors around the United States are seeing higher rates of eye degeneration, due to being exposed to this blinding high intensity lumens that are allowed to be on the road. These headlights are insanely dangerous, and it is not always feasible for one to just "look away" from the headlights. There are people who are driving around with their headlights, led light bar wrapped around the headlights, their fog lights, and off-roading light bars full of LEDs, and other such headlight kits that absolutely blind the heck out of anyone within 50 ft of them on normal roads and highways. Those kind of people should be ticketed for being a road hazard. If you need that many lights, get off the road at night!!

B.3483 February 22, 2024 — Yardley, PA

I'm literally blinded by every light now. Driving at night used to be enjoyable. Now, it just hurts.

B.3484 February 22, 2024 — Yreka, CA

Let's get rid of these blinding headlights

B.3485 February 23, 2024 — Hillsboro, OR

Yes please. I have been in a few near-misses while being blinded by oncoming traffic.

B.3486 February 23, 2024 — Raleigh, NC

It is atrocious that some people think they need excessively bright Headlights, also the lights were never approved or tested.

B.3487 February 23, 2024 — Stratford, ENG, United Kingdom

Tired of having to literally close mid drive to avoid the blinding glare

B.3488 February 23, 2024 — United States

LED headlights are causing problems.

B.3489 February 24, 2024 — Lithia, FL

our great empire of life is threatened by these pieces of dog fecal mater because it stops you from seeing and you crash and die and there is no heaven so death will be permanent

B.3490 February 25, 2024 — Brooklyn, NY

driving at night has become very scary. I drive a sedan but there are way more suvs and high profile trucks on the road now. The newer ones especially have intense and often large headlight arrangements which sit at angle and emit a light that is absolutely harsh and blinding. It is even worse when during winter your outside windows and car mirrors may be a little dirty because it seems to have a prismatic effect. Add this to the hige rise in rude driving practices such as tailgating, lane hopping, speeding, etc and you basically feel like you're driving inside a disco ball with laser beams being aimed at you from every direction! I have had to purchase special night driving glasses which help somewhat but also diminish my ability to see as clearly. I really wish our govt would get off its ass and do something. These newer style headlights really should have met closer scrutiny before they were allowed to become so prevalent!!!

B.3491 February 26, 2024 — Dunlap, TN

Fuck these LED lights and the assholes who blind everyone with them

B.3492 February 26, 2024 — Saint Joseph, MO

This issue started a few years ago it seemed with about ten percent of cars at night. Lately, its about half of cars I encounter. It takes away my view and now distracts me as I have to turn on my fog lights and sometimes brights, just to be able to see my road. When the pavement is wet, it is just plain dangerous from the glare

B.3493 February 27, 2024 — Glen Ellen, CA

Night driving has become very stressful and difficult for me due to the intensity of headlights on new cars

B.3494 February 27, 2024 — Helena, MT

These headlights create unsafe driving conditions for all road users because of their intense glare and brightness. Operators of other vehicles can be blinded, which can lead to accidents with pedestrians, fixed objects, and other vehicles. Banning these headlights would make our highways and streets safer by reducing the potential for conflicts due to reduced visibility of drivers and pedestrians who have to look at these headlights. A national standard for brightness needs to be set and motor vehicles shall not be equipped with headlights above a certain threshold, period.

B.3495 February 27, 2024 — New York, NY

I drive at night and people are bragging about " lighting up people's cabs". They are blinding me.

B.3496 February 27, 2024 — Portland, OR

The blinding headlights are only getting worse. Now there is a whole big bar light across the front of some cars. They are so bright you can't see what's surrounding them. Dangerous.

B.3497 February 27, 2024 — Portland, OR

They blind drivers in oncoming traffic. Especially older drivers who are a large part of the drivers

B.3498 February 28, 2024 — Knoxville, TN

I can no longer drive at night because of the danger.

B.3499 February 28, 2024 — San Francisco, CA

With the increased popularity of SUV's combined with unnecessarily bright headlights the dangers for driving at night for lower chassis vehicles are increasing as well.

B.3500 February 28, 2024 — Snohomish, WA

FMVSS allows headlight beams that a horizontal. Mandating a 1% drop for instance 4 inch every 33 feet would be a good start. Pickup truck should have more drop because lights are mounted higher up by manufacturers design purely for aesthetics rather than safety of others

B.3501 February 28, 2024 — Stratford, CT

85 yrs old with dry eye and can no longer drive at night.

B.3502 February 28, 2024 — Takoma Park, MD

I want to retain the best possible vision health for as long as possible. Reducing incidents of extreme glare exposure, especially during the heightened-attention activity of driving or at-night driving times when you cannot look away or shield your eyes, seems like a sensible step towards that aim. Furthermore, moments of blinding light exposure while driving also threaten the safety of the public, both those in vehicles and pedestrians, and should be designed away via safety regulations.

B.3503 February 29, 2024 — Hamilton, United Kingdom

I find these blinding lights dangerous. Especially when they are fitted in these higher SUV type of vehicles. I literally cannot see where I am going after passing one on a hill or rounding a corner

March 2024

B.3504 March 1, 2024 — Billings, MT

I can’t drive at night anymore. Early evening when auto lights come on is a struggle and causes mild panic. These LED headlights are so bright, my mirrors are rendered useless, I drive through intersections with my hand in front of my face, and I can’t see lines on the road. Not only are the lights painful and debilitating, they’re simply dangerous. If I cannot see someone or something crossing the road because of another oncoming vehicle, there’s a huge problem. Sometimes they are so bright, I can’t even see if it’s safe to pullover. These are worse than traditional brights. I’m not even 40 and I can no longer drive at night. It used to be my favorite time.

B.3505 March 1, 2024 — Corydon, IN

These lights on the way home at night after a long day help me fight sleep, but only because I CAN'T SEE AND FEAR DEATH. These lights should be banned anyone who doesn't change their headlights within 3 months should receive a 5k fine and a driver safety course covering the effects your lights have on drivers.

B.3506 March 1, 2024 — Los Angeles, CA

They are hazardous.

B.3507 March 1, 2024 — Los Angeles, CA

Pedestrians of all ages and movement abilities are absolutely invisible when drivers are blinded by these lights. The danger created in our communities is HIGHLY underestimated.

B.3508 March 1, 2024 — Melrose, MA

These headlights are a hazard to every driver on the road!

B.3509 March 2, 2024 — Caledonia, MI

Is it too much to ask that it not be legal for headlights to be aimed right at my face as a sedan driver?

B.3510 March 2, 2024 — Dallas, TX

Obnoxiously bright headlights are very dangerous.

B.3511 March 3, 2024 — Minneapolis, MN

The blinding headlights need to be band. It is blinding, day and night time.

B.3512 March 3, 2024 — New York, NY

We are moving further away from what is good for us, and must reverse course.

B.3513 March 3, 2024 — United States

I'm tired of being blinded by terribly bright headlights

B.3514 March 3, 2024 — Van buren, ME

Led headlights are so damn bright that sometimes i cant even see the road 5 feet in front of my car, and thats while the oncoming car with the led's is still 1000 feet away, just gets worse as the car gets closer, theres been times i thought i was going off the road. Also led's in the rearview is a big issue.

B.3515 March 3, 2024 — ny, NY

They are dangerous

B.3516 March 4, 2024 — Amherst, MA

Most of my driving is on country roads, often winding and without any streetlamps anywhere. These new headlughts are a disaster for me. I am afraid to drive at night because of them. Suddenly I can't see that the road curves or that there is a deer ahead. I have to slam on my brakes until the other car passes because I'm completely blinded.

B.3517 March 4, 2024 — Bellerose, NY

I drive a sedan and have been "blinded" by the bright lights of oncoming traffic. These lights need to be aimed and focused properly to minimize the danger this poses.

B.3518 March 4, 2024 — Bellingham, MA

"AAA has published numerous studies about headlights and related issues such as glare and did not find a problem" Are they kidding? Are they paid off? I have to focus my vision at the right side of the highway when one of these insanely bright cars is approaching or risk temporary retina burn that makes it nearly impossible to see. And don't get me started about these LED light when the idiot driver has the high beams on...

B.3519 March 4, 2024 — Bradenton, FL

These headlights are dangerous. I almost had many accidents because I was blinded by them.

B.3520 March 4, 2024 — Burlington, MA

It's a type of impaired driving to me. When your blinded and guessing where the road is. It's a safety hazard plain and simple.

B.3521 March 4, 2024 — East Northport, NY

LED lights need to have stricter beam pattern regulations than traditional headlights. They also should not be allowed a certain height off the ground for these behemoth American trucks

B.3522 March 4, 2024 — Greenfield, MA

Today's LED headlights make driving so dangerous for so many drivers. Most of my driving in done locally, so I don't have the advantage of driving on a divided highway, so the oncoming traffic's LED headlights literally blind me. I try to drive less and less during the darker times of the day, but can not avoid this more dangerous time because of my work commitments. The brightness of LED headlights is so dangerous for so many people, I can't believe they're not banned! It's a matter of safety!

B.3523 March 4, 2024 — New York, NY

LED headlights are blinding!

B.3524 March 4, 2024 — Olathe, KS

I am 21 years old and have been driving since I was 16 and am scared one day I won't be able to see the road because of how bright these lights are getting from oncoming traffic. I get blinded at least once each night while driving and have trouble seeing for at least 30 seconds, that is 30 seconds at NIGHT that I cannot see while driving because of unregulated headlights and it's only getting worse.

B.3525 March 4, 2024 — Santee, CA

I'm worried I will get into an accident due to blinding oncoming headlights.

B.3526 March 4, 2024 — Trenton, NJ

Both me and my sister cannot drive at night because of the intensity of newer headlights. Several people in my family have diagnoses of migraines which includes light sensitivity and these new lights make it impossible for us to drive after dark. Please get rid of them, they truly are blinding to other drivers, not sure who thought these were okay to be on the road.

B.3527 March 4, 2024 — Watertown, CT

The LED lights in oncoming cars are so blinding that you actually cannot see the road. I am teaching my son to drive and he says it is getting so bad that he is just hoping he doesn't hit anything until the car passes. These lights are completely dangerous.

B.3528 March 4, 2024 — Woburn, MA

I don't drive late at night much but in winter in Massachusetts night starts by 3:30 pm therefore night headlights are needed. Cars with the new bright lights are blinding. I hate them because I can't see ! There has to be another way to improve night driving!

B.3529 March 4, 2024 — Woodbridge, NJ

Ok, so as I see it, there are a few options here. Either: A) ban these blinding headlights. B) require a warmer temperature light as opposed to the harsh bluish light. C) reinstate headlight aim as part of ALL states′ inspection requirements. D) allow tinting of windshields to reduce the glare. I, personally, have found a pair of lightly tinted, yellow lens, nighttime driving glasses reduces the glare to a comfortable/acceptable level while preserving visibility at night when there are no oncoming headlights. Allowing this type of tint (not a dark grey/smoke) would help those who either cannot find or cannot wear an additional set of eyewear. Any loss of visibility would be much less hazardous than being blinded a what could be a critical moment to avoid a collision. In any case, SOMETHING MUST BE DONE! Thank you.

B.3530 March 4, 2024 — oakridge, NJ

Almost everyday I am confronted by blinding headlights be it in a vehicle coming toward me on the opposite side of the road or behind me.I leave early for work before the sun rises and sometimes I am out in the evening. I drive a compact sedan.These lights are often seen on pick up trucks and large SUVs as it seems the drivers are compensating for something missing in there lives.I just turn my rear view mirror so there lights shine back on them and they immediately back off as they know they are purposely trying to show an aggressive behavior an now don′t like the backlash. Pitiful.

B.3531 March 5, 2024 — Barnstable, MA

Beyond the brighter lights and my own age making it harder, I would like to suggest that too many drivers leave their lights on high beam. It′s partly because the little icon on the instrument panel showing high beams disappears among all the graphics. It should be front and center. And I would like to see the ′automatic′ high beams eliminated. Too many opposing cars blind other drivers, whether from leaving on high beam or automatic high beam that is slow to dim, for example approaching a curve.

B.3532 March 5, 2024 — Douglaston, NY

Driving at night has become very difficult due to headlight glare

B.3533 March 5, 2024 — Lake Zurich, IL

i hate led headlights

B.3534 March 5, 2024 — Palm Coast, FL

I′m amazed at how many oncoming vehicles blind me with their headlights. I flash them believing their highbeams are on only to have them flash me back with highbeams totaling three times the light. This is much more light than necessary for navigating safely when dark. Some parameters need to be enacted on intensity and color of headlights as well as automatic operation of highbeams.

B.3535 March 5, 2024 — Ridgefield, CT

In order to see the road at night I have to put my (usually left) hand up to shield my eyes from the, way too bright, LED lights that all new cars seem to have, which could be dangerous if a car is going to turn in front of me. These lights should be outlawed.

B.3536 March 5, 2024 — Roselle, NJ

I have experienced LED lights shining into my vehicle so bright that it whited out my windshield and left me completely blinded, I had to stop my vehicle for a minute and let the other car go by. This is very dangerous. There is absolutely no reason to have headlights shining into peoples eyes and blinding them.

B.3537 March 5, 2024 — Xenia, OH

There are times I cannot see to my left, my right, in front of me, and or behind. I can not see the dividing lines on the road and had to have faith that I'm moving in the right direction. Even low beam LED lights make it incredibly harder to see. I wouldn't want to do that to someone else so I refuse to purchase led lights myself. Many Americans also deal with having an astigmatism which can make lighting more intense as is the case with me. Only police should have these lights on the road. One day I won't see something coming that I'd wish I would have.

B.3538 March 5, 2024 — Xenia, OH

There are times I cannot see to my left, my right, in front of me, and or behind. I can not see the dividing lines on the road and had to have faith that I'm moving in the right direction. Even low beam LED lights make it incredibly harder to see. I wouldn't want to do that to someone else so I refuse to purchase led lights myself. Many Americans also deal with having an astigmatism which can make lighting more intense as is the case with me. Only police should have these lights on the road. One day I won't see something coming that I'd wish I would have.

B.3539 March 6, 2024 — Australia

I am getting affected by these LED and HID light in my everyday life. Maybe its just a matter of time to have an accident. Goverment should ban these lights before it will get too late.

B.3540 March 6, 2024 — Bay Village, OH

I nearly died last week thanks to LED headlights

B.3541 March 6, 2024 — Cold Spring, MN

I often have to hold my hand up to block my mirror or on coming traffic in order to see the road when headlights are so bright.

B.3542 March 6, 2024 — Detroit, MI

Ban bright lights! It blinding us! Get regular and original lights back on all vehicles and bikes for our sakes!

B.3543 March 6, 2024 — Lehi, UT

Please ban bright headlights. I'm so sick of getting randomly blinded just trying to drive down the street.

B.3544 March 6, 2024 — San Diego, CA

Bright headlights blind other drivers making it more difficult to see pedestrians or other vehicles.

B.3545 March 6, 2024 — Tybee Island, GA

LED lights on vehicles and now being installed everywhere are too bright. These modern LED lights are a hazard to other drivers and are also ruining the nighttime environment when installed on houses and landscaping or as motion sensors. There is no current regulation and people are just blinding others with no penalty or law that regulates the brightness this has to stop.

B.3546 March 6, 2024 — Waltham, MA

Bumper height became law by regulation and the same could be done with headlight height made a standard height so that newer cars headlights are not in eyes of sedan drivers.

B.3547 March 6, 2024 — bronx, NY

It is ridiculous that these lights cause so much trouble and danger. Fix them or get rid of them!!

B.3548 March 7, 2024 — Wallingford, CT

These extremely bright and blinding LED headlights are a danger to other drivers and pedestrians! They must be banned ASAP

B.3549 March 9, 2024 — Pleasanton, CA

LEDs are the most toxic light source there is.

B.3550 March 9, 2024 — Rutledge, TN

I have blue eyes and migraines. My eyes are extra sensitive to bright lights. When I'm trying to drive and have to pass someone or someone gets behind me with the bright led lights I cannot see the lines at all and almost run out of the road every time. I'm so so tired of seeing more and more of these lights on the road. They're so dangerous and unnecessary.

B.3551 March 11, 2024 — Aptos, CA

These headlights are blinding, especially when on large vehicles that sit high on the roadways. They pose a danger to all nighttime drivers, pedestrians in crosswalks, wildlife crossing roadways, and to public safety in general. Please ban them.

B.3552 March 11, 2024 — Dalton, GA

I'm tired of not being able to see. Especially bc I live in a place where everyone has raised cars/trucks so their headlights are beaming the light of God in my eyes directly behind me.

B.3553 March 11, 2024 — Putney, VT

It's becoming very hard to drive at night. I drive a little car, lower to the ground. If an SUV or a Pickup Truck are behind me, I can't use my side mirrors. It feels like the person has their high beams on. Where I live, it's all 4x4 vehicles that are higher off the ground than my vehicle. I understand we all want to be safe, but this is just too much. It's so blinding at night, I have started pulling over on the side of the road to let people behind me pass. And if they're coming towards me in oncoming traffic, forget it. I have to cover my eyes or close them quick because I'm blinded.

B.3554 March 12, 2024 — Forney, TX

If i didnt know my town like the back of my hand driving at night would literally be fcking impossible, AND I have tinted windows

B.3555 March 12, 2024 — Lakewood, WA

It hasn't gotten darker over the past few years... so why am I getting multiple X-rays from headlights on my drive home from work every night? These headlights are so bright I have to look to the fog line and barely open my eyes and even then I'm temporarily blinded.

B.3556 March 13, 2024 — Raleigh, NC

they obstruct others view of the road because of the unnecessary brightness, if you need LED lights for driving, you shouldn't be driving.

B.3557 March 13, 2024 — SAN Diego, CA

I have never had an issue driving at night or with headlight glare up until recently. The latest headlights cause such a blinding glare that it is so difficult to drive against them on a normal open road and almost impossible driving against them on tight winding back roads of rural areas. Recently, while driving up to the San Bernardino mountains, I found myself almost crashing due to the intense HI VIZ lights staring back down at me from traffic coming down the mountain. Some thing needs to change... How many lives will it take?!

B.3558 March 13, 2024 — Salt Spring Island, Canada

Anyone with common sense knows that LEDs cause huge accident increases, especially with elderly drivers. LED is known to cause profound, permanent retinal damage and blindness with over exposures, and all through society these killer lights are diminishing the public's eyesight. This is

your typical indiffernce by corporate/government (same entity) to the well-being of we the people! We absolutely need to ban the headlights, street lights, and LEDs in all public and private facilities in most of North America. And likewise abandon mandates against safe, incandescents and the requiring of only LEDS and CFL - fluoresant - which both emit harmful RF energy, have terible spectral signatures which are bad for health, as well as corrupting electrical systems with dirty electricity, which degrades equipment and human/animal health.

B.3559 March 13, 2024 — lafayette, NJ

Bright white HED headlight are a hazard and car manufactures should be forced to revert to tradition holgens.

B.3560 March 15, 2024 — Honeoye Falls, NY

Blinding headlights are awful!!!

B.3561 March 16, 2024 — Boston, MA

I was blindef

B.3562 March 16, 2024 — Burke, VA

Bright AF headlights hurts my eye and causes headaches

B.3563 March 16, 2024 — Fishkill, NY

It is so dangerous for ne driving at night because of these headlights. They are in front and in back of me blinding me and I cannot see where I am going! It′s just terrible. The new SUVs have at least 6 if not 8 of these as standard. Unacceptable.

B.3564 March 16, 2024 — Richland, WA

I drive a sedan and now avoid driving at evening/night because it is becoming increasingly unsafe due to these LED high beam "regular" headlights. Would you want your family, neighbors, and even teenagers learning to drive be blinded resulting in an accident with major life long debilitating injuries or kill them or someone else just because of headlights? The increasing trends of accidents and fatalities cannot be ignored! At best, these lights are temporary blinding and at worst, they kill.

B.3565 March 16, 2024 — Springfield, MO

LEDS should be banned they blind way too many people and cause a lot of wrecks whether the light is led blue or led white it's insanely painful plus they flash too much and that can cause people to go into seizures and panic attacks and sometimes strokes it's absolutely not okay too have them need to be outlawed in all states

B.3566 March 16, 2024 — United States

Having low vision, I struggle anyway, and there is always a "bewitching hour" I leave events because of difficulty seeing while driving at night. I will NEVER forget the first LED lights my eyes got "hit by". I was totally blind. A higher power took my wheel because I COULD NOT SEE!! Just because a few selfish 'very cool' or just 'idiots' see it as a step up? No one can tell me these have caused no problems on any road at night. All you "cool" dudes? You'll save a life or two if you care. But EGOS run high on the people who install them or buy them on their new car. WE SEE YOU ALREADY! VERY COOL CAR. EXCEPT YOUR HEADLIGHTS MAKE YOU LOOK VERY STUPID.

B.3567 March 17, 2024 — Clovis, CA

I'm so weary of having to hold my hand up in front of my eyes as I drive at night when headlights are so blinding you have to block them out to try to see and be safe. What are we doing by allowing this? It's unsafe for everyone and we can easily do so much better. Please correct this immediately and let's get back to common sense road safety where we can all see again to drive without being blinded.

B.3568 March 17, 2024 — Roselle, NJ

There basically high beams. These blazing headlights are causing accidents. The glare is blinding

B.3569 March 18, 2024 — Asheville, NC

I′m only 23 and have trouble driving at night because of the absurd either bright or improperly aimed headlights. Outdated requirements for headlights, and uninforced existing policy has made it hard

to tell sometimes if the car has highbeams or regular brightness lights on. My vision is starting to become worse at night, and I now have a slight astigmatism, more so in my left than right. I shouldn't have to avoid driving at night or suffering headaches just because the people behind me want their lights to be so bright they can see my future. The cool people in their lifted trucks and tall sun's sure don't help, but improved regulation on headlight would be a start. Require new cars to have automatic pitch changing to their headlights as many cars do in Europe. As with most of what we do, the US is lagging behind the current headlight technology.

B.3570 March 18, 2024 — Brooklyn, NY

These lights literally blind u for a few seconds and are extremely dangerous. These drivers have zero consideration for everyone else on the road.

B.3571 March 18, 2024 — Daytona Beach, FL

These blind me and create more danger for drivers on the road. We've been just fine with regular headlights for decades; lets not ruin it with these LED headlights. If it doesn't stop, soon it'll be impossible to drive at night safely

B.3572 March 19, 2024 — Falmouth, MA

I find myself looking away from oncoming traffic even in the daytime because even a brief direct look at the overly bright headlights momentarily blinds me. Dangerous for everyone including pedestrians.

B.3573 March 19, 2024 — Revere, MA

I drive for a living and work early morning and evening hours. I find these excessively bright lights distracting & dangerous.

B.3574 March 19, 2024 — West Roxbury, MA

I thought I was alone or aging rapidly by being blinded by most new cars. I find Hondas/Acuras and the Cadillac Escalade to be the most aggravating. I work in the automobile business for many years and I get tbe technology. Was happy yo see the reported on WBZ and I eaderly sign my name to help find a solution for the offense of these laser-like headlights.

B.3575 March 19, 2024 — newton, MA

Those lights are blinding.

B.3576 March 20, 2024 — Attleboro, MA

It's getting very difficult to drive at night. New, blinding headlights. Either ban these or make brightness limits when getting vehicle inspecting

B.3577 March 20, 2024 — Dallas, TX

Its getting harder and harder to drive to workn in the mornings nowadays

B.3578 March 20, 2024 — Hartsville, TN

I sincerely departedly I'm concerned about this issue some lights in our area are so bright that literally have to stop in the side of the road until the vehicles pass is extra blinding when you live in the country and you have people with SUVs and with trucks that have turned over to LED lights or even projection lights it can cause complete and temporary blindness one of the thing in the state of Tennessee apparently off-road LED light bars are usable and don't need to be covered when on the state highways I am terribly terribly concerned about the condition is some unscrupulous drivers will use their light bars instead of their headlights apparently there's no log insist I feel it is very dangerous these lights are marketed and said to be off Road lights and I believe they should be treated as such if people are going to try to use them on the highways I feel they should be fine and ticketed this is my comment on this subject

B.3579 March 20, 2024 — Huntsville, AL

These light are so bright that are blinding to oncoming traffic. There have been many times when driving at night that I could not see anything in front of me, forcing me to come to almost a complete

stop, causing more danger to me and other drivers. I guess the main thing is "why do these lights have to be so bright that are putting others in harms way".

B.3580 March 20, 2024 — Indianapolis, IN

I had to stop driving at night . The Led lights are so bright and blind you . I shouldn't have to stop driving at night and getting headaches from the bright blinding led lights

B.3581 March 20, 2024 — Indianapolis, IN

Please ban the lights. Don't drive at night because of those lights can blind me and everyone else. Not Safe!!!

B.3582 March 20, 2024 — Lancaster, MA

This is a huge pet peeve of mine, not just the brightness of regular led bulbs but the inconsiderate drivers who exclusively use their high beams without dimming them to oncoming cars or travel behind other cars with their high beams on. Its rude.

B.3583 March 20, 2024 — Merrimack, NH

These lights make night driving dangerous!

B.3584 March 20, 2024 — Mill Valley, CA

It truly is a huge but frustrating common safety issue. Thankfully, it's fixable!

B.3585 March 20, 2024 — Plano, IL

I need to see too! Which I can not with bright white blue light in my face.

B.3586 March 20, 2024 — Quincy, MA

Good cause and so needed! Intense LED lights from oncoming traffic can be brutal - especially from big SUVs and pickups. OVERKILL! 💡 💡 💡

B.3587 March 20, 2024 — San Diego, CA

Light brightness and color is an issue as is car height. Another issue is that many headlights leave the factory miscalibrated. Ever notice a certain T-make illuminating the 2nd story of the building across the street. Yep. They shine at pretty much the same angle as everybody else's brights.

B.3588 March 20, 2024 — Springfield, NJ

Simple fix...set focusing standards and check at inspection stations...not ONLY emissions.

B.3589 March 20, 2024 — Winthrop, MA

I just learned about this BBH organization when it was featured on the local news (at noontime today). I have been concerned about the hazards of intensely-bright headlights and safety. I've been blinded by oncoming headlights and blinded from behind by agressive tailgate drivers. I'm relieved to know about this effort to facilitate changes. These bright headlights compromise our night-vistion and our ability to drive safely.

B.3590 March 21, 2024 — Bryantville, MA

The roads near me are narrow... when an oncoming car is using blinding lights I can't see the edges of my lane and struggle to not go off the road... I also can't see if there is anyone walking and these lights endanger pedestrians...

B.3591 March 21, 2024 — Chesapeake, VA

Aftermarket LEDs are awful!

B.3592 March 21, 2024 — Fort Collins, CO

I constantly feel blinded at night by these types of lights and believe that driving at night is unsafe when I can barely see the road when bright lights in my side mirrors blind me as well as traffic on the other side of the street or highway. It's definitely a big problem and I'm scared that when I grow older I will have more sight issues due to the increased use of these types of headlights.

B.3593 March 21, 2024 — Medford, MA

We need to be able to see when driving at night! No need for lights blinding us.

B.3594 March 21, 2024 — Milford, NH

Over the last few years I have thought "If someone needs a vehicle with that much light to drive at night they should give up driving!" Their "low beams are brighter than lots of vehicles high beams. A MAXIMUM lumens level needs to be set no matter the source providing the light. Eg incandescent/HID (a welders arc)/ LED. A law disallowing any vehicles to be driven on USA highways with a higher Lumen output. Eg. "OFF ROAD USE ONLY" However we also know how well that works (NOT) with exhaust systems sold as "off road use only"!

B.3595 March 21, 2024 — Providence, RI

I wear glasses and that is bad enough but when someone is coming towards me or especially behind me at night I am blinded. I have almost gone off the road. I live in a place that is very rural and street lights aren't always available. When someone is behind me I have to adjust all my mirrors to keep the light out of my eyes, and that is also dangerous. It's gotten to the point where I don't drive at night anymore because I'm afraid of having an accident. These lights have got to go. I agree they are great for night vision - if they're on your car. There has to be a better way around this. Get rid of those really bright ones!!!!!

B.3596 March 21, 2024 — Simpsonville, SC

My question is why do the manufacturers make LED lights so overly bright to begin with? There must be a way to lower the lumens, but no one in the industry seems to care about that or all the problems they're causing for drivers.

B.3597 March 22, 2024 — Belmont, MA

Too-bright headlights are a danger to everyone and they need to be prohibited.

B.3598 March 22, 2024 — Dover, NH

Bright headlights are blinding and hurt my eyes

B.3599 March 22, 2024 — Lincoln Park, NJ

Those lights are terrible and dangerous for workers who work at night on the road. Also for the average person over 40 who have to drive at night you can't see a darn thing they're terrible. I wish they would go back to the old headlights or come up with something that lowers them when they're coming to a lot of traffic.

B.3600 March 22, 2024 — Manchester, NH

Susan Lavallee

B.3601 March 22, 2024 — Taftsville, VT

I'd sign the a million times if I could!

B.3602 March 22, 2024 — United States

I know. We have to deal with this in Houston, Texas, among other places. This needs to end.

B.3603 March 22, 2024 — United States

I have to deal with this each night with my father.

B.3604 March 23, 2024 — Derry, NH

I have such a hard seeing while driving at nigh

B.3605 March 23, 2024 — FLAGSTAFF, AZ

Blinding LED headlights are a disability issue, as well as an issue for everyone on the road. I suffer from astigmatism, which causes light to hit my eyes at a warped angle and creates huge streaks in my vision. Driving at night has always been a bit challenging because of this. But in the past few years, it's become almost impossible. Recently, I was driving a stretch of I-70 in Colorado and was blinded by extremely bright headlights; I didn't see a curve in the road until it was almost too late. That kind of

vision impairment could have lead to me crashing into a barrier at 70 miles an hour. The fact that everyone knows these headlights are too bright, and yet nothing is done about them, is grossly neglectful and desperately needs to be addressed. We don't have to continue this arms race of ever brighter and more deadly headlights.

B.3606 March 23, 2024 — Minneapolis, MN

It is absolutely ridiculous that headlights have gotten so blinding bright. It is almost impossible to look ahead these days, I find I'm driving more and more while looking at the lane markers on the edge of the road, or off out into space just so I can see something, anything!

B.3607 March 23, 2024 — Pace, FL

I'm tired of driving blinded by oncoming headlights.

B.3608 March 23, 2024 — Westfield, NJ

Halogen projectors were more than sufficient for your average person to drive safely at night. If you truly need obscenely bright headlights to feel safe driving at night, then I'd suggest a visit to your opthalmologist.

B.3609 March 24, 2024 — Beaver, PA

Living in hilly Pennsylvania, it seems that every rise and intersection creates a blinding situation. I have often stopped dead in the road to avoid driving while blinded by incoming traffic.

B.3610 March 25, 2024 — Gilsum, NH

LED headlights are blinding to so many car drivers. Car/truck manufactures are making the front ends of trucks and SUVs much higher, so even their headlights on low-beams are hitting drivers of small cars straight in the eyes, blinding them. I know this from experience. It's dangerous and must be made illegal. I also have a problem with those adaptive headlights in other vehicles. Before they reach my front bumper, those lights go back to bright high beams, thus flashing me straight in the eyes right up close! This is a really horrible experience!

B.3611 March 25, 2024 — Solon, OH

Please pass the legislation or implement regulations to standardize car lights. We need to make roads safer!!! Thank you.

B.3612 March 25, 2024 — Wichita, KS

You guys are CLOWNS! LOL The lights aren't blue (oem at least) it's from the projector.... which ELIMINATES the glare . The light itself is white Boomers

B.3613 March 25, 2024 — Wichita, KS

🤡🤡🤡🤡🤣🤣🤣🤣

B.3614 March 26, 2024 — United States

I'm old enough to know the new headlights are brighter than the old "brights".

B.3615 March 26, 2024 — United States

The blinding headlights are just too dangerous!

B.3616 March 26, 2024 — Wahiawa, HI

These lights have triggered my migraines. I feel so unsafe driving when it's dark because those lights literally blind me. I've had to pull over and wait for the aura to leave. It just reminds me of camera flash and I hate it. Rural areas without a lot of city lights/street lights makes this issue stand out even more. It really feels like I'm going to hand over my keys earlier than I could've anticipated because if I'm having this much trouble in my 30s, I can't imagine how it will be when I'm 60.

B.3617 March 27, 2024 — Las Vegas, NV

I can't f-ing see and almost died tonight. I've had enough.

B.3618 March 27, 2024 — Oak Park, MI

Bicyicleist can not see ANYTHING with snow on-coming car with those lights

B.3619 March 28, 2024 — Paonia, CO

LED lights are dangerous and should not be used on cars. The fact that these were designed as a deterrent to environmental safety is a lie. They have a higher content of mercury than the incandescent lights.

B.3620 March 28, 2024 — Portage, MI

I keep getting blinded by LED headlights almost every time I drive at night and I'm sick and tired of it. I've gotten multiple migraines from this and worry that I'll end up getting into an accident because of how much I'm having to look away from the road/close my eyes.

B.3621 March 28, 2024 — Silver Spring, MD

There is absolutely no need for such high intensity automobile headlights! And they are extremely dangerous to drivers from the opposite direction.

B.3622 March 28, 2024 — York, PA

Don't believe the statistics fit the time frame for the yrs. involved but still really hate those lights. Thorough study of their affect couldn't have been done, at least not properly.

B.3623 March 29, 2024 — Los Angeles, CA

These lights are horrible! They make driving at night a safety hazard and scary. Cars with these lights tailgate and when they eventually pass, I am feel like I am blinded for a good while. Please abolish this monstrosity! This is not doing any one any good

B.3624 March 29, 2024 — Miami, FL

Pay VERY Close attention to pages 11 -&- 21 of this study of pedestrian deaths in the US. Besides the usual factors of the increased saturation of taller SUVs/Pickup Trucks, Distracted driving by Electronic Devices, etc, etc, etc notice how we were doing so well with pedestrian death continually on a decline but, it started to skyrocket since 2010 ? Guess what came into increasing prevalence since 2010 (LED Headlights). Also, on page 21, You'll see Dark hours pedestrian fatalities significantly increase while daylight hours stay relatively flat ? Shouldn't they increase at an even rate ? Aren't LED headlights, LED Streetlights supposed to make everything & everyone safer especially at night ???

B.3625 March 29, 2024 — Miami, FL

https://www.ghsa.org/sites/default/files/2023-06/GHSA%20-%20Pedestrian%20Traffic%20Fatalities%20by%20State%2C%202022%20Preliminary%20Data%20%28January-December%29.pdf

B.3626 March 30, 2024 — Bangor, NIR, United Kingdom

Compare headlights 25 years ago and now - it is not only the LED / projector bulb which is an issue, but the surface area of the reflector which is used to disperse the light. Headlights were around 6" in diameter. Stylists have made headlights smaller and smaller until they are often mere slits in the bodywork. There should be a minimum size for the reflector's surface area as well as a maximum luminance ! This combo avoids any need for more electronic gizmos and would correct a basic design fault ! I sometimes walk home from the pub on well lit streets and often have to shade my eyes from intense (dipped) headlights - always from newer vehicles.

B.3627 March 30, 2024 — Columbus, OH

I can no longer safely or comfortably drive or bike at night. It's not just a highway issue, drivers will idle with their lights on in neighborhood streets, unknowingly making the entire corridor an unrelenting hellscape of white light.

B.3628 March 31, 2024 — Framingham, MA

I drive a lot at night on highways. Not only are the lights themselves annoying but the way people tailgate amplifies oncoming streams of light compounding the problem.

B.3629 March 31, 2024 — Millburn, NJ

The newer bright headlights from oncoming cars are glaring and unsafe. They prevent me from seeing the road in front of me.

B.3630 March 31, 2024 — Northampton, MA

The headlights make it very hard to see anything except the on coming lights. It is dangerous!

B.3631 March 31, 2024 — Pepperell, MA

There are so many different levels of headlight brightness coming towards me that I find it blinding and extremely dangerous. It is especially bad on backroads where there are no other lights to light the area and highways where there could be continuous streams of headlights coming towards me.

B.3632 March 31, 2024 — highland, NY

these headlights are blinding to the point you can't even see the lines or people walking etc. however, that is when people decide to turn them on because i've also noticed another problem is people aren't using their headlines when they should be.

B.3633 March 31, 2024 — nantucket, MA

I'm regularly blinded when driving at night. The new headlights must be adjusted so that everyone is safer.

April 2024

B.3634 April 1, 2024 — Amherst, MA

My car is 2008 and the new lights simply blind me, often when they don't even have brights on! It's made me avoid driving at night as much as possible. But where I live all winter it is dark by 4:30 and I get stuck driving home from medical appointments or grocery shopping and streets are glaring with lines of car lights as people come home from schools or work. HELP! I really worry about the bike riders because these lights add to their dangers. All my friends, many of them younger than me, complain about these new lights. On top of this, if you don't own a big recent SUV yourself, the lights are higher and directly in your face. I wear glasses for driving with glare reduction including for blue light and it's still worse than ever before. We need to stop this nightmare on the roads.

B.3635 April 1, 2024 — Briarcliff Manor, NY

I hate getting blinded by those L.E.D. bright lights!

B.3636 April 1, 2024 — Cambridge, MA

I am one of the over 60 drivers and I find these lights nerve -wracking, especially driving in the dark, which has made me increasingly reluctant to drive at night. I don't see this "upgrade" in lighting as a positive development.

B.3637 April 1, 2024 — Central Falls, RI

The brighter lights make it harder to drive at night

B.3638 April 1, 2024 — Plymouth, MA

I am experiencing this so badly that I avoid driving at night. The problem could also be cataracts, folks. But when you experience both, like I do,-wow!

B.3639 April 1, 2024 — Sedona, AZ

I no longer drive in the dark for this very reason. I absolutely cannot see and it is terrifying. To say this is not happening is outrageous. Something needs to be done. Please.

B.3640 April 1, 2024 — santa cuz, CA

I can't even drive at night anymore. this is ridiculous.

B.3641 April 2, 2024 — Arlington, VA

I have found the lights on emergency and Dept. of Transportation vehicles so bright that they are blinding! These lights make me look away when I should be looking at the road and they even cause

blindness for a few seconds. Also, the headlights on cars are so bright that they are dangerous because you can not see a pedestrian crossing the street because the lights blind you. Even the tail lights have gotten brighter and are painful to my eyes. The bright headlights are even offensive from behind and cause me to move my mirrors to avoid the painful effect they have on my eyes. This is dangerous because I can't see passing cars or see the cars behind me. I have many friends who have complained about these same issues. It is time you take action and stop allowing the use of these LED lights.

B.3642 April 2, 2024 — Cheadle Hulme, ENG, United Kingdom

find it so difficult to drive with these bright lights. far to bright and being a small car owner they shine through the windscreen. dangerous.

B.3643 April 2, 2024 — Plymouth, ENG, United Kingdom

they are dangerous the light are a blur

B.3644 April 2, 2024 — fort stewart, GA

Too bright!!!

B.3645 April 3, 2024 — Chicago, IL

OMG do I need to say more. !!! How our Government allowed this is insane. They want us blind, broke and starving. I am on my Senator all the time. Can't drive even in daytime.

B.3646 April 3, 2024 — Chicago, IL

{"videoUrl":"https://stream.mux.com/eVQiHMXbqnvmICItrzLC4kLMSq005HtYPwLHsnkmeHG8","cloudflareUid":"28fe8a804997bffea31de859be9197ed","muxAssetId":"1fCRWiKAAVFeVARS02NW8pi02t7ogiFtZq00rBZl7YvYhg","muxPlaybackId":"eVQiHMXbqnvmICItrzLC4kLMSq005HtYPwLHsnkmeHG8","muxPlaybackUrl":"https://stream.mux.com/eVQiHMXbqnvmICItrzLC4kLMSq005HtYPwLHsnkmeHG8","muxThumbnailUrl":"https://image.mux.com/eVQiHMXbqnvmICItrzLC4kLMSq005HtYPwLHsnkmeHG8/thumbnail.jpg"}

B.3647 April 3, 2024 — Croydon, United Kingdom

I have astigmatisms in both eyes. I am being blined and now not driving in the dark.

B.3648 April 3, 2024 — Dublin, Ireland

I cannot drive safely at night with current levels of glare and brightness from other drivers' headlights

B.3649 April 3, 2024 — Hackensack, NJ

it is so dangerous

B.3650 April 3, 2024 — Indianapolis, IN

I HATE blinding headlights

B.3651 April 3, 2024 — North Royalton, OH

This should be an obvious no brainer, and yet dept of transportation federally and locally are inept...

B.3652 April 3, 2024 — Stockport, United Kingdom

Blinding LED lights have been an ongoing issue for a number of years now and I am surprised that the government has not raised and tackled the issue sooner. I dread to think how many road deaths of car drivers, motorcyclists and pedestrians can already be attributed to this and how many people have their lives restricted by the issue of not wanting to drive at night. Surely if you can select the degree of whiteness of LED lights in your kitchen then manufacturers can do the same for road vehicles. It also appears that there is currently no direction control on headlights. Older MOT.s always had headlights directed to the left in the UK. Reduce road deaths and get this issue resolved.

B.3653 April 4, 2024 — Addington, ENG, United Kingdom

Whoever came up with the idea LED bulbs this bright for cars is a numpty. I know many poeple who say they cuffer or just dont drive at night becasue of this.

B.3654 April 4, 2024 — Chicago, IL

We should get together and sue the government if a death or injury occurs. Take pics asap if you have an accident and of the car with dam lights!!!! The people using them are aholes and don't give a dam!!!

B.3655 April 4, 2024 — Claremont, NH

Get rid of the blinding headlights!!!!!!!!!

B.3656 April 4, 2024 — Claremont, NH

Do you tolerate bright light being shined in your eyes at night? I no longer drive at night because of it. I hope you can see because I can't ! That's right, this is America and you don't care.

B.3657 April 4, 2024 — Houston, TX

LED lights are extremely blinding to the eyes. They should be out right banned for safety reason. Lights also shouldn't be too blue as it hurts the eyes. They should be yellow or soft white.

B.3658 April 4, 2024 — Willesden, ENG, United Kingdom

These LED lights are unregulated and too bright - especially hazardous on SUVs as they are directly in the sight line of drivers in ordinary cars. They are a dangerous hazard and should be regulated so they are less powerful and a warmer colour (2700 - 300 Kelvin would be an acceptable colour temperature) We had no problem seeing the rd with filament lights - so the "safety aspect" of brighter lights being safer - quoted by the manufacturers is irrelevant and unnecessary. All LEDs need proper regulation - but car headlight must be a priority as they are a health and safety issue.

B.3659 April 5, 2024 — Brunswick, GA

I can't even drive at night any more, this has been taken away from me because of other people's LED, high-beam headlights. It is really unacceptable that I am blinded by other people's headlights to the point that it's a safety issue because I can no longer see the road.

B.3660 April 6, 2024 — Warminster, United States

I couldn't be any happier to join in this to get rid of these blinding lights. Especially on trucks and SUVs

B.3661 April 7, 2024 — Knoxville, TN

As a truck driver who often drives at night these headlights are blinding and dangerous.

B.3662 April 7, 2024 — Scarborough, Canada

This is a serious problem

B.3663 April 7, 2024 — Silver Spring, MD

These lights are clearly a hazard to oncoming traffic. How can they even be legal?

B.3664 April 8, 2024 — Glendale, AZ

Going on a roadtrip and its impossible to see anything behind me with those lights!

B.3665 April 8, 2024 — Saint Louis, MO

I'm constantly blinded by these lights in the city. It feels like it's causing me flash blindness which is definitely a safety concern.

B.3666 April 9, 2024 — Albuquerque, NM

The new LED headlights are brighter than the old bulbs were on highbeam, and are DANGEROUS to oncoming traffic as they blind other drivers.

B.3667 April 9, 2024 — Columbus, OH

Car LED lights have a major affect my light blue colored eyes both during day and night time. Besides temporarily blinding me, I also noticed it affects my eye retinas as I also temporarily see black spots more often after getting blinded LED lights as I get older.

B.3668 April 9, 2024 — Spokane, WA

I suffer from epilepsy and in doing some research found this petition. While bright headlights itself does not effect me so much, the use of LED lighting literally everywhere does! It is discriminating against the 3 million people of us within the US who also suffer from this. I can not go in to a store more than 5 to 10 minutes before I have issues, I can not drive under LED street lamps or look at any lights any where that have changed to LED. Places I never had issues going to until just the last year or two I can not be at more than a few minutes. While I understand the rush to "go green", you are not thinking this through for the people who literally can not be around this lighting because it is dangerous! It causes life threatening seizures! And now you can not even buy "normal" light bulbs any more for your home so what do you want us to do that can not handle the LED's? Light our homes with candlelight? Just like the push for EV cars - there needs to be some thought behind things. I am in architecture and design so I am well aware of good design and this is very very bad design!!! The politicians in charge need to stop bickering amoungst themselves and actually LISTEN to the people they claim to represent. ALL THE PEOPLE! Including those of us who can not be around this new lighting!

B.3669 April 9, 2024 — St. Peter, MN

LED lights are garbage and bad for living bodies

B.3670 April 9, 2024 — St. Peter, MN

I'm not good with words but LED lights need to be done

B.3671 April 10, 2024 — Cheadle, United Kingdom

Sometimes you are blinded whilst driving in dark and raining conditions.

B.3672 April 11, 2024 — Hewlett, NY

It's almost impossible to drive at night anymore. As an older adult, my eyes don't recover quickly enough. Makes driving hazardous

B.3673 April 12, 2024 — Pittsburgh, PA

I work in the optical business. These headlights cause disabling glare. In particular if a patient has cataract not removed yet. Terrible idea.

B.3674 April 12, 2024 — Rialto, CA

I've been blinded by vehicles of newer years multiple times it's a very dangerous thing I am afraid of crashing

B.3675 April 13, 2024 — Chicago, IL

We can spray them black or put tape or break

B.3676 April 13, 2024 — Chicago, IL

Under Biden everything stupid now. That's how

B.3677 April 13, 2024 — Holden, MA

The lights are a safety hazard

B.3678 April 13, 2024 — Pittsburgh, PA

I am a victim of these destructive lights, I complained to my eye doctor and they said "unfortunately you have the glare lends, it's the car lights which a lot of people have trouble with" so Fck them lights

B.3679 April 14, 2024 — Bozeman, MT

These blinding bright lights are making being able to drive a hassle because the amount of times I have nearly gotten hit from not being able to see is insane

B.3680 April 14, 2024 — Portland, OR

The people behind this crime against humanity, are killing people intentionally, flat out causing wrecks and blindness. That is the truth, and they should be banned permanently as well as the new led street lights. They are terrible and shame on the people that have imposed upon us.

B.3681 April 15, 2024 — City of Saint Peters, MO

With my astigmatism, I don't feel safe driving any time past sundown.

B.3682 April 16, 2024 — Bishopville, MD

On Nov. 3, 2022 at 9:14 p.m. an approaching vehicle had LED headlights on high beam which blinded my vision and ended up in a ditch. Which the approaching vehicle did not stop kept on driving. My vehicle was totaled and I suffered a very bad concussion. The LED headlights should be banned. My accident could have been a lot worse.

B.3683 April 16, 2024 — Dickinson, ND

These lights make it unsafe to drive. My husband has a horrible time seeing with these led headlights passing by but I have it much worse because of the halos around lights that I get after having lasik. This is a COMMON side effect with lasik. How many accidents need to happen from these horrible lights before common sense prevails.

B.3684 April 16, 2024 — Indianapolis, IN

I value my eyesight and safety. Ultra bright headlights are damaging to the eye and dangerous as they blind you from seeing potential danger.

B.3685 April 16, 2024 — Tenafly, NJ

As a migraine sufferer, these headlights trigger migraines and create dangerous driving conditions for me.

B.3686 April 21, 2024 — Allentown, PA

I have been hurt multiple times by these bright lights and they are unnecessary

B.3687 April 21, 2024 — Cadillac, MI

As someone who has journeyed through the evolving landscape of our nation's roadways, I stand before you at the age of 38, having witnessed a significant transformation in automotive lighting. The advent of LED headlights has brought about a dichotomy of experience: a beacon of progress for those behind the wheel of such equipped vehicles, and yet, a blinding hazard for those ahead. I am privileged to navigate the night sparingly, but let us turn our thoughts to the countless Americans for whom darkness is a daily passage. They traverse vast distances, night after night, to sustain their livelihoods and support their families. It is a journey made perilous by the blinding glare of oncoming traffic. With the passage of time, the challenge only intensifies. The stark, piercing lights that line our roads do not discriminate by age, but the resilience of our eyes does. The danger of being blinded by these lights is not just a discomfort—it is a looming threat to our safety. Consider the plight of my wife, who finds the night unnavigable, plagued by headaches induced by the relentless strain of modern headlights. Her vision, like that of many others, cannot adapt with the swiftness of youth. The glare is not merely an annoyance; it is a barrier that obscures her path and endangers her journey. This is not an isolated struggle. It is a shared burden, a collective risk that we must address. It takes but a fleeting second for an accident to occur—a second where lives can be irrevocably altered. We stand at a crossroads where technology and safety must converge. We must advocate for regulations that protect all travelers, ensuring that innovation illuminates our path forward without casting a shadow upon others. Let us strive for a future where every American can drive under the starlit sky with clarity and peace of mind. Thank you.

B.3688 April 22, 2024 — Fort Worth, TX

The State used to take responsibility for checking headlights annually with vehicle inspections. What happened? Most mornings my family experiences temporary blinding from just a handful of selfish TX drivers. This happens in school zones and is infuriating. We don't feel safe driving blind around children! Get em out!

B.3689 April 24, 2024 — Madison, OH

Yes please. Some people don't have them on or off when necessary, certain times of the day here in Ohio, but sometimes law has not gone far enough to protect our health and life.

B.3690 April 25, 2024 — Newmanstown, PA

I get a headache when under LED, Halagon and florescent

B.3691 April 25, 2024 — Roseburg, OR

I can't see when someone with bright headlights on.

B.3692 April 26, 2024 — Kearney, NE

Daytime driving is now negatively impacted with bright LED headlights distrupting depth of field vision and creating blind spots.

May 2024

B.3693 May 1, 2024 — Culver City, CA

Do not want any more emails about this. Please remove my name.

B.3694 May 1, 2024 — Dillsburg, PA

My heart went out to the elderly patients in a nursing home recent Iy as the hallways were insanely bright.

B.3695 May 1, 2024 — Macedon, NY

Tired of being blinded on the road. It is not safe given that after exposed I cannot see a thing.

B.3696 May 1, 2024 — Melbourne, Australia

I drive city to country regional one night a week and don't need extra aggrevation on my eyes on a 80 minute trip. Besides night should be calmer. I don't want night to be like day or I can't sleep at home. It disrupts our circadian rhythms. The world seriously needs *less stress* right now.

B.3697 May 2, 2024 — Adelaide, Australia

After 13 years as a delivery driver I am now blinded almost every night by maniacs in huge utes/4wds/suvs with giant bullbars and massive extra high-beam LED spotlights used completely inconsiderately, sometimes intentionally, causing eye pain, blindness and nausea. We've had 124 years of automobiles and never deemed any of it necessary except in the past 5 years. This is entirely mental illness (narcissism/psychopathy).

B.3698 May 2, 2024 — Chicago, IL

I'm 49 and can't drive at night in a major city, this is insanity. It's too bright! Unfair to keep people off the road like this and it's killing people

B.3699 May 2, 2024 — Glendale, CA

I can't see well at night anyway but being blinded does not help

B.3700 May 2, 2024 — Rochester, NY

Everyone including decision makers who drive at night is well aware of this hazard particularly in wet weather. It's time for leaders to step up, take accountability and act accordingly.

B.3701 May 2, 2024 — Toms River, NJ

This is so dangerous to the on coming driver, completely blinding them, especially the trucks with 4-6 lights coming towards a car. Think about other people for once.

B.3702 May 3, 2024 — Mechanicsville, VA

Please! Stop blinding me so that I don’t have a car accident that could lead to the loss of life!

B.3703 May 3, 2024 — Tacoma, WA

Screw LED headlights! And screw poorly done HID and LED retrofits! There are people who would still be alive today if these things weren't on the road!

B.3704 May 4, 2024 — Doylestown, PA

These new headlights must be removed they are a huge pain and companies must be forced to get rid of them and replace the ones they sold for free.

B.3705 May 5, 2024 — Ashland, PA

It's scary to guess where the road is because of another driver's LED headlights, and it's even more scary for the people that are not driving a truck, SUV, or van. It's time we make evening driving safer for everyone.

B.3706 May 5, 2024 — Fairport, NY

So glad someone is doing this. My last night trip was awful because of those lights Thanks for doing this

B.3707 May 7, 2024 — Australia

I hate driving at night now every second car blinds you i think these people must be scared of the dark.....

B.3708 May 7, 2024 — Reno, NV

This petition matches the goals of my Nevada Civil Action Project, and as someone with astigmatism, I would greatly appreciate a reduction in the brightness of LED headlights.

B.3709 May 10, 2024 — Denver area, CO

LEDs lights and to me, especially used on cars, are a real hazard; my city will now no longer use anything other in its streetlamps than LEDs in showing the world what a "green" and sustainable place it is. Ban or at very least, regulate this type of light to where we are not continually in danger of harm.

B.3710 May 10, 2024 — Golden Valley, MN

LED lights are blinding.

B.3711 May 11, 2024 — Evansville, IN

I can not see when these cars headlight are coming towards me.

B.3712 May 11, 2024 — Halifax, Canada

It's dangerous to drive with blinding lights in your eyes at night. Get rid of them

B.3713 May 11, 2024 — Philadelphia, United States

Thanks for the highly useful information. I will now quickly adopt more incandescents in my home environment.

B.3714 May 12, 2024 — Ely, United Kingdom

Very dangerous

B.3715 May 12, 2024 — Portland, OR

Finally!! led lights are fine in some cars, mostly German, but new Toyota, Hondas, Subaru and Mazda have so much glare, that it's frustrating to drive at night. Worst offenders are trucks or higher cars!! This is both a law enforcement and lack of policies governing light intensity problem. Most people don't realize if their headlights are misaligned and are causing glare to the opposite traffic. And manufacturers have started putting LEDs in reflector headlight assemblies which makes the issue of glare even worse. We need policies that limit the intensity of glare. Matrix LEDs are too expensive but do a great job at not blinding the opposite traffic.

B.3716 May 14, 2024 — Portland, OR

This LED headlight epidemic and the resulting difficulty and stress of simply being outside has impacted my life so greatly, I feel like I'm now a handicapped person--just for having a slight astigmatism. I'm trying everything I can to adapt: I wear sunglasses all the time now, I bought blue-light filtering glasses, I tilted my side mirrors down, I'm going to tint my windows, including my windshield. This is such a glaringly (pun) obvious oversight and negligence by the NHTSA. Nothing else--not divorce, not a terrorist attack, not politics, not drugs--has affected my day-to-day quality of life like this has. It sounds pathetic, but I can't stop obsessing and feeling heartbroken for just being reminded of the mass ignorance and selfishness in this country every time I leave the house. All of these people purposefully chose to make the worst part of life EVEN WORSE. It may have been the

last straw on the camel's back, but I seriously need therapy now because I just don't know to cope and be "normal." My life is literally worse because of this. Is this not the most eligible scenario for a class action lawsuit, like ever?

B.3717 May 14, 2024 — St. Augustine, FL

I think are far too dangerous.

B.3718 May 14, 2024 — sagada, Philippines

I hate LED

B.3719 May 15, 2024 — Glasgow, SCT, United Kingdom

These lights are so bright, they're dangerous.....accidents waiting to happen.

B.3720 May 15, 2024 — Kansas City, MO

They are blinding!

B.3721 May 15, 2024 — Westfield, IN

I have bad night vision and try to avoid driving at night. I'm heavily dependent on lighting and road markings. I was in an area where the lights were off and the markings weren't well maintained. A truck was across from me and it was tall enough to shine its extremely bright headlights into the cabin of my car and into my face. The light lingered in my eyes for a while afterwards and a car was behind me trying to turn left. I could not see and almost hit the median. I looked up why the lights lingered for so long and it's because the lights are bright enough to burn the cells in your eyes responsible for night vision.

B.3722 May 16, 2024 — Livermore, CA

Blinding headlights, especially when drivers leave them on the high or brightest setting causes accidents and make driving at night harder.

B.3723 May 17, 2024 — Philadelphia, PA

These hyper bright LED headlights are DANGEROUS!!! Even in daylight traffic my retinas are burned by them as they approach me, and they are especially especially blinding at night!!! They should be illegal and taken off the market!!

B.3724 May 22, 2024 — Campbell, CA

I've lost count of the number of near accidents because of blinding LED headlights.

B.3725 May 22, 2024 — Secaucus, NJ

Every other car on the road it seems has had insanely bright lights that make it impossible to see where you're going without hurting your eyes. It's dangerous and it has been an issue that seems to just be getting worse for at least a year now. I've noticed this in various states across the US.

B.3726 May 23, 2024 — Candler, United States

I had a TBI in 2011 and have been hypersensitive to direct high-contrast ever since. While I have had some improvement in my condition over time, this timeframe also coincides with the brightening of headlights on the roads at night. I can not safely drive at night or in the rain due to the threat of high-intensity LED headlights. This impacts my employability. I have changed jobs several times since my injury, and finally sold my house & moved in right next to where I work. Even walking at night is hazardous for me, as I can experience dizziness, blurred vision and even "blinding out," where all I see is white light. This also often leads to migraines, which cause me to miss work and suffer greatly. I would appreciate any and all efforts to regulate headlights to a level that is safe for other drivers.

B.3727 May 24, 2024 — Katonah, NY

The light pollution that is occurring on U.S. highways is the beginning of the newest environmental disaster for wildlife, especially migrating birds

B.3728 May 26, 2024 — Brooklyn, NY

Intense LED headlights are irritating and the glare is dangerous.

B.3729 May 26, 2024 — Quechee, VT

If you can't see with regular headlights, you shouldn't be on the road at night anyway. Your compensating lights blind everyone else, including those whose vision is perfect. Road hazard.

B.3730 May 27, 2024 — Phoenix, AZ

I have been blinded by those super bright lights.

B.3731 May 29, 2024 — Parrish, FL

Bright blinding headlight glare gives me a near death experience at least once per week! It must be tamed!

B.3732 May 31, 2024 — Chicago, IL

I put reflective material in my rear window. It works great and sends the light back to that ignorant driver. They could do something but don't. I shine my LED light out my window also when there's an *** toward me.

B.3733 May 31, 2024 — Chicago, IL

We will all get macular degeneration. They have an evil agenda with this. Under Biden's admin.

B.3734 May 31, 2024 — Chicago, IL

Our evil admin. has a plan that's why nothing's being done. It's not America anymore.

B.3735 May 31, 2024 — Fountain Hills, AZ

STOP those damn blinding headlights! Consider where these lights are from just like the mercury lights! Our enemy wants us blind! They are illegal and TOO BRIGHT!

B.3736 May 31, 2024 — Jacksonville, FL

Ban the production and sale.

June 2024

B.3737 June 3, 2024 — Pflugerville, TX

I am in my mid-to-late 20s and I have recently noticed that driving at night has become significantly more difficult due to the prevalence of extremely bright LED lights on vehicles. We need to fix this now!

B.3738 June 4, 2024 — Lombard, IL

I can't see when driving on the road. I'm 20 I'm supposed to have good eyesight and for the most part I do, but I can't drive when I'm being blinded by the light of god on all sides. I've started driving at night with sunglasses because I genuinely can't see. And what's worse is that I see better with the sunglasses on that without them because the LEDs light up the entire road. The best part is that even with sunglasses on tho, they're still blinding at times. Isn't it illegal to have something on your car that impares another driver? Well the LEDs are imparing my ability to see so I don't get why they aren't illegal. I even tried talking to a cop about why they never pull people over for their brights and LEDs and I was told they aren't "high enough priority". Funny how someone driving 5-10 miles over the speed limit is higher priority than not being able to see the road at all. Either I have to wear sunglasses or put my hand in front of my face to not be blinded but then the problem is if my hand is in front of my face I can't see the road at all. These LED's aren't safe and there's no way for me to avoid them. Sure they make it easier to drive at night for YOU. But what about ME? What about every other person on the road that's not in the same car as you? What about those of us with shorter cars? Are we just supposed to suffer? I don't feel safe driving at night. And it's even worse on cop cars too. Especially when you get pulled over and all of their lights are blinding not only the person who's pulled over but every other person on the road but now it's white, red, and blue lights blinding you while they blink on and off. And I'm wondering if cops aren't as affected by the LED's since their windows are tinted so people can't look in. Doesn't it work both ways? If people can't look in I'd assume it means it blocks out a lot of the light from LEDs. Something has to change there's no way this is safe for people. The people who love them are the people in tall cars with blinding LEDs since no other car is tall enough for it to bother them. I just want to be able to see the road when I'm

driving. Isn't that the whole thing we were taught in school? Don't drive if you can't see? I can't just stop in the middle of the road but I might if people keep doing this. I shouldn't have to choose between not seeing the road or just barely seeing the road.

B.3739 June 5, 2024 — Chicago, IL

Please stop allowing people to drive with these blinding headlights. I can not see well when they are coming toward me and feel as though I could crash. They are just too dangerous.

B.3740 June 6, 2024 — houston, TX

bright LED lights are a hazard to other drivers. Be safe

B.3741 June 7, 2024 — Manchester, MO

It is wildly dangerous. I'm a ride-share driver, and working at night has become genuinely frightening. If they were pointed down even a few degrees, it would make a world of difference.

B.3742 June 7, 2024 — Toronto, Canada

Vehicles should annully be checked for dip

B.3743 June 8, 2024 — Brooklyn, NY

These headlights need to be regulated as to acceptable total brightness to avoid the blinding glare. It needs to be handled as soon as possible to prevent further accidents.

B.3744 June 8, 2024 — Niceville, FL

Those lights blind me.

B.3745 June 8, 2024 — Round Rock, TX

This is very frustraiting

B.3746 June 8, 2024 — Salem, NJ

The lights are blinding! This needs to stop

B.3747 June 8, 2024 — Santee, CA

Driving at night is unbearable with blinding headlights.

B.3748 June 8, 2024 — Somerset, MA

I agree it is very dangerous for pedestrians and also have experienced the pain in my eyes from them.

B.3749 June 9, 2024 — Bellevue, WA

I've never had an issue seeing the road in my 1990 Toyota, but since led lights became normal I can barely drive at night. My friends with astigmatism are even worse off, many no longer able to drive at night at all. End this disgusting hazard once and for all.

B.3750 June 12, 2024 — Beverly Hills, CA

I just want to drive at night without having to swerve to avoid being blinded

B.3751 June 12, 2024 — Beverly Hills, CA

I just want to be able to see

B.3752 June 12, 2024 — Kirkland, WA

I never had migraines before the recent onslaught of super-bright LED lights in all the new vehicles. I don't remember anyone claiming that existing cars' headlights weren't bright enough but all of a sudden in the last few years, I can't drive after dusk without being blinded. It's horrible being subjected to massive light-induced migraines on a daily basis just to get home from work. It has cost me so much in my quality of life. It needs to end now.

B.3753 June 13, 2024 — Ahmednagar, India

I almost had accident due to this white light people use it as upper which blinds the car ahead and front of them

B.3754 June 13, 2024 — Cedar Rapids, IA

LED headlights trigger my migraines and make it extremely difficult for me to drive at night, and I'm a YOUNG ADULT. I can only imagine how it's impacting older people. You don't need a 5,000 lumen industrial-grade spotlight to drive your awful SUV at night.

B.3755 June 13, 2024 — Parsippany-Troy Hills, United States

It causes accidents.

B.3756 June 13, 2024 — Tallahassee, FL

The brights on a car with halogen bulbs are a special light that must be activated by a lever. If your headlights are the same as standard brights, it is too dangerous.

B.3757 June 14, 2024 — Winston-Salem, NC

What changed? It used to be that running brighter high beam headlights within 500' of an oncoming vehicle was illegal because it blinded the opposing driver. Now manufacturers are allowed to install even brighter "low beam" lights that cannot be dimmed, blinding oncoming drivers when cresting a hill or when the vehicle is loaded in the rear or is pulling a trailer. This is dangerous and should be brought back under sensible control. Please regulate the brightness of low beam headlights.

B.3758 June 15, 2024 — Newtown, United States

Used to love driving at night, my eyes are so sensitive I can barely do it anymore.

B.3759 June 15, 2024 — silver spring, MD

i get migraines whenever i drive at night now

B.3760 June 16, 2024 — Ashland, OR

Super bright Led headlights are harmful to the eyes and super dangerous. I have to wear yellow glasses at night so I can still see without being constantly blinded. This shouldn't be allowedto happen. This is outright dangerous and needs to be banned immediately

B.3761 June 20, 2024 — Indianapolis, IN

I absolutely hate driving at night now it's like everyone is driving with their brights on. I can't see and they blind me and I am only 38 years old. I have 20/20 vision. There is nothing wrong with my eyes and there is everything wrong with these LED bright lights. They need band and they need band immediately

B.3762 June 20, 2024 — Springdale, AR

I've almost crashed a few times already with how bright some trucks have their headlights. I drive a sedan so I'm constantly blinded by these cars and trucks that have even brighter headlights than I do. I've came across a few already where they light up my whole entire car just by being behind me at a red light. It's becoming a bigger issue as time passes and something needs to be done about it.

B.3763 June 30, 2024 — East Point, GA

I absolutely HATE these lights. I drive a regular car, not a truck or suv. I hate them most when people are driving with them on in the middle of a bright sunshine day!! Why!! I can't even go out at night anymore, as most people are now driving with the bright beams regardless of on coming traffic. Please Make It Stop!!!!@

July 2024

B.3764 July 1, 2024 — Austin, TX

This causes a dangers to approaching traffic.

B.3765 July 1, 2024 — Fort Worth, TX

I literally cannot see at night.

B.3766 July 9, 2024 — Greenville, SC

This is so important!

B.3767 July 11, 2024 — Huntley, IL

I mean. Has there ever been a time where a single human being has said, “I love those LED headlights in new cars!!! They help me see so much better now that more people have them!” ?????? Your honor, I rest my case. — also, I want to note that does f150s/f250s are like the second or third most purchased car in the entire United States — so the most blinding incident when it comes to stupid LED headlights (a truck that is raised up & apparently has enough headlights that it can double as a stadium light for football fields…) — this is an incident that happens regularly, and Al too often. The only thing worse than an LED headlight would be two strobe lights. Legit one step above strobes. Ban them.

B.3768 July 13, 2024 — New Orleans, LA

I use yellow lense safety glasses for night driving. They work well .The yellow lenses knock out the glare from on coming traffic .

B.3769 July 16, 2024 — Severna Park, MD

Go back to YELLOW LIGHTS these bright white LED and the ones abused by idiots thinking it will blind others should be outlawed. LED were adopted to be used as a communication device later. Halogen could not be used for that purpose.

B.3770 July 21, 2024 — Navarre, FL

They’re truly insufferable, it makes me fearful to drive on roads without street lights as is most common in the USA. I fear i won’t be able to see someone or something in the road or miss a curve if I’m on an unfamiliar road, they’re as bright as regular high beams but that’s just their normal setting! There needs to be heavy regulations on how bright they can be or an outright ban and return to the yellow that used to be standard, the LEDs make the roads more dangerous and are only safer for those that have them but even then I’m sure they’re unable to see as well when they come upon another vehicle with them.

B.3771 July 22, 2024 — Cambridge, United Kingdom

Iwmacer

B.3772 July 25, 2024 — Sebastian, United States

Michael Ciufo

B.3773 July 30, 2024 — Auburn, WA

This is a real problem, and needs addressing. Lights are brighter than they were in the past, and drivers don't think of others.

B.3774 July 31, 2024 — Rocklin, CA

Yes this is f*cking rediculous. I also sent an email to the national highway traffic and safety administration. By the way, never "chip in" on this website, it's a scam. 100% of the money goes to change.org. None of it goes to the cause you want to support.

B.3775 July 31, 2024 — Sacramento, CA

I have a bad case of astigmatism and these lights at night maje it so dangerous for many while driving at night.

August 2024

B.3776 August 1, 2024 — Searsmont, ME

I'm sick of halfway veering off the road

B.3777 August 2, 2024 — Port Charlotte, FL

These unregulated led and ultra bright headlights are a major distraction and safety issue.

B.3778 August 4, 2024 — Amherst, MA

Turn your high beams off when passing oncoming cars too!

B.3779 August 4, 2024 — Conway, AR

Driving at night is too dangerous because of LED lights. I want the road to be safer for my family.

B.3780 August 5, 2024 — Mesa, AZ

I can't drive at night with out being temporarily blinded by a giant SUV's bright headlights

B.3781 August 6, 2024 — Norwich, CT

The new headlights are very blinding.

B.3782 August 8, 2024 — Albemarle, NC

I already have bad eyesight as is and even with me wearing glasses at night I still get flash banged and I absolutely cannot see anything for a solid 5 seconds and have to slow way down so I don't wreck into anything. This morning, we're in the middle of a hurricane and I'm on my way to work and it's still pitch black. This truck has the most god awful obnoxious amount of headlights and awfully bright along with that. I was horribly blinded and couldn't see anything but god himself and all his glory on the front of the truck and almost ran off the road. Keep in mind with this hurricane and it raining like it is, it's already hard to see so I'm already on the verge of having a meltdown driving to work because the roads are flooding and there's sticks and whatnot in the road, so to be flashbanged by some a**hole who likes to see the hair on a raccoons a** at night, I definitely cried after that.

B.3783 August 9, 2024 — Saugus, MA

These headlights are a major safety hazard! Oncoming blind you so that you are forced to slow down to an almost complete stop. When they drive behind you, they shine in you rear and side mirrors making it virtually impossible to safely change lanes. I literally have to angle my mirrors completely away from my vehicle because I cannot see. They need to he out lawed.

B.3784 August 14, 2024 — Fairchance, PA

I drive a small car and I have come across issues where i am completely blinded due to a truck behind me blaring their led "low lights" straight into my back shield lighting up the whole car, piercing into all three mirrors, reflecting perfectly into my iris. the only solution to this free laser eye surgery is to flip my rear view mirror and completely turn my outer mirrors so that they are completely useless. well in my case, it's more useful to not see what's on my sides in exchange for the ability to keep my eyes open.

B.3785 August 14, 2024 — Peoria, AZ

I almost dread having to drive at night now, it's ridiculous that I can't drive without being constantly blinded by these LED lights, it's outta control. I'm so glad to see I'm not the only one who thinks this has got to stop!

B.3786 August 18, 2024 — Knoxville, TN

I have an '85 Camaro & it's INSANE too drive at night with ALL the STUPID, ARROGANT self-centered IDIOTS who BLIND me from behind with these INSANE, after-market egotistical HID/Xenon lights that SHOULD BE BANNED!!!!! Enough is enough NHTSA!

B.3787 August 20, 2024 — Niceville, FL

I have astigmatism. It makes light sources look like a lens flare in a movie. The brighter the light compared to the ambient light, the bigger the flare. The LED headlights are so bright that they can occupy my entire field of vision, especially at night. This leaves me unable to see signs, lines, and other cars on the road. It is wildly unsafe. I am one of thousands of drivers in the US with astigmatism. I cannot emphasize how dangerous these lights are to other drivers.

B.3788 August 21, 2024 — Abbeville, LA

I, along with many others, are about to lose our ability to drive at night because of these outrageously bright lights.

B.3789 August 22, 2024 — Australia

Health is affected by bright light.

B.3790 August 23, 2024 — staten island, NY

I have started to drive less and less at night because I can't stand being blinded in my mirrors while driving. It's unsafe, and it can be very distracting. I also have sensitive eyes, so those strong bright lights hurt sometimes as well.

B.3791 August 26, 2024 — Victorville, CA

These lights are very blinding they have blinded my eyes to where I only see blackness and makes it very dangerous to drive with these on your face on your eyes

B.3792 August 31, 2024 — Gulf Breeze, FL

These led headlights are dangerous and I've almost crashed already multiple times. They should be banned completely in the name of public safety.

September 2024

B.3793 September 4, 2024 — laurel, MS

I'm signing because these kinds headlights or what caused the wreck that my mother-in-law died from and my sister-in-law is in bad shape

B.3794 September 5, 2024 — Middleburg, FL

Headlights have become so bright they are blinding even in the day time. In Florida!

B.3795 September 5, 2024 — Philadelphia, PA

It hurts my eyes so much and i dont understand why people put them on their cars. Its not cool at all.

B.3796 September 6, 2024 — Louisville, KY

I'm blinded and can't see anything going to cause me to have an accident. They're getting worse every day.

B.3797 September 9, 2024 — Dayton, United States

I flash my flash light at them so they can see how it feels

B.3798 September 9, 2024 — San Francisco, CA

I struggle with driving at night for long distances because the reflection of these bright lights in my mirrors + with glasses triggers migraines for me. Almost as annoying as the amount of times my husband complains about the bright lights to me. ;)

B.3799 September 10, 2024 — Henrico, VA

I am 23 years old and can barely drive at night due to LED headlights. I am forced to make reckless driving decisions because I cannot see behind or beside me, let alone in my rearview mirror. There is no need for any vehicle to have headlights that are automatically that bright; that is why 'brights' exist. Save it for back roads when there is no ambient lighting and no other drivers.

B.3800 September 10, 2024 — Old Forge, PA

I hit a deer because the person coming my way had bright led's and i couldn't see! The deer had jumped out into the road but it was last second when i finally saw it!! Had significant damage to my car and anxiety for over a year when driving at night!!!!

B.3801 September 10, 2024 — Wixom, MI

What a ridiculous world we live in where this has gotten so completely out of hand. What a great way to show you literally care about nobody but your yourself. The manufacturers need to be sued for the countless deaths I'm sure they've directly caused due to these lights.

B.3802 September 11, 2024 — Saucier, MS

Imagine driving on the winding roads of one of America's national parks before sunlight. Now imagine blinding headlights speeding around a curve. How is it fair that only some individuals get to use public roads after dark?

B.3803 September 12, 2024 — Dallas, TX

Astigmatism, these lights make it impossible to leave work or go anywhere in the cool afternoon/night.

B.3804 September 12, 2024 — Encino, CA

In the last few years I've noticed all the headlights are too bright. I can't look directly at anything and I'm always afraid I'm going to hit a pedestrian at night because the lights are so blinding you can't see anything in the road. I can't see behind me at night and all the trucks with daytime running lights blind me in the daytime. This is really too out of hand and it seems like auto makers are really trying to kill people by causing blindness or seizures or accidents. We need dimmer headlights, not brighter.

B.3805 September 12, 2024 — Fredericton, Canada

This flickering causes me so much pain both in daytime and night. I think it′s absurd to have this amount of light, or this amount of flicker in an auto′s forward facing lights. I am terrified that there is an animal or (heaven forbid) a person beyond the beam of light while I try to navigate the roads at night.

B.3806 September 12, 2024 — Oskaloosa, IA

I have a family member who has epilepsy and I have conversion disorder. Nobody should have to lose their independence because we can′t look out for our vulnerable members of our society.

B.3807 September 12, 2024 — Queens, NY

Driving at night has become incredibly dangerous with these ridiculously blinding headlights.

B.3808 September 13, 2024 — Anchorage, AK

Mathew S

B.3809 September 13, 2024 — Ashland, OR

These lights are unnecessary and causing more trouble than they are worth. And who is benefitting from this push? And who are the pushers? Suspicious and corrupt.

B.3810 September 13, 2024 — Fremont, CA

The road feels less safe and makes for tiring driving

B.3811 September 13, 2024 — Mesa, AZ

I have been blinded by lights in the city and on highways from people behind me. It's made it dangerous to drive at night because their lights are So Strong!

B.3812 September 13, 2024 — Wellesley, MA

I have astigmatism and I am nearly blinded by the ultra-bright lights on the road, to the point where I have been forced to pull over at times. This so extremely unsafe.

B.3813 September 13, 2024 — san antonio, TX

The height of newer truck fronts, and their headlights, have become blinding / dangerous for standard size vehicle drivers …

B.3814 September 14, 2024 — Aguilar, CO

crashed my bike once because I was blinded by bright headlights 👍🏽 people die because of this.

B.3815 September 14, 2024 — Tucson, AZ

I used to love driving at night because there fewer cars on the road, all I had to do was watch out for wildlife crossing the road…. But now I have to wear sunglasses at night and constantly adjust my mirrors, raise my hand to block the light reflecting on my rear view mirrors. What's the point of these mirrors anyway if we can't even see ? That's the problem with these LED lights WE CAN'T SEE because of them. And they're completely unnecessary.

B.3816 September 15, 2024 — Albany, NY

Enough is enough. Laws should have been put in place before this became the nightmare it has become. These headlights are not only a safety hazard but a health hazard as well. Quality of life has diminished in towns and cities across the U.S due to these ridiculous headlights, the prevalence of chopped illegal mufflers and super bikes. Banning these headlights would be a step in the right direction. After that how about the police start enforcing the noise laws already on the books to hand out tickets en masse to stop the increasing prevalence of illegal loud chopped mufflers on import cars and motorcycles, as well as super bikes? Do something now! The people have had enough!

B.3817 September 16, 2024 — Conroe, TX

Blue light activates two receptors in the eye (of three total). It activates them in an area where they are both highly sensitive. Blue light appears to humans to be brighter than it is because of this. LED lights usually emit light in nearly a single wavelength because it is cheapest to produce single-wavelength LEDs. Not only do I believe that LEDs are exceeding legal limits for other headlight emitters, but I also believe that they have almost no consideration built into the law for the fact that single-wavelength blue-light LEDs appear MUCH brighter (to humans) than their luminosity would suggest because the blue light is so easily detected by the human eye whereas there are large swathes of the light spectrum emitted by other lights that are harder for the human eye to detect, but which are still measured in luminosity tests. Using something like OKLab to test PERCEIVED luminosity of previous headlamp emitters which were legal and not widely considered too bright ... then scaling that to any proposed (or existing) light emitters would make for a great start to reducing glare which is blinding the HUMAN eyes on the road. We need NHTSA to make changes.

B.3818 September 17, 2024 — Kalispell, MT

I am tired of not even wanting to drive at night. I am ready to put a mirror on my bumper!

B.3819 September 18, 2024 — United States

https://www.tpr.org/news/2024-05-16/pennsylvania-woman-may-be-the-first-in-u-s-to-be-tested-on-ties-between-non-epileptic-seizures-and-led-exposure

B.3820 September 18, 2024 — Weare, NH

Please put limits on how bright car lights "appear". Also require that cars have a default setting of low beams and it requires manual change for high beams.

B.3821 September 19, 2024 — TN, United States

I cannot see a foot infront of me when a truck with LEDs drives twords me. It's 2024, I don't want to hit something I can see.

B.3822 September 20, 2024 — Clayton, NY

Not only are DRLs blinding other drivers , they are also very distracting when someone is driving close behind you or tailgating you with those lights. These lights are completely unnecessary in daylight and they are also contributing to climate change, by cars using more fuel to constantly power these lights and the lights releasing extra heat into the environment, especially on hot, sunny days and with billions of cars on the roads.

B.3823 September 20, 2024 — Las Vegas, NV

My vision for the past month now has been terribly disrupted by these led lights. They're visible from miles away and not for a good reason. I'm tired and irritated that these exist. Specially in a bright, super lit city. It's actually disgustingz

B.3824 September 20, 2024 — South Orange, NJ

Duh

B.3825 September 23, 2024 — Hamburg, NY

I find them blinding!

B.3826 September 24, 2024 — Berkeley, CA

blinding headlights are a life-threatening hazard causing serious accidents

B.3827 September 24, 2024 — Chicago, IL

Those explosively bright lights on a dark road temporarily disable one's vision, and require a period of re-accommodation once they pass. It's simply an unsafe situation. This is where government needs to step in and act on behalf of the populace.

B.3828 September 24, 2024 — Derby, IA

I have noticed that a lot of LED lights for any use are damaging our eye's one of the first things affected is depth perception then focus and then can't read anything for nothing. I also think fog lights should be banned along with most LEDs. And if people would dimm there dash lights they could see better to because they glare on the windshield blocking view. Then ban any light on buildings shining directly towards roadways. And motion detection light that comes on when car goes by

B.3829 September 24, 2024 — North Providence, RI

I have to avoid driving at night because of how unbearable modern headlights are, Also those lights make it harder to see turn signals and license plates.

B.3830 September 24, 2024 — Watsonville, CA

This is long overdue!! LED headlights are without a doubt BLINDING to oncoming drivers! I know as so many do, enough near death experiences!

B.3831 September 25, 2024 — Escondido, CA

I feel my brain physically hurt from the constant blinding flood lights of oncoming cars. Even the cars behind me, their lights bling me from the rear view. I'm 23 years old and I feel scared for the future. It's so painful and dangerous to have to deal with this.

B.3832 September 25, 2024 — Santa Cruz, CA

I'm being blinded every time I drive! They burn a hole in my head.

B.3833 September 25, 2024 — Strasburg, VA

Those lights are blinding!

B.3834 September 26, 2024 — Berkeley, CA

So many headlights I find quite blinding. They are truly hazardous and could cause an accident!

B.3835 September 27, 2024 — Leawood, KS

It feels like a matter of when, rather than if anyone will get in an accident due to being blinded by insanely bright LED headlights. I am losing count of the number of times I will be driving at night and then, from hundreds of feet away, I can already see blindingly bright headlights coming my way. That is bad enough, but people will even have their brights going with these, making it feel like you are driving while staring in the sun. This whole thing is selfish and stupid. Please ban these.

B.3836 September 27, 2024 — Montgomeryville, PA

I suffer from migraines, light sensitivity and my daughter has astigmatism. There have been many times where we were almost in a car accident due to excessively bright headlights passing us or behind us.

B.3837 September 27, 2024 — Salt Spring Island, CA

I have been blinded by the bright headlights so much that I have had to come to a complete stop... not good at night perhaps. They should not be allowed. Our safety is more important than one person seeing way too clearly.

B.3838 September 29, 2024 — Gulf Breeze, FL

I've personally almost crashed multiple times and have had a collision with a boat sticking out in the road, you can't see nothing when those cars are coming at you with those led headlights. Another failure in the name of public safety.

B.3839 September 29, 2024 — Winston Salem, NC

This really needs to be addressed.

B.3840 September 30, 2024 — weaverville, CA

I've almost been killed driving at night on my mountain roads. Try to avoid night driving altogether now because of this but sometimes it's unavoidable. Whomever thought this was a good idea should be shot!

October 2024

B.3841 October 1, 2024 — Murrysville, PA

Connie

B.3842 October 2, 2024 — Winston-Salem, NC

I already have vision issues I don’t need unnecessary bright lights impeding my vision when driving

B.3843 October 4, 2024 — Ooltewah, TN

They’re AWFUL

B.3844 October 5, 2024 — Falls Creek, PA

If People Need THAT HORRIBLY BRIGHT Of A Headlight To See To Drive. Then They Shouldn't Be Driving AT ALL...

B.3845 October 5, 2024 — Leander, TX

I’ve had so many near horrible accidents due to how bright they are. it’s ridiculous that they were able to even be allowed in the first place.

B.3846 October 6, 2024 — San Diego, CA

Something has to be done! With so many experiencing issues and difficulties with nighttime driving due to glare of headlights, how can this problem be ignored. It’s unsafe but necessary to drive during nighttime. It looks like everyone is driving around with high beans on. Older model headlights are safer. How could the powers that be in California not want to make the roads safer for all.

B.3847 October 9, 2024 — Herriman, UT

I'm a young adult with decent vision and am starting to have a hard time driving at night because so other people's lights are so bright they blind me. I can't feel confident making left turns when LED headlights are in front of me because I can't see if other traffic is coming or if there are pedestrians in the crosswalk.

B.3848 October 10, 2024 — Portland, OR

Since money is the biggest motivator in the USA: Think of all the lost money, and hit to the economy from every person who avoids driving at night now due to being blinded. These lights need to go. Regulate them. Ticket them, and generate even more money as you fix this.

B.3849 October 11, 2024 — Evansville, IN

I'm tired of being blinded by blue light LED headlamps and outside lighting.

B.3850 October 11, 2024 — Shreveport, LA

Mechelle D Thompson

B.3851 October 13, 2024 — Nashville, TN

Other drivers on the road that have these super bright headlights make it nearly impossible for me to drive at night without the use of sunglasses. I have been pulled over multiple times because of it and given written warnings. The manufacturers of these super bright headlights need to stop and politicians need to start banning them in their states. Without sunglasses I literally cannot see the road to drive. I have nearly wrecked several times driving home from work over the last couple of weeks, because I couldn’t see the road.

B.3852 October 13, 2024 — Phoenix, AZ

I drive 1500-2000 mi./wk for Lyft in the PHX metro area ("The Valley") and I am astonished by how many times I am blinded by LEDs in cars behind me/in mirrors & from head on traffic. It is literally like everyone is driving w their hi-beams on, but they're not. Last time I checked, before these f***ing LED headlight bulbs became a thing, if you had your brights on and approached a police cruiser from the front... if said police vehicle flashes you to turn your brights off and you don't, you would be pulled over and ticketed! So why are these a**holes who use these nuisances for bulbs in their vehicles headlamps not being pulled over and ticketed now?? It's the most egregious safety hazard I have ever encountered in the road in 37 years of driving. These things are DANGEROUS AF!!!!!!!!!! Ban them already, FFS!!!!!!!!!!!

B.3853 October 14, 2024 — Kansas City, MO

the headlights are way out of control and endangering me and my family while we're on the road at night. I'm generally not a huge fan of lots of regulations for stuff in transportation or any other industry, but this is a big problem.

B.3854 October 15, 2024 — City of Saint Peters, MO

I ride motorcycles and have almost gone off the road at night due to the insanely bright LED headlights from oncoming large new trucks and SUVs. Sometimes when cars are tailgating me their lights are so bright I can no longer even tell if mine are on? Driving at night sucks now. I'm just grateful I was a youth during the halogen days when you didn't go blind driving at night. Deeply sorry for all the lives lost and folks hurt from our government's inability to address this issue in a timely manner.

B.3855 October 16, 2024 — Corning, United States

Every day when I take my children to school I have to ride with my visor down because of these lights. And it still doesn't help. My car sits low and I'm short so the bigger vehicles shine directly into my windows, rear view mirror and causes a major glare. In the short 10 mins it takes to get them to school I have eye pain and a headache from the brightness. I can't see at night so I don't drive. I've bought transition lenses for my glasses which do nothing. These lights are a safety risk and need to be banned or dimmed way down.

B.3856 October 18, 2024 — Boulder, CO

These lights are absolutely horrible, we need to get rid of all the bright LED lights!! Bike lights, head lamps, car, truck, motorcycle, semi.....all of them! We do not need these lights so bright!!

B.3857 October 18, 2024 — Rockmart, GA

I believe LED headlights are dangerous. No matter how low they are "aimed", if the road grade or curvature is on a slope the lower-positioned driver will still get blinded. The situation becomes extremely perilous on any two lane undivided highway or country road.

B.3858 October 18, 2024 — pascagoula, MS

These LED Headlights are blinding us out here on the road trying to safely get to where we are going!!! Ban and outlaw LED headlights NOW!!!

B.3859 October 20, 2024 — Cleveland, OH

I have been pulled over more than once for going too far RIGHT in right hand lane. Why? I was blinded by led headlights. I can no longer drive after dark which means I do less shopping (not a 'day person', and refuse to change) and has severely effected my social life. Really feel they (government) are trying to blind us. Yet another reason not to trust them.

B.3860 October 20, 2024 — Jonesboro, GA

Ban these lights! It's ridiculous.

B.3861 October 21, 2024 — Harrisburg, PA

Have seen cases in clinic, primarily deer-strikes, where a driver couldn't see the deer because of oncoming headlight glare. Please do the absolute smallest thing for us and better regulate automotive headlights.

B.3862 October 21, 2024 — Woodridge, IL

I have a dimming rearview mirror and it's a testament that lights are too bright when that's not even enough anymore to keep lights from blinding me from behind. Not to mention, changing lanes becomes dangerous when some jerk is hitting you with his high beam LEDs. I've also noticed that not long after being hit with a blast of light to the eyes, a migraine often sets in. Enough is enough. We know that we can't trust consumers to act responsibly. There is no reason auto manufacturers should even give them the option to endanger others like this.

B.3863 October 22, 2024 — Bolingbrook, IL

SAFETY!!

B.3864 October 22, 2024 — Concord, MA

These LED headlights are a hazard for oncoming drivers

B.3865 October 22, 2024 — Lewiston, ME

LED headlights seriously need to be banned. If we can't legally use our high beams, then how are these okay instead? My high beams are dimmer than most LEDs! Driving at night is truly a nightmare for me, especially with my astigmatism. These lights are unnecessary, no one needs to be able to see 40 miles ahead, for goodness sake. Ban these. They're terrible and unsafe.

B.3866 October 22, 2024 — Paoli, PA

I have chronic and severe migraines that make me photophobic almost all of the time. This makes night time driving very painful and difficult.

B.3867 October 23, 2024 — Mechanicsburg, PA

These LED lights are dangerous!!! The lights are so bright and always in the on coming traffic eyes!! You would think these lights would at least be pointed down at the road instead of up at the eyes??? I've lost sight of the road multiple times when vehicles with LED lights coming towards me. Something needs to be done about these lights!!!!

B.3868 October 23, 2024 — Minneapolis, MN

Been driving me crazy(lol) that a lot of people don't understand how dangerous these are, and even end up getting upset at the drivers who's vision becomes affected. Still dealing with a blind spot from the amount on the roads where I live.

B.3869 October 24, 2024 — Macon, GA

It's truly a problem

B.3870 October 24, 2024 — Salem, MA

Blinding headlights are a totally unnecessary problem which can be fixed with this simple legislation

B.3871 October 24, 2024 — Toronto, Canada

I'm blinded daily by headlights that are too bright and probably not pointed in the correct direction - it makes my commute to work in the morning very difficult and much less safe than it could be

B.3872 October 25, 2024 — New Albany, IN

I myself struggle to see on the roads with people with LED headlights that are on during the day and brights are almost always on at night!! today (October 25th 2024) for example, multiple and I mean multiple cars with their brights on during the DAY for christ sake and at night just to have them on do headlights really need to be this bright?? NO they do not. I'm blinded every day and unable to see properly because of these headlights they are unethical for main road use!!! Many people crash due to these lights blocking their view of the road. LED LIGHTS DO NOT NEED TO BE ON CARS!

B.3873 October 27, 2024 — Melbourne, Australia

I believe that this causes accidents especially in remote areas going around bends it's literally blinding and I believe has taken lives already we need to make sure this is passed immediate In 2012 led's were still classified as lasers ffs!

B.3874 October 28, 2024 — Los Angeles, CA

Things have gotten so far out of hand with these bright headlights. These car manufacturers care more about installing spy software in your car than issuing a nation wide recall and replacing these blinding headlights with softer lights. Even after all of the accidents and deaths no one in power who can make a difference seems to care. Only in America!

B.3875 October 28, 2024 — Paris, KY

You can't see anything and you can't even hardly see the moon and stars

B.3876 October 28, 2024 — Titusville, NJ

These are increasing even though I'm pretty sure they used to be illegal. Scientific research has been supporting the use of red-based lights at night, to the effect of blue-filtering lenses being sold widely. There is no logic behind bright blue lights at nighttime other than being able to see everything on the road-- however, this fails to consider the other drivers approaching who are then unable to see past these lights. It is actually a road hazard, and can disrupt our sleep and for some people potentially even at least temporarily damage their retinas.

B.3877 October 29, 2024 — Nalgonda, India

https://education.nationalgeographic.org/resource/light-pollution/ National geographic channel on light pollution. Its bigger that we think it is. Its about day and night light pollution as LED DRLs during day are adding to increased hot temperatures.

B.3878 October 31, 2024 — Rome, GA

People shouldn't be blinded while traveling 60mph+, the fact this hasn't been dealt with sooner is a failure to keep the public safe.

B.3879 October 31, 2024 — San Francisco, CA

Impossible to see oncoming cars with those headlights that were typically pointing down and to the right with older cars. Intersections and people following blinds drivers in mirrors as well.

B.3880 October 31, 2024 — Sugar Land, TX

Everyone's life is precious and worth saving

November 2024

B.3881 November 1, 2024 — Aurora, IL

I drive in the dark alot. I've noticed that even some of the "auto" dimmers appear to switch to a low beam but don't do it until the car light beams are past the on coming car. Also these headlights seem to be aimed down at the road which is great but when that car comes over a hill or the crest of an intersection or over a bump in the road the lights shine right into oncoming traffic. I don't think these smart headlights would work in those cases. So even with the smart aim type system there will still be major problems. These lights also are so bright that even when there is a large median between lanes they blind on coming traffic even like a tollway with 30 feet of separation. Also the auto system won't work when a car is on the inside of a curve those lights shine right into oncoming traffic on the outside of the curve. They must be dimmable not just aimed.

B.3882 November 1, 2024 — Rensselaer, IN

The new LED headlights cause temporary blindness . Or you have to take your eyes off the road and look away . Many cars are driving with Led on bright . They leave them on auto dim but still blind you to point it seeing green dots in your line of sight after the car passes by. You also have individual putting led lights in headling housings not made for LED lights and those are probably the worse for causing head on traffic to be blinded. I have seen many vehicles just stop in the middle of the because they cannot see with on coming traffic with LED lights . It's dangerous, unnecessary and most of those older vehicle have illegal lights that are only for off road purposes.

B.3883 November 2, 2024 — Grand Rapids, MI

I have been struggling with this for some time and thought I was the only one who had an issue. I try to compensate for the blinding LED by looking to the side of the at the right should line, but that

rarely helps and I am left blind for a few seconds after the opposing car passes me. The effect is even worse in rainy conditions when the headlights reflect off the road. Another issue, equally as bad is when a car with bright Leads comes up behind you and you are blinded in your side mirror. I have to hold my hand up to block that light, move my mirror, or shift in my car, all the while hoping that an opposing vehicle doesn't come at the same time! I hope this gets addressed soon because I am getting to the point of not wanting to drive at night!

B.3884 November 2, 2024 — Louise, TX

Excessively bright headlights in rural America make driving at night unsafe. Temporary blindness from the bright light couples with lack of street lights, reflectors to signal curves in the road and wildlife poses entirely too many safety risks.

B.3885 November 2, 2024 — New York, NY

Please ban those evil and rude Teslas installing high beams as low beams! Ban Teslas, save lives!

B.3886 November 4, 2024 — Oxford, United Kingdom

I'm sick of getting BLINDED.

B.3887 November 4, 2024 — Paris, KY

There are two reasons why I need those headlights to be banned. First of all I get migraines and I cannot look at those lights without getting one. Secondly, I have to avert my eyes to the right side of the road because I cannot see the road when they are coming at me, I almost ran off the road in a terrible place that would not have ended well. I am begging the makers of those headlights to stop making them and I pray that the ones that are out there are banded. Also, I just remembered an incident where one was behind me and it was so blinding. I could not focus on the road in front of me. They are just dangerous.

B.3888 November 4, 2024 — Providence, RI

They're dangerous. They've literally blinded me from seeing the road at night several times.

B.3889 November 4, 2024 — San Diego, CA

LED headlights are a danger to the public. Proper angles mean nothing unless roads are completely flat, which they aren't.

B.3890 November 4, 2024 — Somerville, MA

I can't see at night - if you're in a sedan and an SUV comes up behind you, they are at the level of your rear window and seemingly blind you. I have astigmatism and it makes it so much harder to see at night

B.3891 November 4, 2024 — Stoneham, MA

How is this shit legal? As someone with astigmatism, I don't need Uncle Fester tail gating me in his yee haw ass monster with cornea destroyer 9000's.

B.3892 November 5, 2024 — Orange, MA

If doctor, nurses, paramedics and emts can't use LED in their pen light because it destroys eye, who thought it was a good idea to put them in cars. Someone didn't do research.

B.3893 November 6, 2024 — Coral Gables, FL

It is extremely dangerous for everyone!!!!!

B.3894 November 6, 2024 — Irvine, CA

Driving in Irvine necessarily means contending with sunspots or using sunglasses at night. It is a dangerous endeavor as oncoming headlights and overly bright tail lights obstruct the view by not just washing out the view of the road but also by causing blind spots to occur by burning the retinas. Driving is a necessity since Irvine is a hyper car-centric city but driving becomes more and more dangerous as lights get brighter and brighter. The most memorable car was a new yellow mini due to being able to cause me sunspots in broad daylight. I had that union jack burned into my vision and missed the green light. Honestly glad I didn't miss a red.

B.3895 November 6, 2024 — Montague, CA

Yep. Good Ole saftey features…. not. When the lights are so bright they overshadow your own lights , it′s too bright.

B.3896 November 7, 2024 — Akron, OH

If you drive a sedan, you know what it′s like to be blinded by some big@$$ truck tailing you. It′s made all the worse by people who keep their high beams on all the time. I′d personally prefer NOT to die because of someone else′s stupidity or laziness, thanks.

B.3897 November 7, 2024 — Cary, NC

Yes, LED headlights can damage the retina: https://www.eduardobessermd.com/blog/are-led-lights-safe#:~:text=It%20revealed%20that%20long%2Dterm,fatigue%2C%20and%20risks%20of%20accidents.

B.3898 November 7, 2024 — Dallas, TX

I feel as though we could use them as the bright but not as the main lights. These lights blind people to where your almost going off the road.

B.3899 November 7, 2024 — Parlin, NJ

Thank goodness for this petition. I am blinded at night by these extremely bright headlights. It is painful and there is no way to avoid seeing them. I have had to pull over even on a highway because they are so bright you cannot see. This needs to be fixed. Go back to the old type of headlights or put adapting LED headlights on SUV′s and cars.

B.3900 November 7, 2024 — Stow, OH

The new headlights and police lights make it so I can’t see at night. It’s dangerous.

B.3901 November 7, 2024 — United States

headlights are too damn bright

B.3902 November 8, 2024 — Ashford, ENG, United Kingdom

To bright

B.3903 November 8, 2024 — Burlington, VT

I don’t feel safe driving at night because these lights are so blinding. When a car with these lights is passing by I have to look completely down at the road so I can see where the lines are (can barely see the lines and can’t see them at all when it’s raining). If something were to be stationary in my lane of travel I have no doubt I’d hit it due to being blinded by these lights. They are so incredibly unnecessary…

B.3904 November 8, 2024 — St. Louis, MO

I am always getting blinded by these new overbriggr new dangled headlights. It is downright dangerous.

B.3905 November 10, 2024 — Avon, OH

Night driving is awful lately

B.3906 November 10, 2024 — Coatesville, PA

Night driving is so challenging for me and many others due to the extremely bright headlights of other cars on the road.

B.3907 November 10, 2024 — Humacao, Puerto Rico

Estoy de acuerdo

B.3908 November 10, 2024 — KS, United States

They are painfully bright.

B.3909 November 10, 2024 — Mount Desert, ME

Headlights are too bright and it’s a legitimate safety concern

B.3910 November 10, 2024 — New York, NY

My eyes are getting bad due to LED lights. I get so angry on the road due to this and we need to take a stand. Let's go back to good old fashion yellow lights. LEDs are hurting us not helping us. More accidents and for the health of our eyes please take them away.

B.3911 November 10, 2024 — Philadelphia, PA

It cause driver to look sight and can cause an accident

B.3912 November 10, 2024 — Richmond, VA

This blue light is driving people insane.

B.3913 November 10, 2024 — Salem, MA

These lights have affected me from seeing properly on the road. I've seen accidents occur due to these blindly lights! This is a public safety concern! We need change.

B.3914 November 10, 2024 — United States

Scott Kane

B.3915 November 10, 2024 — jupiter, FL

While we're at it let's also ban the idiots that don't know they're supposed to turn their brights off as soon as another car is visible

B.3916 November 11, 2024 — Edgewood, NM

It's even worse when you have astigmatism.

B.3917 November 11, 2024 — Inwood, Canada

Those bluish white headlamps give me an insta headache. No need for them to be that bright! The yellowish ones did fine for decades!

B.3918 November 11, 2024 — Knoxville, TN

I drive 3 hours between cities after dark regularly. I cannot look in my mirrors at all without blinding myself in the night. I have to lean forward as far as possible to avoid the intense glare in my peripheral vision, allowing myself to see the road at the expense of seeing my speedometer. I make frequent lane changes, without the use of my mirrors, to allow the brightest headlights to pass me on the road, in an attempt to be able to look in my mirrors again. It's at the point where I would need to choose between sunglasses and having no mirrors to drive comfortably. Certainly, with the way things are now, there is no such thing as safely driving at night anymore, unless you are the only person on the road in both directions.

B.3919 November 11, 2024 — Lyndhurst, NJ

The lights are too damn bright! Especially in rainy weather and they reflect. Driving is the most dangerous thing we all regularly engage in. Let's make it a bit safer for everyone.

B.3920 November 11, 2024 — Sarasota, FL

apart from being an aesthetic crime, bright white LEDs in our vehicles and street lights are dangerous because they blind drivers, make it very hard to accurately judge the distance of cars behind us (unlike old incandescent headlights which gently contour the vehicle) and have negative effects on our circadian rhythms, hormones and overall health. Driving at night was generally a pleasant and soothing experience but it is now a harsh, tense and, most importantly, dangerous endeavor.

B.3921 November 11, 2024 — Warrensburg, MO

These blinding lights make it dangerous to drive at night.

B.3922 November 12, 2024 — Bowling Green, KY

I often have to turn my mirrors down and away if a car with LEDs is following behind my car and hold my hand up to shield my eyes when a car with oncoming LED lights is heading towards me in order to ensure I can drive and see!

B.3923 November 12, 2024 — Woodstock, MD

I am a driver and this affects me directly as well as other drivers

B.3924 November 13, 2024 — Cincinnati, OH

It's absolute bullshit that others need to see the fuckin moon when they drive pisses me the fuck off

B.3925 November 13, 2024 — Hood River, OR

The LED's seriously need to be reevaluated, or maybe they were designed to be blinding and increase accidents...hmmm

B.3926 November 13, 2024 — Portland, OR

The headlights on cars are to blinding way way to bright they need to be banned there is no need to have that bright of a headlight the old ones were good enough

B.3927 November 13, 2024 — Rincon, GA

i gotta drive at night to get to work and its a struggle with all the bumps near me in the roads

B.3928 November 14, 2024 — Chaska, MN

I can see just fine at night but when an oncoming car or another directly behind me has those blinding lights I struggle to even stay on the road. I am a healthy 21 year old with no sight issues but have a hard time with those overly bright headlights. I can only imagine how others with astigmatisms or light sensitivity may feel.

B.3929 November 14, 2024 — Midlothian, VA

I've almost had several accidents due to being blinded by excessively bright headlights. The most recent one being an oncoming Is vehicle blinded me to the point I couldn't see the stopped vehicle with dim taillights. Had I spotted him 1 second later, I may very well not be here to type this message. I wonder how many lives these is unnecessarily bright headlights have already claimed.

B.3930 November 15, 2024 — Elgin, TX

I'm so sick of being blinded by 2/3 of the cars on the road. It's ridiculous.

B.3931 November 15, 2024 — Leander, United States

I have issues with lights at night producing starburst. The new LED headlights absolutely blind me and are a safety hazard to others.

B.3932 November 15, 2024 — Montclair, NJ

It's difficult to see while driving with these LEDs!

B.3933 November 16, 2024 — Provo, UT

I have very sensitive blue eyes and driving at night these days sometimes feels like a gamble with my life. People driving through a well-lit city street or on a lit highway DO NOT NEED multiple LED headlights!!! And if you're driving through a darker area, do the courteous thing and turn off your brights when there is opposing traffic! We have to get after the car companies who are designing and installing a feature that makes driving more dangerous for others on the road. Come on.

B.3934 November 17, 2024 — Cameron, MO

I am for the ban, but above & beyond that, people need to pay attention to what they are purchasing. As long as these companies get your money they could careless about your safety. Do the research and buy from companies that do not have years of recalls, etc... Once they have your money you are no more to them but a dummy. What people buy determines what they keep making. Please test drive and inspect any vehicle before buying even if that means taking it on a rough road because an irritated noise can become a dominoes effect. Not all vehicles are assembled the way people assume they are.

B.3935 November 17, 2024 — Fairland, IN

They are a danger to everyone on the roadways

B.3936 November 17, 2024 — Seattle, WA

these suck!

B.3937 November 17, 2024 — Westlake, OH

I have several medical conditions that make me sensitive to light, namely LED light. It blinds me, makes me nauseous, get headaches, disoriented, dizzy, and the increasing difficulty to attain softer lighting is ridiculous! I can't even find lighting for my own home as easily as I used to. I am disabled and poor so finding the older kind of bulbs is increasingly difficult for me. My neighbors porch light is blinding! Christmas lights are now also blinding, and to drivers thats too distracting/disorienting ! Headlights are blinding and that's sooooo dangerous for drivers! Why on earth is that something they think is ok??? I don't know what they manipulated in the "research" that they claim says LEDs are better, but they do not nearly long enough, you have to buy them more and more often. I believe their "efficiency" just means they work poorly, so you have to go buy more, shameful. I am sick of getting sick because of these stupid lights. A trip to the Dr's is soooo dreaded because I know that I will be sick the whole day, I don't need more of these lights to bombard me everywhere else too! I get as much as I can delivered to me because one of the reasons I can't go into stores is the lighting. I am begging here, begging them to stop with the E LEDs!!

B.3938 November 18, 2024 — Arlington, MA

LEDs are technology gone too far. We are losing connection with the natural world and drowning ourselves with blinding blue light. Help bring darkness back.

B.3939 November 18, 2024 — Chicago, IL

I'm too young to not want to drive at night anymore!! Headlights are blinding!

B.3940 November 18, 2024 — Miners Rest, Australia

Glaring lights increase driver difficulty in perceiving distance and speed of oncoming vehicles. This is especially dangerous for drivers entering a carriage way when head lights are used in the daytime. This is particularly dangerous with motorbikes which have the headlights hard wired on by law and other drivers who choose to leave their head lights on during the day causing a lethal problem even without the added glare of the new LED headlights.

B.3941 November 18, 2024 — Portland, OR

I can't see!!!!

B.3942 November 18, 2024 — oakland, NJ

Blue wavelengths are known to be experienced by the human eye as "glare," which literally hurts. That's why the Serengeti sunglasses company used orange in their lenses. Orange is the opposite of blue. Cutting the blue wavelengths allows a person to SEE comfortably without pain in their eyes. "Daylight" headlights allows a driver to see the road well, BUT when those same headlights are aimed toward other drivers, THEY ARE BLINDED BY GLARE. This results in more accidents, not less. I support a full ban on daylight headlights for the safety of all drivers.

B.3943 November 19, 2024 — Euless, TX

The LED headlights that are being made are too bright. Driving down a country road, I have to stop every time I see those blinding headlights coming from far away, because I know by the time they get closer, I won't be able to see the road. I'm afraid I'll end up in a ditch if I keep driving.

B.3944 November 19, 2024 — Fernandina Beach, FL

These LED lights are nauseating and dangerous. The instance of wrong way collisions is as high as ever, and the intense glares from LEDs create a deer in the headlights situation for anybody who doesn't have them. I can't imagine anyone would properly be able to avoid danger with these lights headed straight at them, they are completely blinding.

B.3945 November 19, 2024 — Kalispell, MT

I'm a healthy 24 year old with no sight issues but I do have green eyes that are somewhat sensitive to light. When a car with halogen lights is coming towards me I have no issues but when the vehicle has

led lights it's unbearable. There's no point to them. We've used halogen lights forever and they have worked.

B.3946 November 19, 2024 — Lincoln, NE

Literally why not?!?! It's safer for everyone.

B.3947 November 19, 2024 — Lynnwood, WA

I try to avoid driving at night. Every time a newer vehicle is driving toward me I am unable to see the road in front of me, and am still somewhat impaired after they have passed. When they are behind me, I have to flip my rear view and readjust my side mirror so the lights are out of my eyes. As you might imagine, that makes it very difficult to drive safely. There needs to be a cap on the lumins allowed for lights on cars.

B.3948 November 19, 2024 — Tampa, FL

Yes im in favor of banning bright headlights , i have 20/20 vision and it hurts my eyes at night .

B.3949 November 20, 2024 — Highlands Ranch, CO

It's insane and irresponsible to think that these bright lights are okay with any auto makers. Newer cars with these LED's seem as they have their brights on all the time.

B.3950 November 20, 2024 — Long Beach, NY

How do car companies like GM (the Escalade especially) and Acura get away with these blinding headlamps?

B.3951 November 20, 2024 — New York, NY

I don’t feel safe driving after dark anymore because I can’t see.

B.3952 November 21, 2024 — Pasadena, CA

Blinding lights are dangerous!

B.3953 November 21, 2024 — Winchester, VA

It is difficult to see the road at night in a lot of oncoming traffic with the newer bright blue- white headlights which all seem to be aimed too high. My eyes don't have a chance to adjust, and I get eye fatigue and headache from the glare.

B.3954 November 21, 2024 — crysal river, FL

I drive 1 hour to work every morning and the amount of lights that are blinding me in my mirrors behind me and oncoming traffic is insane. Something needs to be done there is no need for lights to be that dam bright

B.3955 November 22, 2024 — Bronx, NY

These LED lights on these automobiles are blinding. I honestly could say that I'm not in control of the car that I'm driving due to the blindness from these lights.

B.3956 November 23, 2024 — Chestnut Hill, MA

I was just rear ended by another car while pregnant. The oncoming headlights were so bright they prevented the driver from seeing my brake lights. Now I worry about my unborn child and my husband sustained a brain injury from this. There is no explanation for the increase in dangerous accidents at such a level other than these absolutely excessive and violating use of bright headlights.

B.3957 November 23, 2024 — Deptford, NJ

the headlights are awful, you can’t see, you get angry, and they mess up you’re circadian rhythm

B.3958 November 23, 2024 — Massillon, OH

i’m tired of having migraines from driving and not being able to see

B.3959 November 23, 2024 — Orlando, FL

There is a huge negligence in safety with studying the effects of headlights. There needs to be more regulations on how powerful car headlamps are. There is no point in being "mindful" on safety

devices in your car to protect you in a crash when headlamps are becoming more of a hazard causing more crashes. I've personally had to start wearing different type of sunglasses at nighttime while driving due to getting massive night blindness with super bright headlights beaming into my pupils and the older I get the more of a struggle this becomes. This really shouldn't be a issue.

B.3960 November 23, 2024 — San Bruno, CA

With the clouding of my own headlight lenses with older halogen lights, it's already a bit difficult to see, but when I get hit by the oncoming LEDs, it creates a momentary blindness, and it is getting quite scary every time this happens. On top of it, if my windshield should be slightly filmy on the inside, I basically end up with a pure white "screen" in front of me instead of a view of the road. I literally hate driving at night nowadays.

B.3961 November 23, 2024 — San Francisco, CA

I sign because there is no reason for us to be subjected to "dazzling" while driving , while enjoying (?) time at home, while out and about recreating, etc. Enough is enough. We must no let up on regulatory agencies. I wish there were a class action lawsuit in place. Nothing will change until we find a way to put our symbolic knee on the (symbolic) neck of automobile manufacturers and lighting manufacturers. This is the same as my having to breath second-hand smoke or subjecting me to chemical hazes be it in theatres (for lighting effects) or pesticides used on crops. STOP THE MADNESS

B.3962 November 23, 2024 — Summerville, SC

These blinding headlights are killers!

B.3963 November 24, 2024 — Fairlawn, VA

I have astigmatism and try to avoid driving at night. But I had to on this particular night. I was hit with the most blinding white headlights that I was blind and it caused me to run off the road. Luckily I was not hurt. LED headlights are dangerous to people who have vision issues and should be banned.

B.3964 November 24, 2024 — Mississauga, Canada

I've had a seizure from these damaging lights!!

B.3965 November 24, 2024 — Seattle, WA

These lights are dangerous and harmful to vision

B.3966 November 24, 2024 — Zimmerman, MN

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B.3967 November 25, 2024 — Auburn, CA

When thrse light shine in my view, I cant see well it inpairs my viewing abilities . Please ban them.

B.3968 November 25, 2024 — Danielsville, GA

I'm blinded by these lights and am becoming afraid to drive at night.

B.3969 November 25, 2024 — Hanover Park, IL

To state the obvious, it's really frustrating to flash your headlights at an oncoming vehicle when you think they have their blinding brights on but it turns out that's the way their headlights always look. It's really not the driver's fault so we need to do something at the manufacturing level.

B.3970 November 25, 2024 — Macon, GA

I'M TIRED OF BEING BLINDED AT NIGHT! I DON'T EVEN LIKE TO GO OUT!🤨

B.3971 November 25, 2024 — PA, United States

So far, three times since DST started, I have almost gone off the road by being blinded to disorientation to my own position on the road. Offenders are typically ″monster″ trucks with jacked wheels and with nuclear bright headlights and light bars that are at eye level, even to SUVs. I have to come to a complete stop so I can close my eyes as not to crash. Nobody is doing anything about this.

B.3972 November 25, 2024 — South Milwaukee, WI

It's dangerous and annoying

B.3973 November 26, 2024 — Buffalo, NY

These stupid modern lights have made driving more dangerous, not safer. Oncoming glare has caused me great difficulty in noticing other obstacles in the road and even pedestrians. If I were a new driver today instead of having my 17 years of experience I have no doubt I probably would have struck someone by now.

B.3974 November 26, 2024 — Walnut, CA

Our community has a problem with individuals who use high beams on top off already blinding LED lights!

B.3975 November 27, 2024 — Glen Head, NY

I 100% agree with this petition but there is a very significant point that needs to be made. This problem is not an issue of LEDs, its an issue of lighting design and lack of regulation. There needs to be regulation about the overall CHARACTERISTICS of light emitted from headlights. The issue isnt specific to LEDs The way we perceive light is the result of a COMBINATION of factors: Intensity (illuminence, ″brightness″), Light Wavelength / Color temperature (ex: 1700K is a ″warm amber″ color, 4000K is ″cool″ white, 8000K is cold white). Light sources need to be adapted to fit their intended applications. Headlights should not produce blinding bright white lights, there should be guidelines and enforcement of the rules to keep everyone on the road safe.

B.3976 November 27, 2024 — Portland, OR

I drive for a living and it has become increasingly dangerous to be out on the road at night when I can′t see it because of all the newer vehicles with excessively bright headlights. Not only are these headlights creating a safety hazard, but a health hazard due to the increased eye strain on nighttime drivers. I get headaches after being subjected to hours of bright lights in my face when I′m driving for work. Sometimes, the headaches are so bad that I have to take the rest of the night off. Headlights used to be around 1000 lumens, but now the standard headlights go up to 4000 lumens and some aftermarket headlights are much brighter than that. The automotive industry should be held accountable for creating dangerous road conditions and the sale of excessively bright headlights should be banned because they make driving less safe for everyone on the road.

B.3977 November 28, 2024 — Knoxville, TN

I really don′t know how this isn′t in the hundreds of thousands.

B.3978 November 29, 2024 — Dallas, TX

These things are literally the worst and I hate driving with them.

B.3979 November 29, 2024 — Luton, ENG, United Kingdom

They are a hazard on the roads!

B.3980 November 29, 2024 — Republic, WA

It′s hard and dangerous to drive when I am being blinded by insanely bright headlights.

B.3981 November 29, 2024 — Solvang, CA

The lights are just too bright and the wrong color for our eyes and our local wildlife. Sometimes on long roads and an approaching vehicle has these bright blue halogen lights (not on high beam) I have to pull off the road and wait. Even at a quarter mile the bright light is damaging to my sensitive eyes (which I use for work) I also work through the night. I failed to mention I work only outside and these lights are brutal on your vision and are very dangerous. I live out in the country with no street lights,

buildings, it's very dark outside. This is not the city full of more light pollution. The bright lights need to be banned or have a light filter installed over the light bulb itself.

B.3982 November 29, 2024 — WA, United States

The lights are too bright! We need more yellow/orange/red tinted lights so we don't lose our night vision. It's ESPECIALLY DANGEROUS for people that live in more rural mountainous areas that have animals like deer, elk, moose, among other animals that like to hangout in the road.

December 2024

B.3983 December 2, 2024 — Lebanon, MO

Can't see anything when driving at night been ran off the road and everything

B.3984 December 2, 2024 — Lebanon, MO

Nobody needs lights that bright. They're blinding for the rest of us and I literally see spots after they pass

B.3985 December 2, 2024 — Thames Ditton, ENG, United Kingdom

I am totally frustrated driving at night and being constantly blinded by cars having lights that looks like full headlights, accident waiting to happen! It should be illegal like in Canada and Denmark

B.3986 December 3, 2024 — Oakland, CA

It's a PROBLEM!

B.3987 December 3, 2024 — Sunnyvale, CA

Headlights pitched on a upward curving road are making it impossible to see what actually matters: the road. Please do something to introduce additional technology already adopted by some OEMs in the EU which help to prevent this problem

B.3988 December 3, 2024 — Tomball, TX

With such bright lights around, the human eye cannot contract/expand the way it needs to against these oppressive lights. It is a danger to myself and those on the road with me, not only including other drivers, but pedestrians as well.

B.3989 December 3, 2024 — Troy, TX

I've narrowly avoided getting into accidents caused by these headlights. They are so blinding, so unsafe, and make driving in front of someone with these lights borderline impossible. There are already so many hazards associated with driving - artificial blindness shouldn't be one of them.

B.3990 December 4, 2024 — Missouri City, TX

I see it everyday. It takes away nearly all visibility at night. It's like when you turn the lights on and off and your eyes have to adjust, so you can't see anything. This one day I was going down a road and this truck's lights were so bright I couldn't make out anything of it - not the shape, color, make, or license plate. So I thought in that moment, if I end up running over someone because I can't see literally anything, the only way I could find out who has those blinding lights is if I ask the neighborhood who was driving down that certain road at that exact time. Otherwise that truck was completely unidentifiable and I would be at fault for hitting someone when I couldn't even see anything because of those blinding headlights.

B.3991 December 4, 2024 — Richmond, VA

These lights blind me from the front and the back. It takes me 5 to 10 seconds for my vision to get the brightness to get better but doesn't go fully away and so far I have been lucky not to crash but I have come close!!! I only missed the car because I turned sharp enough to miss it not because I saw it because my eyes were still blinded by the headlights. I also adjust my rear view mirror and my side mirror so the lights from behind don't blind me to bad so I'm pretty much driving blind and can't use my safety equipment to keep me and everyone else safe!!! Anyone that denies these lights are dangerous and should be banned obviously don't care about life and safety and just want money. I hope these lights get bannned asap and they become illegal

B.3992 December 4, 2024 — United States

Headlights shouldn't be too bright because they can blind people, hurt them, and even kill them.

B.3993 December 4, 2024 — san antonio, TX

Getting dark means get home fast. This keeps a segment of society not being able to drive anywhere after dark, it keeps us at home isolated. Not Fair.

B.3994 December 5, 2024 — Middletown, CT

I WANT TO SEE AT NIGHT AND NOT FEEL LIKE MY LIFE IS IN DANGER EVERY SECOND I AM BEHIND THE WHEEL

B.3995 December 5, 2024 — Presque Isle, ME

Living with astigmatism is tough, but it is outright unbearable with other cars' retina searing capabilities. I'd love to see something done about it.

B.3996 December 5, 2024 — forestville, CA

The situation is out of control

B.3997 December 6, 2024 — Alhambra, United States

Can't see at night, man. Ain't right. Oncoming traffic with white LED lights are like flashbangs.

B.3998 December 6, 2024 — Austin, TX

Headlights have gotten too bright and make safe driving impossible.

B.3999 December 6, 2024 — Bay City, MI

My eyes hurt, and I like being able to see the road I and others drive on.

B.4000 December 6, 2024 — Berkeley, CA

Lights are to damn bright

B.4001 December 6, 2024 — Des Lacs, ND

I am so sick of being blinded by every vehicle newer than 2018. Unless you drive a giant SUV or Pickup taller than everyone else's vehicles (in turn becoming the one who blinds others), you will be blinded by every single oncoming vehicle. And don't tell me headlights adjustments are the problem, I live in one of the flattest cities in one of the flattest states. Small bumps in the roads or bridges negate those projector cutoffs. People's "dim" lights will blind you just as bad because of them.

B.4002 December 6, 2024 — Destrehan,, LA

Nearly ran off the road last night because it was like I was trying to look through the sun. Had to stop travel completely to see the curve in the road and not continue straight. Lack of manufacturer ethical responsibility and no local enforcement of the law are leading to extremely unsafe conditions at night. There needs to be accountability.

B.4003 December 6, 2024 — Eau Claire, WI

I'd say "there outta be a law," but I feel like this really falls under the already existing legislation on high beam vs low beam headlights. It's already illegal to drive exclusively with high beams exactly BECAUSE it creates a hazard to other drivers. But somehow an LED headlight, which on average is anywhere between 3-10 times brighter than a standard halogen light is legal (low beam halogen bulbs typically run around 700 Lumens while LED low beams typically run anywhere between 2,000 - 10,000 Lumens)?!? C'mon, man!

B.4004 December 6, 2024 — Hanford, CA

I frequently take several-hour drives with my daughter to Disneyland from the Fresno area, and driving when it's dark has become borderline dangerous because of the intensity of the brightness of modern headlights and the lack of enforcement on aiming angle and power. I literally have to put my hand in front of my face, as if I was staring at the Sun, in order to be able to see any vestige of the road in front of me. This is dangerous and completely unneeded. Action needs to be taken to get this serious problem under control and avoid any more injuries and/or deaths to innocent citizens.

B.4005 December 6, 2024 — Long Beach, CA

Because these lights are too bright!!!!!

B.4006 December 6, 2024 — Minneapolis, MN

I don't like to be blinded while driving

B.4007 December 6, 2024 — Mooresville, NC

I'm sick of being fucking blinded when I'm driving at night. That's it. That's the only reason. It's annoying and it can cause accidents.

B.4008 December 6, 2024 — Onaway, MI

The lighting is dangerous and with winter here and long nights it makes driving to and from work very perilous.

B.4009 December 6, 2024 — Ponchatoula, LA

Melissa Thomas

B.4010 December 6, 2024 — Randolph, MA

i have light sensitivity yet we live in a car brain dead society were i can't even drive because people have their high beams on 24/7

B.4011 December 6, 2024 — Saint Louis, MO

They hurt my eyes when driving at at night now and makes it much harder to drive in the rain.

B.4012 December 6, 2024 — San Jose, CA

I can no longer drive at night and I'm only 53!

B.4013 December 6, 2024 — Santa Cruz, CA

Driving home the other night on a rural two lane highway I almost caused accidents several times because I couldn't see as a result of the blinding headlights coming at me from the other direction. It's getting to the point that I don't want to drive at night because I'm afraid I'll cause an accident from being blinded for a few seconds. I've never heard an issue with headlights blinding me until maybe the last five years. We need changes made or there will be fatalities as a result of someone being blinded by these things. Sometimes the white line isn't on the right hand side of the road so you're basically guessing where to steer.

B.4014 December 6, 2024 — St Louis, MO

These lights suck!

B.4015 December 6, 2024 — Tacoma, WA

I'm signing because I have to drive at night for work, with children (foster care kids), and I've lost count of how many times I've been forced to come to a COMPLETE AND TOTAL STOP in the middle of the road, because even putting my hand up to shield the glare, I am completely and totally blinded. This is UNACCEPTABLE! And it's terrifying. Utterly and completely terrifying.

B.4016 December 6, 2024 — Tucson, AZ

it's so bad I have started wearing sunglasses to drive at night time

B.4017 December 6, 2024 — Vancouver, Canada

Even after double cataract surgery and secondary cataract laser procedure on the lens capsule in both eyes the excessively bright, glaring headlights of vehicles on the road is a safety concern to me...even as a pedestrian in the city (they blind me to what is underfoot) and certainly when I am at the wheel of a vehicle or on a bicycle. It is socially irresponsible for car makers to turn headlights into virtual weapons on the road. Safety for drivers is NOT enhanced by harming others. This has to change.

B.4018 December 7, 2024 — Calgary, Canada

i want to be able to see at night

B.4019 December 7, 2024 — Cheney, WA

One of the best ideas I've heard of in a very long time. Please get RID of these ridiculously bright lights, they're everywhere and on everything, not just the cars. I passed a lighted billboard recently and felt as though I was going to have a seizure. I tell my kids not to look at the lights, afraid that their vision will suffer. Time to tone it down! Thank you.

B.4020 December 7, 2024 — Chicago, IL

The crop of headlamps appearing in the last five years or so are outrageously bright and seem to be indistinguishable from what used to be “high beams”. I find I need to take my eyes off the road and follow the right lane stripe to control the vehicle. Very dangerous. Also trucks and SUV placement is at eye level for normal cars and they don’t need to be.

B.4021 December 7, 2024 — Chicago, IL

The glare is painful from oncoming cars when night driving. But headlights also don’t provide enough light when night driving on remote roads.

B.4022 December 7, 2024 — Hayward, CA

Vehicle LED lights is not the solution for not replacing and repairing street lights. Head on glare of the LED vehicle headlights is blinding and dangerous especially in areas with limited street lights. For seconds, you can not people existing vehicles, bicycle ride, pedestrian unexpectedly crossing and vehicles. The industry is suggesting to purchase yellow tinted glasses or were shades at night instead of fixing the public safety issue.

B.4023 December 7, 2024 — Houston, TX

I feel if you can’t see without a 40000 lumen light bulb you shouldn’t be driving at all, this issue really effects us car drivers, as your raised or non raised trucks headlights are level to every single mirror in the car, when you’re behind us at a red light, we’re being blinded from every angle, not to mention the people who are waiting at the opposite side of the intersection is also just far enough away where their headlights are also eye level, it makes it hard to see the road which is EXTREMELY dangerous

B.4024 December 7, 2024 — Kansas City, MO

The level of agitation I'm struggling to regulate now has caused me tears time and time again. I have two major things that make me especially vulnerable when driving: astigmatism, and autism, the former being a condition that effects probably 4 of every 10 people on earth. So the amount of people that can't stop the glare is a vast portion of drivers on the road. Being okay w blinding even one car by chance, is NEGLIGENCE and at this point it's offensive driving.

B.4025 December 7, 2024 — Memphis, TN

I almost crashed being unable to see the road because a SUV was behind me with those blaring lights. Those lights should be banned they are dangerous.

B.4026 December 7, 2024 — Oak Creek, WI

I have experienced night time glare from LED headlights so extreme it blinded me, leaving me dangerously unable to distinguish my own lane position. This is extremely dangerous, especially on a two-lane road in the dark of night.

B.4027 December 7, 2024 — San Mateo, CA

Please also address the issue of blindingly bright LED brake lights. These are causing temporary blindness for other drivers. The current situation with LED headlights and brake lights makes it too dangerous to drive after sunset.

B.4028 December 7, 2024 — Springfield, MO

After a TBI 9 years ago, I have extremely painful trouble with flashing bright lights, such as the LED emergency vehicles lights. It's like being shot in the head to passa wreck, and migraines are frequent. Now these headlights - pure torture. I have literally stopped the car in the middle of a road until someone passed, and even stopped in the middle of a curve. I'm temporarily blinded to blackness, I stand terrible pain, and cannot see to operate a car safely even for seconds. I'm constantly moving mirrors and avoiding direct visual from behind, and it is impacting my life to even try to navigate

after dark. No one needs this intensity to see better, while blinding the other driver. For me, it's impact plus pain and suffering. Their lights cause my reaction, which could cause me to wreck or impact another person driving. This is dangerous. Please change to outlaw for the sake of everyone impacted!

B.4029 December 7, 2024 — miami, FL

There was no reason to change it. It's impossible to even see beyond my windshield and most of the time it feels like I'm leaving it up to chance getting from one point to another. Horrible.

B.4030 December 8, 2024 — Freehold, NJ

I literally can't see the road while I'm being eye-blasted by LED headlights. Them being blue makes it even worse. It's a huge safety concern when my only option is to pray that there's nothing in the road after being temporarily blinded by these lights.

B.4031 December 8, 2024 — Richmond, IN

I find the blinding glare from these headlights to be not only annoying but painful and blinding enough that I can lose my ability to see the lane lines to maintain my vehicle in the correct lane. In cases where there are no lane lines, as on dark nights on narrow country roads the glare from these headlights is particularly dangerous. I find myself having to slow my vehicle to nearly a stop to avoid crossing the center line or driving off the side of the road.

B.4032 December 9, 2024 — Seattle, WA

I got in a really bad wreck cuz someone in a Benz was driving behind and blind spotted me . I couldn't see with those very bright lights straight looking into my eyes and blinding me

B.4033 December 9, 2024 — Spartanburg, SC

I can no longer drive at night due to the blinding of the headlights

B.4034 December 10, 2024 — Lancaster, CA

i'm sick of being blinded on the road. if you need LEDs to drive, you shouldn't be driving at night period.

B.4035 December 10, 2024 — clovis, CA

I can barely drive at night anymore, the glare of oncoming headlights is so intense! Please help !!

B.4036 December 11, 2024 — Alton, ENG, United Kingdom

I can no longer drive at night as the glare blinds me and I don't feel safe.

B.4037 December 11, 2024 — Apollo, PA

The turn to LED replacements everywhere is beyond horrible. HPS lamps being replaced with extremely bright white LED has disasterously affected local ecosystems along with the circadian rhythms of people. LED headlights absolutely destroy your night vision capablilities and very often completely wash out your sight to where you cannot see on the road. Its insane how often i have to literally stop in the middle of the road so that i can genuinely take a second to figure out where im going rather than just be able to look and see. Instead i have someones headlights completely taking away my vision.

B.4038 December 11, 2024 — Chicopee, MA

I have been saying this forever, these LED headlights need to be banned. I'm at the point where I am not comfortable driving at night period. Not because of my abilities but because these are mind numbingly blinding. I feel like either a deer in the headlights or a moth to the flame when these are oncoming, it's one or the other no happy medium. This makes me feel unsafe! We aren't supposed to legally use our high beams, but these are these okay? Driving at night is truly a nightmare for me, it's awful I've always loved driving at night. These lights are out of control and unnecessary. Whether they are head on or behind, it is unfair. I have to constantly adjust my mirrors when these are behind. These lights are ridiculous. They truly are blinding, they cause pain and are absolutely 1000% unsafe. Then add in rain and forget it, especially since I too have astigmatism. Vehicles with these lights are

basically weapons and are responsible for accidents that will, not if, happen plain & simple. Get these off the road. Ban these. They're unsafe.

B.4039 December 11, 2024 — Indianapolis, IN

Modern headlights are needlessly bright, to a point which 1. Provides no added benefit for the driver, and 2. Makes driving at night significantly more dangerous for the rest of us by REDUCING visibility due to their overwhelming brightness. A road full of blinded drivers is not a safe road. There needs to be a legal limit for these things.

B.4040 December 11, 2024 — San Antonio, TX

I CANT SEE AND ITS DANGEROUS - OKLAHOMA

B.4041 December 11, 2024 — Springfield, MO

There needs to be regulation on how bright headlights can be from manufacturer and after market alike.... it causes headaches, temporary blindness, and is incredibly dangerous to everyone around them. i am sick of running across these entitled assholes who think that driving behind the full force of the sun so only they can see is ok. i cant even legally tint my windows to diffuse the lights so i can see.. why should they be able to blind everyone on the road? ticket the drivers every time they drive with blinding light and the manufacturers should get a ticket every time one of their cars is stopped with blinding lights too.

B.4042 December 11, 2024 — brooklyn, NY

Its extremly dangerous to the point im afraid to drive

B.4043 December 12, 2024 — Pluckemin, NJ

Driving home on back roads can feel horrifying when I round a corner and get blinded by these high intensity lights. Their inclusion in cars was a mistake in design.

B.4044 December 13, 2024 — Murrysville, PA

Blinding drivers on the road is unsafe and unnecessary. And painful! Add your voice.

B.4045 December 14, 2024 — Alexandria, VA

These lights are causing lots of health issues in people including seizures, migraines, etc.. they should be banned

B.4046 December 14, 2024 — Asheville, NC

All LED lights (including the ones that illuminate the screens we're using right now) are antithetical to visual and mental health & wellbeing, but when used in headlights-- and at such an intense level-- they are absolutely deadly. It's beyond criminal that these products are available for purchase. Take ALL LED lights off the market, and bring back warm, inviting incandescent lighting!

B.4047 December 14, 2024 — Bangor, ME

This needs to cease, I remember a time when KC lights needed a cover because they were illegal to drive with. Now the LED lights are 10x brighter than a KC light ever were. Under the guise of OEM being legal. OEM needs to be regulated.

B.4048 December 14, 2024 — Easton, PA

I'm sitting here after driving an hour with a pounding headache in the dark and my brightness on my phone turned all the way down and still too bright. I'm in so much pain but this needs to be done. I almost drove off the road tonight because I couldn't see any of the road and have had this massive throbbing headache from all of the intense blinding lights behind and in front of me all night. And especially considering everyone in my state likes to drive behind you with not just their blinding headlights but also their blinding highbeams. First off Homie if you're the blind that you need both when your low beams are already brighter than the goddamn sun, you shouldn't be driving, second if you're behind someone you don't need your highbeams and third if you're coming towards someone it's bad enough that your low beams are blinding, but if your highbeams are on too, I'm assuming you want them to crash. There's literally no reason for it. If you can't drive at night without them then here's a quick solution, don't drive at night. How many fatal accidents gotta happen for the people in

charge to give a fuck? Good to know that our lives and well beings are regarded as this unimportant that no one's outlawed these yet.

B.4049 December 15, 2024 — Downers Grove, IL

I have almost had accidents because of these lights. What's worse is when it rains it doubles the problem because they also reflect on the wet road.

B.4050 December 15, 2024 — Harrogate, ENG, United Kingdom

Im finding driving in lanes at night dangerous driving because of blinding head lights

B.4051 December 15, 2024 — Lagrange, OH

I hate being blinded.

B.4052 December 15, 2024 — Long Beach, CA

This is dangerous for all of us

B.4053 December 15, 2024 — Mount Vernon, NY

Laura Carrera

B.4054 December 15, 2024 — Peterborough, ENG, United Kingdom

They,distract and lose my full attention. On the road in front of me, when in darkness you need more attention driving . I would estimate that it,possibly only 25%,with the blue,light beams.

B.4055 December 15, 2024 — Plattsburgh, NY

I can't see the road at night

B.4056 December 15, 2024 — San Francisco, CA

I have a astigmatism and this blinds me at their lowest. They provide little to no extra benefit for sight on roadways. While blinding others. You obviously didn't do properly research on headlights when you came out with this product. If you did you'd understand why we have yellow tinted lights instead of white lights. Instead your neglecting actions have now led to multiple acticdents and possibly liability to death due to your choice of headlight design that would probably lead to the biggest recall of vehicles. I hope that California stops being the place where we think good things come from this state has caused nothing but problems for this country.

B.4057 December 15, 2024 — Spokane, WA

I'm a petite driver. While driving at night I'm constantly blinded by the headlights of other vehicles. I will tell you only halogen headlights blind me like LED headlights do. I've resorted to wearing sunglasses at night. My eyes take longer to recover from a flash of LED light then they do from a flash of incandescent light.

B.4058 December 15, 2024 — Staplefield, ENG, United Kingdom

I am struggling to see on the commute home in the dark, due to being dazzled by these lights.

B.4059 December 16, 2024 — Bellingham, WA

I am in my twenties, have perfect vision, and I'm not normally sensitive to light. However, I notice more than ever that driving at night feels especially stressful now because so many cars have horribly bright LED lights. The blue tint actually hurts my eyes. The main freeway I drive on doesn't have a lot of overhead light either, so the lights from oncoming traffic are even more blinding. Most of the time it seems like drivers have their brights on, but it's just the LED. Regardless of whether these new lights are considered more energy efficient, I actually find this to be a really dangerous development for anyone who drives a car, AND counterintuitive to safe driving conditions. Please get these lights banned and find another solution!

B.4060 December 16, 2024 — Cincinnati, OH

It is blinding to those with astigmatism.

B.4061 December 16, 2024 — Miami, FL

I cannot SEE when the headlights from the LED lights come towards my direction - I FEAR AN ACCIDENT since I cannot see what's in FRONT OF ME due to blindness of LED lights - PLEASE MAKE OUR ROADS SAFER ... remove them!

B.4062 December 16, 2024 — Seattle, WA

OUCH. MY EYEBALLS.

B.4063 December 16, 2024 — Suffolk, VA

I'm 57 years old and cannot drive at night because of blinding headlights. My adult children (only in their 20s) are having trouble seeing as well. This MUST change.

B.4064 December 17, 2024 — Westerly, RI

Everytime someone with LED headlights comes up behind me I have to slow down and move out of their way. It's the same with people who have their high beams on behind me. I simply have to slow down nearly to a stop because I can't see. I know this is unsafe for me to do especially on highways that I travel often on like I-95 considering it's a high speed limit but what else am I supposed to do when I can't see. It's illegal to drive within a certain distance of vehicles with high beams, yet drivers who have LED headlights suffer no consequences even when it has the same effect. It's a risk to many people's safety and causes anger and frustration across the masses of drivers.

B.4065 December 18, 2024 — Bel Air, MD

I'm ready to sue the Department of Transportation for allowing those highly deadly LED lights to be used on motor vehicles. I escaped death within seconds after being completely blinded by these dangerous lights to be used. I'm getting peolple to file a class action suit against the DOT. I want to know who has been affected, had an accident, has a friend or family member hurt or killed in an accident because they were so blinded they couldn't even see the road. Im sick and tired of some big truck pull up behind me with those dangerous lights blinding me so bad that I have run off of the road. How fair is that. The DOT needs to be completely taken down for such a gross and negligent violation against the rights of drivers to have safety rules in place. Whoever approved these headlights should be put into prison for killing people. It's BS and I'm starting a class action suit for anyone who has been affected, hurt or killed because of them. WTF is going on here. The DOT is going down for this and I don't care what I have to do, I want them charged criminally for the distasterous and deadly have a class action suit

B.4066 December 18, 2024 — Essex, MA

I think bright headlights are dangerous.

B.4067 December 18, 2024 — Garland, TX

I suffer from chronic migraines and not only can overly bright lights trigger a migraine, they cause me physical pain when I am already in a compromised state. I cannot drive after taking my migraine medication, so I frequently have to suffer through driving in the dark with a migraine and being blinded by headlights so that I can get home and take my medication.

B.4068 December 18, 2024 — Newark, CA

Fuck bright headlights. It's impossible to drive safely with those in your eyes

B.4069 December 18, 2024 — Tucson, AZ

There is absolutely no reason someone would need such bright lights. Seeing as I can see just fine with my old school headlights and I have pretty bad eyesight.

B.4070 December 18, 2024 — seattle, WA

I live in L A and spend a lot of time on the road. Many of the newer cars have lights that are extremely blinding. It makes driving uncomfortable, tiring and dangerous. I wish there would be regulations about light height, intensity, amount of lights on a car to limit the strain on the eye and driving experience. Thank you.

B.4071 December 19, 2024 — AL, United States

LED headlights are a public nuisance in causing temporary blinding glares that prevent other drivers from seeing their surroundings properly and safely to avoid needless accidents or fatal harm to themselves and others. LEDs are unsafe for the driving community overall.

B.4072 December 19, 2024 — Akron, OH

Automotive lighting needs to be examined and regulated. If lighting is distracting, annoying or impairing than it′s a problem

B.4073 December 19, 2024 — Albany, NY

I'm 56 and have glaucoma in both eyes. It's being treated, but in recent years it's gotten worse. With the bright LED headlights of oncoming cars (4 times brighter than the halogen headlights that vehicles USED TO have), I've become very uncomfortable driving after dark, especially in the rain or someplace I'm unfamiliar with. These too-bright LED headlights are disorienting. I've resorted to organizing my life so that I never need to drive at night, but sometimes it's unavoidable. And I shouldn't HAVE TO stop driving at night; the headlights shouldn't be this bright!

B.4074 December 19, 2024 — Caledonia, MI

All the bright LED headlights makes it very unpleasant and unsafe to drive at night!!!

B.4075 December 19, 2024 — Carrollton, OH

When you have leds in headlights, turn signals and dont have respect for others you are blinding as you drive...if you need lights that bright, you don′t need to be behind the wheel

B.4076 December 19, 2024 — Chicago, IL

I agree with that women said those led are so bright you can even see the road.they are to bright!

B.4077 December 19, 2024 — Cleveland, OH

Constant blinding by headlights, usually on overly huge trucks and suvs

B.4078 December 19, 2024 — Cleveland, OH

LED lights are way too blinding at night and early mornings when dark.

B.4079 December 19, 2024 — Glouster, OH

They literally blind me on the road and I must adjust my rearview and side mirrors on LED cars behind me, haven't you?

B.4080 December 19, 2024 — Heath, OH

People with mild cataracts, like me, have problems with LED car headlights lights causing very bright sparkly halos around the headlights at night. This makes oncoming vehicles at night a big problem. The sparkly halos are blinding people and very unsafe. I avoid driving at night now. This has been a well documented problem for several years. Note: I am a retired Quality Assurance Manager from the largest lighting company in the world. I have a lot of experience with LED lighting. This LED problem has existed for a long time.

B.4081 December 19, 2024 — Macedonia, OH

Leds Make it hard to see the markings on the road so i find myself slowing down when a car or especially a a pickup truck with led lights is approaching. its hard to tell when they have there high beams on and then there′s aftermarket lights that you can install yourself these are even worse. This is a no brainer make the manufactures fix the problem and save some lives!

B.4082 December 19, 2024 — Minerva, OH

The LED lights on pick up trucks literally blind you! There has got to be a safer way for headlights than LED. We survived for how many years without them? Seriously people!

B.4083 December 19, 2024 — Mount Perry, OH

I have to stop right in the road because I am so I blinded by LED headlights that I can′t see the road

B.4084 December 19, 2024 — Sandusky, OH

I also have vision and neurological issues. Driving at night is tough enough without blinding headlights. Please stop the LED lights!

B.4085 December 19, 2024 — Seabrook, TX

My husband suffers from seizures, and these LED headlights have caused him numerous seizures while just being a passenger.

B.4086 December 19, 2024 — Shiloh, OH

I have astigmatism

B.4087 December 19, 2024 — Springfield, MA

Lives are being endangered by the extreme brightness of cars' headlights & they're not the high beams. The automotive industry needs to address & correct this huge problem!

B.4088 December 19, 2024 — Trophy Club, TX

As someone who struggles with astigmatism, alongside multiple family members of driving age who also have astigmatism, LED headlights are not only blatantly inconsiderate of other drivers on the road, they're blinding to the point of disabling road visibility, headachingly painful to drive against, and proven to be dangerous. It is selfish and criminally negligent for vehicles to continue harboring these reckless weapons when a safer alternative is and has been available. Each life of every driver and every passenger is immeasurably valuable; Ensuring roadway safety is of imminent and paramount importance. I sign in agreement to politely demand that Congress, the Department of Transportation, NHTSA , and the FDA take this matter seriously and properly regulate LEDs as spatially non-homogeneous, directed energy radiation. BAN LED HEADLIGHTS in vehicles driven in shared spaces and public roadways.

B.4089 December 19, 2024 — United States

https://www.cleveland19.com/2024/12/18/local-woman-joins-push-ban-led-headlights/

B.4090 December 19, 2024 — Waynesville, OH

These lights give me a headache and I'm unable to drive at night now because of how blinding these lights are, it take up to 30 seconds before I can actually see to drive again.

B.4091 December 20, 2024 — Beltsville, MD

This is a matter of extreme public safety. Driving at night is already dangerous because of low visibility. We have minimize this with headlights. However we are now being blinded by these headlights. Particularly, the led lights on newer models. I have to avert my eyes from the road inorder to not become disoriented from the unnecessarily bright lights of oncoming cars.

B.4092 December 20, 2024 — Chicago, IL

Its dangerous

B.4093 December 20, 2024 — Columbus, OH

LED headlights are very blinding and distracting. I have to look at the white line on the side of the road while driving to work in the dark morning hours. When they have thier brights on its 10x worse.

B.4094 December 20, 2024 — Dayton, OH

When driving on dark roads that do not have street lights you want to be able to what is ahead in front of you. To be blinded by the bright LEDs from incoming traffic is absolutely dangerous, you are either trying to avoid being blinded or are blinded both of which takes your eyes off the road which can potentially cause accidents. Whoever originally thought of utilizing LED headlights clearly did not think of the repercussions on the road and to drivers

B.4095 December 20, 2024 — KIRTLAND, OH

Please include verbiage that includes restrictions on and accountability for headlight alignment and angle of emission. Headlights should be prohibited from egregiously crossing over the center line. Oncoming traffic headlights have no business being in my face when I am on the other side of the

road. Blinding other drivers makes our roads dangerous and makes night driving impossible for. Headlights used to align to the shoulder. It should remain like this. Thank you for this petition.

B.4096 December 20, 2024 — London, United Kingdom

THESE LIGHTS ARE BLINDING

B.4097 December 20, 2024 — OH, United States

There’s no good reason for these LED headlights, they’re blinding most drivers and that’s a danger to all lived

B.4098 December 20, 2024 — Struthers, OH

Those lights may "shine brighter and further allowing you to see further." However they for people even with 20/20 vision they are blinding. Just as bad as staring directly into the sun!

B.4099 December 20, 2024 — Willoughby, OH

LED lights are far too bright for use in vehicles. There's no good argument for them, they are beyond unnecessary and extremely unsafe!

B.4100 December 21, 2024 — Akron, OH

This is dangerous.

B.4101 December 21, 2024 — Edgewood, KY

It makes driving at night a burden. Why should I need to consider spending money on tinting my windows to avoid the bright lights?

B.4102 December 21, 2024 — Greensboro, NC

We need to be taking more steps to making US roads less of a deathtrap like so many European countries have.

B.4103 December 21, 2024 — Harwood Heights, IL

These lights are so dangerous my husband and I are older and drive a smaller car and I worry that we will get into a accident

B.4104 December 22, 2024 — Aurora, IL

My wife can’t see

B.4105 December 22, 2024 — Greenwood, IN

I have Astigmatism which when paired with the crazy bright LED headlights, means I can’t drive at night and I’m 30. It’s not safe as the lights are so blinding I cannot even see my lane. Please do something.

B.4106 December 22, 2024 — Portland, OR

Driving at night has become increasingly dangerous every year due to these new cars coming with extremely bright LED headlights. I've nearly been in many accidents from going around bends only to be blinded by an oncoming car. I live in a state where it rains 9 months out of the year, which only makes the glare worse. And not only is it awful seeing it from the front windshield, but these lifted trucks who's headlights shine directly through my back window and reflect off my rear view mirror make it difficult to concentrate on what's in front of me. They need to be banned ASAP.

B.4107 December 22, 2024 — South Yorkshire, ENG, United Kingdom

These headlights are downright dangerous

B.4108 December 23, 2024 — Blackwood, NJ

I think this is a concern for people's health, the lights really cause a lot of stress, and it makes people really angry that we have people driving 1 you act like that can't see to have really high lights is disgusting it's nasty. There were many times I wanted to get out my car and take a bat to light and solve the issue my way. The radiation isn't good and hurts the human eyes. I think instead of tints, having really high lights on when driving should be band and illegal and jail time should be served, on any car and government car. Like I said it's blinding.

B.4109 December 23, 2024 — Buffalo, NY

The widespread use of LED lights, particularly the extreme brightness of white LEDs, has become a significant concern for both humans and wildlife. These lights are often unnecessarily bright, disruptive, and harmful to health and the environment. Their negative effects must be addressed with greater consideration for all forms of life. For humans, the brightness of LED lights can be overwhelming. Personally, I find it difficult to drive at night with these lights glaring into my eyes. They cause headaches, discomfort, and an overall sense of unease. It's unfair to subject people to such harsh lighting in everyday situations, whether they're walking down the street or driving a car. This issue is even more pronounced for wildlife. Insects, trees, and other organisms are all negatively impacted by these lights, which disrupt natural cycles and habitats. The argument that LED lights are "cheap" isn't enough to justify their widespread use. History has shown us that prioritizing cost over quality can have dire consequences. For example, asbestos was once considered a miracle material, but its long-term health hazards forced us to abandon it. LED lights may be cheaper to operate, but they're already causing harm. Over time, they could lead to widespread eye problems, increased reliance on corrective lenses and technology, and more waste in landfills due to the need for constant upgrades and replacements. We need to prioritize quality lighting solutions that respect both human and wildlife needs. Higher-quality lighting may cost more to operate, but the benefits far outweigh the drawbacks. No one should fear having their neighborhood streetlights replaced with bright, glaring LEDs that trespass into their homes, disrupt their peace, and destroy their right to private enjoyment of their property. For example, a covered front porch should remain a usable, enjoyable space—not rendered useless by light pollution from harsh streetlights. Streetlights in residential areas should not exceed 2,200 Kelvin. Lighting above this threshold is too harsh, creating a sterile, unnatural environment that clashes with the character of our homes and neighborhoods. These LEDs aren't even traditional lightbulbs—they're engineered products that don't provide the same warmth or quality. They don't "rewind" any damage done to the environment and are not a panacea for climate change. Instead of focusing on overly bright, harmful lighting, we should consider planting trees to offset carbon footprints, preserving existing wildlife, and ensuring solar farms are placed on rooftops rather than on valuable natural land. In conclusion, while LED lighting is marketed as a cost-effective solution, it comes with significant hidden costs. The health, environmental, and aesthetic impacts are too great to ignore. We must advocate for lighting solutions that are both environmentally sustainable and respectful of human and wildlife needs. Quality lighting isn't just a luxury—it's a necessity for the well-being of our communities and the planet.

B.4110 December 23, 2024 — Cleveland, OH

I have vertigo as well from LED light sensitivity. It is definitely a hazard for those who still are capable of driving at night but with limited driving distance due to the LED headlights.

B.4111 December 23, 2024 — Ontario, CA

When I am faced with someone with these headlights, it blinds me for about 20 seconds. I've almost been in countless car accidents as a result.

B.4112 December 24, 2024 — Lake Havasu City, AZ

As our population ages, eyesight is a concern. These horrible bright lights are blinding and older eyes don't react as quickly as they once did. There is no reason for them.

B.4113 December 24, 2024 — Seattle, WA

It is too dangerous to have to turn my head to the right when there is oncoming traffic. Or when I'm walking my dog and I lose much of my vision because an oncoming car is 2 blocks away. Or driving a short distance in my neighborhood and being blinded from cars in my side view mirror. Or even sitting in my living room, cars 3 blocks away lighting up my interior. It affects life off the roads too, stress and eye health - huge safety concern.

B.4114 December 24, 2024 — Tucson, AZ

Nothing has diminished my quality of life in the modern world like the new headlights. It's hard to drive a mile to the grocery store without nearly running over a pedestrian due to headlight induced blindness. The headaches after a long night drive can last hours, and my last cross country trip was

increased by days because I had to stop driving at sundown. Driving at night was a pleasure in the 90′s and early 00′s. I

B.4115 December 25, 2024 — Auburn, NY

I strongly feel that these blinding headlights are an issue and especially as someone who already doesn’t have the best vision, it has decreased my vision more than before even with blue light blocking glasses.

B.4116 December 25, 2024 — Ludington, MI

I CANT FUCKING SEE!!!’

B.4117 December 25, 2024 — Minneapolis, MN

Regulation and enforcement on the issue of overly bright headlights is long overdue. This should be common sense.

B.4118 December 25, 2024 — Valley Mills, TX

When high beams are on, they blind me and make it hard to see the road. I drive an older car without bright lights, so it makes the situation even more difficult.

B.4119 December 26, 2024 — Bridgewater, MA

Or or or, and hear me out, require headlights be mounted at a lower height on the vehicle. No more headlights above 3ft on new vehicles

B.4120 December 26, 2024 — Calgary, Canada

Cars can be dangerous weapons of death, and we need to hold manufacturers accountable for creating safety risks for everyone on the road/bike lane/sidewalk.

B.4121 December 26, 2024 — Canandaigua, NY

I’m on the verge of needing to change my work hours so I don’t drive at night. I have a 30 minute drive home and many nights I arrive home with a headache from squinting to avoid the lights of oncoming traffic. I’m also pulling over if anyone is driving behind me at a distance that causes their headlight to him the rear and side mirrors at the same time.

B.4122 December 26, 2024 — Cedar Grove, NJ

There are far too many times where I′m blinded driving in the middle of the night. I like to take mountain roads where there′s no one there and I have my high beams on. However, I turn them off immediately when a car passes and they typically do the same. There are too many times where I was blinded and I thought that they had their high beams on. I flashed them with my own and boy, was I wrong when they actually did put their own high beams on. I would have to come to a physical stop because I couldn′t see and I didn′t want to drive off the road. It′s disgusting. I can′t drive in peace in the middle of the night without getting blinded or have an excruciating headache. My normal lights are yellow. My high beams are LED. That′s what it should be. It shouldn′t be regular lights are LED and high beams being an even more blinding LED. Ban bright headlights. There′s no need for a constant LED light in my face whenever I′m driving.

B.4123 December 26, 2024 — Chesapeake, VA

Please stop destroying my eyes. I may literally die and kill all of my passengers by accident one day if this continues. I don′t want that but, like all creatures with eyes, I can′t see when blinded.

B.4124 December 26, 2024 — Goshen, KY

If I get blinded by 1 more lifted pavement princess I will cause a head on collision

B.4125 December 26, 2024 — Highland, IL

The risk to the public, particularly families with small children, caused by these absurdly bright lights is outrageous. One′s life and one′s safety on our public roadways should and do outweigh the preferences of those who out of malice or to overcompensate for other…issues blind drivers on the roads.

B.4126 December 26, 2024 — Milton, FL

Every night, me and my wife come across these blinding LED headlights, pointed right at eye level for smaller cars, making it impossible to see anything until they pass, leaving us with ghost vision, a terrible headache, and immense eye pain. These headlights are brighter than our brights. They are completely unnecessary, and more importantly, dangerous. Especially in a state with elderly drivers, blinding people can cause serious traffic accidents and already has. This needs to change, before it gets even more out of hand.

B.4127 December 26, 2024 — North Hollywood, CA

Why do you need lights that damn bright? Especially in the city! Having astigmatism makes the situation a whole lot worse. Stop blinding drivers!!!!

B.4128 December 26, 2024 — Provo, UT

Time to ban LED headlights and automatic high beams. The lights are excessively bright and blinding. And the auto bright feature doesn't work, staying on far too long. Enough is enough. It doesn't have to be hard. Just ban the LEDS altogether.

B.4129 December 26, 2024 — San Antonio, TX

I get blinded by excessively bright headlights practically every time I drive after dark. Thankfully it has yet to cause me to miss a curve, vehicle or pedestrian in front of me. But it is only a matter of time before something terrible happens.

B.4130 December 26, 2024 — Seattle, WA

Regulate these led lights

B.4131 December 26, 2024 — Tallahassee, United States

I'm so tired to being blinded by these new ridiculously bright headlights. They are dangerous and need to be better regulated. Please do something to fix this issue.

B.4132 December 27, 2024 — Burley, ID

Every time I get blasted with these intense led headlights, my optic nerve sends a shot of intense pain through my brain, down my spine and back again. It's become such a problem in my area (because almost everyone has them) that I'm almost ready to quit driving at night altogether. There are people I need to drive for, but this problem just gets worse. Something needs to be done!

B.4133 December 27, 2024 — Burnaby, BC, Canada

It's a GLOBAL issue actually...

B.4134 December 27, 2024 — Deer Isle (family property), ME

Three minutes of blinding, center-of-vision afterimages in drivers is INSANE! Prohibit these headlight! Now!

B.4135 December 27, 2024 — Eagle River, AK

LED Headlights are dangerous! Ive had to pull over before because my eyes hurt and I couldn't see, it is a safety concern.

B.4136 December 27, 2024 — Milwaukee, WI

Such a danger to drive with what seems to be a total lack of headlight brightness regulation. Some are blinding even in daylight. The ones that strobe are terrible. I'm afraid to drive at night for fear of being blinded not only by oncoming traffic, but also by reflections of them in the rear view mirror. Some are as bright as a car with their "brights" on. Something seriously needs to be done!

B.4137 December 27, 2024 — New Orleans, LA

I want to be able to drive safely again at night. I am night blinded every time I try to drive after dusk because of these overbright lights.

B.4138 December 27, 2024 — Santa Cruz, CA

LED lights are bad for our eyes, great place to start would be with our cars' headlights.

B.4139 December 27, 2024 — South Glastonbury, United States

Who the fuck is in support of blinding other drivers. No shit we need to ban LEDs

B.4140 December 28, 2024 — Cincinnati, OH

I've started night driving a lot more for work. Ever since my eyesight has been dwindling and I'm unable to see things like I could just a few months ago. I mostly blame it on LED lights because they are so bright they hurt my eyes and I have no choice but to endure them so I don't get in an accident.

B.4141 December 28, 2024 — Cudahy, WI

These new headlights are dangerous. How could they be allowed? Accident waiting to happen.

B.4142 December 28, 2024 — Detroit, MI

It hurts my eyes come on guy

B.4143 December 28, 2024 — Ferguson, MO

Super Blbright LED lights should not be used for regular headlights on a car. People shouldn't have to get tinted windows or have to put on sunglasses just in case another driver has irritating LED headlamps. Every time these vehicles approach from behind to pass your vehicle, you have to adjust your sitting position or shift your side/rear view mirror so you don't get blinded. It's even worse for vehicles driving from the opposite lane as you have no choice but to shield your eyes and slow down/stop in the middle of the road to avoid driving while blinded.

B.4144 December 28, 2024 — Fruitland Park, FL

I have had multiple instances where I have almost run off the road due to blinding incorrectly aimed led headlights from oncoming vehicles. I have had to stop multiple times and wait for the vehicles to pass so I could see the road again.

B.4145 December 28, 2024 — Gaithersburg, MD

Avoidable, dangerous, careless headlights without options.

B.4146 December 28, 2024 — Garden, MI

These lights are so bright as to be obviously unsafe, I recall reading a report some time ago that LED lights do not improve visibility of the road ahead for the drivers of these vehicles, I can't remember who did the study but it makes sense as the light is focused rather than dispersed.

B.4147 December 28, 2024 — Irvine, CA

These headlights make it dangerous for other drivers. These newer bright headlights are getting way to bright

B.4148 December 28, 2024 — Murphysboro, IL

While I'd love to have personal freedom, I've been avoiding getting my license for 4 years. I'm 19 now, but my eyesight is just too poor to drive on the same road as LED headlights. I can never even tell the difference when someone switches from high beams to low beams or vice versa because they're just that bright. Having hereditary migraines certainly hasn't helped me. Almost everyone I talk to agrees that they're too bright for the road.

B.4149 December 28, 2024 — North Olmsted, OH

The sun can be too bright at times and I can wear sunglasses, but with some of these factory LED headlamps, I am almost blinded at night and forced to look at the right side of the road to maintain my position in my lane. It can be very disorienting.

B.4150 December 28, 2024 — Sacramento, CA

i keep my hi-beams on all the time now. they are still not as blinding as those f#%*ing led lights

B.4151 December 28, 2024 — San Carlos, CA

I'm nearly unable to drive at nights, due to the blinding effects of the bright LED headlights.

B.4152 December 28, 2024 — Sandy, UT

Anytime i am driving at night and someone has the LEDS im blinded for a certain amount of time because theyre so bright, people are selfish about it. as long as they can see its fine right? but nobody else matters right? i hate LED headlights, they are extremely dangerous, and selfish. do better

B.4153 December 28, 2024 — Sapulpa, OK

I am tired of other people's selfishness and inconsideration blinding headlights being allowed on our streets and highways. This is a safety issue that needs regulations, enforcement, and fines.

B.4154 December 28, 2024 — Seattle, WA

I started driving again after about 4 years. I got a job and then daylight savings hit and I was driving home in the dark. I was astounded at how hard it was to drive while being faced with such bright headlights. The headlights have definitely gotten brighter in the time I wasn't driving. I've tried everything to help, like blue light filtering glasses, but its still so hard to see and I don't feel like I'm able to drive as safely at night. This and the size of vehicles needs to be regulated. People are dying because cars in the US are becoming bigger and brighter.

B.4155 December 30, 2024 — Aurora, CO

I am just learning how to drive and had to do night driving as to get my hours in and I have been blinded by these dangerous bright lights!! I also have astigmatism which does not help at all!! my eyes are already poor due to this and I am not trying to go blind or crash for my first time driving!!

B.4156 December 30, 2024 — Aurora, CO

{"videoUrl":"https://stream.mux.com/ZI26ELUaASg2Fqj9q019RbWQiRqBGxJgfo004j4i5kr3w","cloudflareUid":"d282dd45ceb19d4a943b6d016d3f38a7","muxAssetId":"DrOL02NKhTT35QSO4scwA58roEm01LcbTYDDk6yjBh01pI","muxPlaybackId":"ZI26ELUaASg2Fqj9q019RbWQiRqBGxJgfo004j4i5kr3w","muxPlaybackUrl":"https://stream.mux.com/ZI26ELUaASg2Fqj9q019RbWQiRqBGxJgfo004j4i5kr3w","muxThumbnailUrl":"https://image.mux.com/ZI26ELUaASg2Fqj9q019RbWQiRqBGxJgfo004j4i5kr3w/thumbnail.jpg"}

B.4157 December 30, 2024 — East Sparta, OH

I no longer drive at night because this issue is so bad. Insane that this is acceptable.

B.4158 December 30, 2024 — Goodlettsville, TN

Dark Sky Advocate in Tennessee. We have too many overbright headlights on raised pickups that blind everyone on the road. The NTSB should also allow safer lights that can point down when needed.

B.4159 December 30, 2024 — Milan, PA

I have total more vehicles than I care to count because I couldn't see what's in front of me because the other vehicle coming at me had extremely bright lights. I've almost been hit by multiple 18 wheelers and more due to blinding headlights. I'll be happy to see them banned.

B.4160 December 30, 2024 — San Francisco, CA

Technology has outpaced regulations to keep us all safe on the road.

B.4161 December 30, 2024 — cambridge, MA

LED's have significantly changed my life. I can no longer drive, walk outside at nighttime, go food shopping, etc. I also end up with intense migraines and anxiety. In addition, they change the circadian cycle, animals need to be able to rest at night, too. Not to mention all of the car accidents!

B.4162 December 31, 2024 — Southampton, ENG, United Kingdom

I support the control of LED headlights

Comments left in 2025

January 2025

B.4163 January 1, 2025 — Boulder, CO

I'm amazed that these lights are still legal. Frequently, they are worse than traditional high beams. There are instances when I can not see lines on the road or a turn of the road.

B.4164 January 1, 2025 — Burlington, NC

These headlights are actually brighter when the car or truck is on a rise. Then they do appear to be “high beams”. I’m always flashing my lights at these blinders because it appears they are using their high beams! This has been going on for years. Something must be done, please!

B.4165 January 1, 2025 — Canby, OR

Because I have astigmatism and there are times when I feel that I can't see. That I need to be wearing sunglasses

B.4166 January 1, 2025 — Central Point, OR

I have migraines and these super bright headlights are like an ice pick in both eyes. I suffer for several days after having to drive at night, particularly in the rain.

B.4167 January 1, 2025 — Franklin Lakes, NJ

I am blinded when I drive at night in dark winding roads :(

B.4168 January 1, 2025 — Glen Head, NY

I am 62 and drive a small car. These new headlights aim right into my face. I have been able to mitigate them substantially with special yellow tinted night driving glasses but getting rid of these headlights altogether would be far better.

B.4169 January 1, 2025 — Grants pass, OR

Since the new led headlights, I’ve had to stop driving at night. They are beyond blinding, terrified I’ll get into an accident because of on coming traffic as well as someone behind me with the blaring light. Shouldn’t be legal.

B.4170 January 1, 2025 — Longmont, CO

I live in a more rural area, with lots of trucks. These new headlights almost blind me at night. I too have astigmatism and between the new LED headlights, and now vehicles with one long headlight across the front,, it just blinds you, even on low beams. These need to be outlawed, before more people are hurt or killed.

B.4171 January 1, 2025 — McMinnville, OR

As an individual that has this issue the newer vehicles? The newer headlights are literally blinding me to the point I have to get brighter headlights just to be able to see over theirs. This is a battle where nobody will win. This needs to be regulated.

B.4172 January 1, 2025 — Meriden, CT

So many cars seem to have their high beams on... at least that's what I originally thought, but seeing the difference between the softer lights and brighter ones led me to believe that more and more cars have LED lights which are just too bright. I always think people have high beams on which is so aggravating but it's just LEDs. These things are not safe.

B.4173 January 1, 2025 — Newville, PA

Because of these lights I've almost been in several accidents. Everytime I start to see the bright lights it just makes me what to stop right in my tracks.

B.4174 January 1, 2025 — North Bergen, NJ

There will be more pedestrian struck by blinding drivers

B.4175 January 1, 2025 — Pontiac, IL

I hate those lights. .

B.4176 January 1, 2025 — Seymour, IN

These headlights blind me with astigmatism that I have

B.4177 January 1, 2025 — Trenton, NJ

I'm constantly blinded by these headlights

B.4178 January 1, 2025 — Woods Cross, UT

These lights are blinding. I also wonder if there is something in the Disabilities Act that would make these illegal since it makes it impossible to see when these lights shine at me while I'm driving. I have astigmatism in one eye. What about those with eye disabilities who are licensed drivers? These overly bright lights will take their freedom to drive where they want or need to go at night. Personally I despise these lights, even though they are on our vehicles.

B.4179 January 1, 2025 — cincinnati, OH

I drive!

B.4180 January 1, 2025 — fort walton beach, FL

I can't see when cars are coming towards me

B.4181 January 2, 2025 — AR, United States

I have perfect vision and no astigmatism and it is still seriously hard to drive when you are blinded by someone with stupidly bright lights. It's not right. There has to be some kind of regulation so that other drivers are safe !

B.4182 January 2, 2025 — Bedford, IN

The LED headlights do need to be outlawed. I absolutely agree it's light shining the brightest of flashlight in a person's eyes. I have experienced this so many times I've lost count. I actually have to put my fog lights on. And keep looking down at the road lines till that vehicle goes by. To be perfectly honest. I don't drive at night anymore. Because I am afraid of having a wreck.

B.4183 January 2, 2025 — Cooperstown, NY

Because I can't drive at night anymore

B.4184 January 2, 2025 — Grass Valley, CA

I have astigmatism, so these super bright LED headlights are much worse for me. They're blinding. According to the American Academy of Ophthalmology, approximately 33% of Americans suffer from astigmatism. That should be enough right there to ban these.

B.4185 January 2, 2025 — Hohenwald, TN

I don't understand why they aren't illegal. Could see well enough with the yellow lights, these white LED just blind everyone and make the roads dangerous.

B.4186 January 2, 2025 — Indianapolis, IN

Definitely BLINDING! It's hard to drive straight on winding roads and when I slow down to a crawl cars get mad. That's extra wear and tear on my brakes and many other things on my vehicle as well as unsafe. From squinting and being on edge it adds extra wrinkles causing premature aging

B.4187 January 2, 2025 — Lake Stevens, WA

Headlights so bright that they temporarily blind incoming traffic are an obvious and avoidable hazard. They need to be regulated!

B.4188 January 2, 2025 — Meredosia, IL

These lights blind me as I drive a hr home every night. I wear glasses and have astigmatism these headlights are out of hand. Especially on full size pick ups.

B.4189 January 2, 2025 — Omaha, NE

I have astigmatism and because of that, bright lights from these new headlights causes more of an issue than that of the older incandescent headlights.

B.4190 January 2, 2025 — Palos Hills, IL

I have astigmatism and these lights blind me at night.

B.4191 January 2, 2025 — Parrish, FL

I drive 2-lane rural roads at night and cars with blinding lights have me navigating the road (at 50-60 mph) by focusing on the edge of the pavement where it meets the shoulder__if there was anything in the lane in front of me, I'd run right into it! These overly bright lights are a definite hazard, particulary to anyone in sedan-like vehicle, and not a jacked up truck with headlights that are 4- feet above the ground. Thank you NHTSA, for dropping the ball and not doing your job!

B.4192 January 2, 2025 — Philadelphia, PA

https://www.youtube.com/watch?v=nFalI-hT2Uk

B.4193 January 2, 2025 — Spokane, WA

As a young mom it's terrifying driving at night due to the high volume of cars with LED lights. As someone who already suffers from astigmatisms and is borderline legally blind in one eye, it's hard to feel safe driving in the dark. They tell you to look at the right side of the road when facing bright headlights but these are so bright that it glares over the entire windshield basically making it so I hope and pray I don't get in a crash. Let alone the amount of pedestrians that are barely seen crossing roads with oncoming LEDs frying your corneas, you can't see them crossing until they're just out of direct LED headlights. There's no amount of corrective lenses or sunglasses that can combat the blinding lights.

B.4194 January 2, 2025 — Staten Island, NY

This is an accident waiting to happen. People are already driving into police cars and ambulances with bright led lights. We'll be driving into other cars next.

B.4195 January 2, 2025 — Suffolk, United States

These lights are blinding and could cause someone blinded by them a bad wreck

B.4196 January 2, 2025 — United States

https://www.dailydot.com/news/led-headlights-astigmatism/

B.4197 January 2, 2025 — United States

Extremely dangerous especially when you have cataracts in addition. Please get with times and do something about this. Almost 50% of the population has an astigmatism.

B.4198 January 2, 2025 — Utica, PA

The brightness in all the led lights today are in my opinion more dangerous than what used to be. From personal vehicles to emergency vehicles. Blinding always.

B.4199 January 2, 2025 — Westfield, United States

Those lights are dangerous to everyone on thee road

B.4200 January 2, 2025 — austin, TX

The LED headlights on cars are way too bright. I avoid driving at night now, because those lights literally blind me to what's in front of me. It just isn't safe. Please ban these lights.

B.4201 January 2, 2025 — burbank, CA

The auto makers don't really realize that those LED lights even on the trucks that leave them on the high beams. That could give migraine headaches, it also has us trying to avoid them, but we can run off the road. The pick up truck owners don't care what they're doing to oncoming traffic or they following behind somebody. I have to adjust my mirrors because of the lights are so bright. I want to

continue driving at night time, but not at the expense of the LED lights that are doing to me and other drivers

B.4202 January 3, 2025 — Angleton, TX

I live in a rural town 30 mins south of Houston. Our road quality isn't the best and paired w these led headlights it is impossible to drive safely anywhere. They will run you off the road after they blind you w their lights. Please, help bc praying and driving isn't doing it.

B.4203 January 3, 2025 — Atlanta, GA

On the health side of things.... These new white/blue LEDs are very fatiguing to the eyes. Blue light could potentially damage retinal cells and it can also disrupt your circadian rhythm. This damaging blue light has been found in the LEDs. The bad thing is that we are forced to be exposed to this light everyday. LEDs on cars is a horrible idea it causes more damage than it does good, from potentially damaging driver's eyes from prolonged and repeated exposure, to completely blinding and potentially causing an accident. You don't need to see so much in front of you when you are usually not alone on the road... They should make car light bulbs that have both the yellow light and the bright white light. Being able to toggle between the two would have been the better way to implement LEDs into cars. It still would not have been ideal, because there are people who would use the white light for everything, but it would at least have given an option that's not available now. "How are those lights not illegal!" I've said to myself many times after being completely blinded by LED headlights. I'm sure everyone loves playing guess where the road is when you get blinded on a curve. I get that it's better to be able to see more of the road, but isn't blinding everyone else worse? I have had to resort to lowering my side view mirrors (luckily I drive on a 1 way road to and from work) so I don't get blinded from the cars behind me. I flip the tab on my rear view mirror so I'm not blinded by cars behind me. For the incoming traffic I use a shaded pull down visor that's supposed to be for the sun, but now has the function of keeping me from getting blinded. That seems like a bad idea, but it's the only way I comfortably see the road.

B.4204 January 3, 2025 — Atlanta, GA

I CANT FUCKING SEE AT NIGHT IM DAMN TIRED OF IT

B.4205 January 3, 2025 — Attleboro, MA

I feel they blind me at night and I have to pull over until my eyes are better, I have astigmatism

B.4206 January 3, 2025 — Brockton, MA

Driving at nights has become so difficult i dint want to do it anymore. The led lights makes my eyes feel like they are burning. You're literally blind and can't see nothing infront of you.

B.4207 January 3, 2025 — Cheyenne, WY

I'm a mechanic, auto manufacturers need to step down the brightness of LED headlights, they are becoming dangerous and they should know better.

B.4208 January 3, 2025 — Cincinnati, OH

I don't like looking at them.

B.4209 January 3, 2025 — Cullman, AL

How are these safe when the only person who can see is behind the wheel. Everybody else is blinded, but that one person is more important than everyone else?

B.4210 January 3, 2025 — Des Moines, IA

I also have astigmatism

B.4211 January 3, 2025 — Fort Dodge, IA

I HATE THESE LIGHTS

B.4212 January 3, 2025 — Greensburg, IN

This needs to be investigated but higher command. Im su its not just about astigmatism . No one can see with thise lights.

B.4213 January 3, 2025 — Haymarket, VA

I drive where other vehicles are. Can these things be made to auto dim when other light is around? I drive slower when I can't see forward, hopefully the car behind me will eventually pass. Blinded in front? You know the road is under what is blinding you. I avoid dark driving.

B.4214 January 3, 2025 — Houston, TX

I thought I was the only one with this issue. It seems to be way more than me. I have astigmatism also and it is blinding. So much so I be scared that I'm going to hit something or someone. Please ban the use of these lights unless necessary.

B.4215 January 3, 2025 — Jackman, ME

Basically avoid driving at night now because of these lights. Hell even during the day, some of these lights are still very noticeable from a good distance. Doesn't help that some vehicles are so tall the headlights are face level as well so even with low beams they can xray your brain.

B.4216 January 3, 2025 — Johnstown, PA

New headlights are too bright, blinding to other drivers making driving at night unsafe for everyone on the road.

B.4217 January 3, 2025 — Knoxville, TN

I'm an early riser. Have been for the past 20 years and almost every single morning I have to take a two lane road to get to work with these awful blinding headlights coming towards me. I have to wear night glasses to block out the sight of these led and ridiculously bright lights every now and then. Incandescent bulbs in my opinion are much safer and have been approved multiple times by different automakers and the DOT.

B.4218 January 3, 2025 — Lake Oswego, OR

At 24 years old, my eyesight has never felt worse than it has driving on the road at night now. I am constantly blinded, having to turn my mirrors outward, and flip my rear mirrors, essentially giving me 0 visibility. Cars should not be allowed to have headlights this bright and be unregulated. Someone needs to be held accountable. I genuinely fear for my life driving on the road with intense rain and weather conditions.

B.4219 January 3, 2025 — Louisville, KY

LED headlights, especially on pickups and other high vehicles, are blinding. This is especially true when they are cresting a hill.

B.4220 January 3, 2025 — Phil Campbell, AL

I shouldn't be scared to drive at night at age 36. These lights are ridiculous and behind times compared to the rest of the world. The research and statistics should be enough for a change already.

B.4221 January 3, 2025 — Prescott, AZ

LED headlights, physically make me instantly angry. I use blue light glasses at night to try to make the brightness of the LED lights not so aggravating. I feel these type of headlights need to be banned. They are so blinding.

B.4222 January 3, 2025 — Providence, UT

Many, if not most, drivers are experiencing night blindness solely due to the extremely high intensity of vehicle lights currently in use on our roads & highways. Personally I an appalled that basic roadway safety is so easily & frequently violated. These lights must be eliminated.

B.4223 January 3, 2025 — Silver Spring, MD

You don't need to have an eye problem to know those headlights are blinding. They should be banned.

B.4224 January 3, 2025 — Tucson, AZ

I thought it was me!! Thank you for doing this. I drive to work at 6am and I fight this everyday. My rear view mirror is permanently in the up position.

B.4225 January 3, 2025 — United States

https://www.dallasobserver.com/news/texas-law-allows-for-intensely-bright-headlights-21411057

B.4226 January 3, 2025 — Wolfforth, TX

I can't even drive at night anymore due to several close calls on the road due to blinding headlights. I drive a Beetle so if someone comes up behind me, it's pretty much over. Add in my astigmatism and blue eyes, and it's a recipe for a serious crash. Something needs to be done about this.

B.4227 January 4, 2025 — Forest Lake, MN

Those headlights are dangerous for oncoming traffic they are completely blinding! You know it's bad when you actually have to close your eyes as they come towards you and it's becoming more and more dangerous driving at night. In my honest opinion I feel there will be more and more accidents happening because of these headlights and that's a shame because nobody should get into a car accident and possibly lose their lives over headlights being too bright

B.4228 January 4, 2025 — Hugo, MN

These lights are blinding

B.4229 January 4, 2025 — Medford, NY

These headlights are blinding, there's no need for them. They are absolutely dangerous.

B.4230 January 4, 2025 — Nashville, TN

This issue has been a struggle for not just me but also my family ever since LEDs became popular. My mom has astigmatism and wears glasses. Whenever LEDs became the new normal my mom always had to pull over in fear of hitting the oncoming vehicle. LEDs when too bright can effect even those who have 20/20 vision. My dad also has had issues driving at night with bright LEDs And he does not wear glasses. I have even had to pull over or stop because I had to adjust my eyes back to my normal peripheral vision. Before I even got my license to drive I've been saying something needs to happen with these blinding lights theres no reason for them to be that bright. They should only have to be complyaint to traffic laws. Not far beyond that.

B.4231 January 4, 2025 — Palm Coast, FL

I think everyone can agree that LED headlights can be blinding and being blinded while driving can cause accidents!

B.4232 January 4, 2025 — Seattle, WA

Astigmatism is making it really un safe with these lights. i see some people using their high beams to counter. fix this.

B.4233 January 4, 2025 — Spartanburg, SC

I am blinded by these headlights.

B.4234 January 5, 2025 — Asheville, NC

seeing at night with blinding lights in front and behind me is impossible now

B.4235 January 5, 2025 — Bellaire, TX

These lights pose a real danger

B.4236 January 5, 2025 — Redmond, WA

Glare is a problem and these new "brighter" lights are the cause.

B.4237 January 5, 2025 — San Diego, CA

I'm tired of bright cars constantly damaging my eyes to the point that it hurts.

B.4238 January 5, 2025 — Snohomish, WA

My primary concern for the safety of myself and my family is driving at night, especially in the rain we experience in Washington. During the winter the sun sets at 4:30 and I find myself driving to work and back home in the dark on rainy streets. Oncoming traffic and vehicles behind me will temporarily blind me and I find myself looking down and to the right to focus on the white lines in the road just so

I can make it home. I'm absolutely terrified that I will get in an accident and god forbid cause harm to myself or others. Halogen bulbs are perfectly acceptable. The harsh blue light of LEDs is completely unnecessary, and many aftermarket bulbs exceed NHTSA standards. Something needs to be done to make our roads safe to drive at night.

B.4239 January 5, 2025 — United States

https://supercarblondie.com/driver-with-astigmatism-blinding-led-headlights/

B.4240 January 5, 2025 — York, SC

I'm not tryna die 🙏

B.4241 January 6, 2025 — Annandale, VA

LED lights are extremely dangerous when used as headlights and can cause many sensitivities in people when used to light offices and homes.

B.4242 January 6, 2025 — Columbia, SC

I'm sure other people have said this but I'm scared to drive at night because if I'm on a two lane road and someone has these bright lights coming at me there's about 10-15 seconds where I literally can't see anything. Not figuratively, literally. It's terrifying. If they're behind me, they light up my entire car and I can't check my rear view mirror or side mirrors at all.

B.4243 January 6, 2025 — Lisle, IL

These exceptionally bright LED headlights make it dangerous for oncoming traffic. Especially when applied to truck headlight use. Please regulate

B.4244 January 6, 2025 — London, Canada

I wear glasses and they blind me which is so so dangerous

B.4245 January 6, 2025 — Los Angeles, CA

LED lights are too bright and create a problem for drivers. I have noticed brighter lights on the road and it is becoming harder to actually see the road with all the glare from other LED headlights.

B.4246 January 6, 2025 — Memphis, TN

Some of the cars headlights are so bright, that you would think they had high beams on. It's just the regular head light. This is so dangerous especially at night when you are being blinded from behind AND in front. Not only that but people nowadays are so selfish they will ride on the back of you with high beams on to make you get out of the way, but somebody like me goes super slow, if im Inconvenienced so are you! Some of these people have the audacity to turn on high beams like they are in the middle of nowhere surrounded by darkness blinding you now from ahead and dont have common curtesy to shut them off until they pass you. I am 24 years old. I have been driving the roads since I was 16 and this was not a bad issue, especially with high beams. Now we have a high beam probably AND those cars headlights that are naturally high beam. Who idea was it to change how bright headlights are? Why is there not being a test to see how bright the lights look from the opposite direction and from behind another car.

B.4247 January 6, 2025 — Oakmont, PA

Blinding headlights can cause accidents

B.4248 January 6, 2025 — Ypsilanti, MI

I don't consider myself to be especially light sensitive, but driving at night has become increasingly difficult for me in the last few years. I love that LED lights conserve energy, but, like each one in my home, they need a dimmer. We limit lumens in our homes, based on activity, and they should be limited on our roads in an enforceable way. Without regulation, it will continue to be a race to the brightest. If your neighbor drives with super bright regular headlights, you feel the need to increase the brightness of the ones on your car, just so you can see. This needs to be put to a stop. Drivers also need to be aware that although their cars have "automatic brights," they often don't pick up those who need to see the most: pedestrians, cyclists, motorcyclists and road workers. Also, having the

brightest lights on the market won't save your precious vehicle from a bounding deer. It only blinds the oncoming car that is also going just as fast as you.

B.4249 January 7, 2025 — BON SECOUR, AL

These things are a hazard and have nearly caused me to wreck on multiple occasions by rendering me unable to see.

B.4250 January 7, 2025 — Citrus Springs, FL

I would love to just give up my car I hate driving mainly because of other drivers it used to enjoyable now I only drive when I have to I try to do everything in one trip to avoid as much driving as possible the lights are by far the most stressful because the roads are flowing with people animals trash it's so stressful to drive trying to avoid hitting someone or something temporary blindness has caused me to hit things in the roads heart rate going through the roof people are dying out there who's next how many died while writing this please do this one thing to help save lives with people walking down the streets it's only a matter of time who can live with that kind of guilt the stress alone can cause heart attacks killing others please listen to all these pleas it's real

B.4251 January 7, 2025 — Cleveland, TN

I had no intention of being limited to daytime driving because of laws being broken regarding the limits of headlights brightness limits. Is there anywhere I can sign up on a class action suit

B.4252 January 7, 2025 — Kirkland, WA

Unnecessarily bright lights and tall cars are sold as a safety feature, but they are only safe for those in that car. They are much more dangerous for everyone else!

B.4253 January 8, 2025 — Dalton, GA

I too have astigmatism & LED lights make it nearly impossible to see the road. It was already hard enough but these new LED lights make me not even drive at night anymore unless need be.

B.4254 January 8, 2025 — Deshler, OH

I'm a driver with two different lenses in my glasses, since my left eye is more farsighted and my right more nearsighted. I also have an astigmatism which makes lights expand into vertical, bright lines. When these LED headlights come into view, not only do I see dual reflections from my glasses, but they cover the ENTIRE road with light because of my astigmatism. I compared this with regular red-hue light and the effect is easily looked around otherwise. How come I have intense glares covering my entire view ONLY when LED headlights are on the road? I have to ride the white line, barely on the road sometimes, just to make sure I'm not getting too close since I can't see their car at night OR the middle yellow line because of the astigmatism. How long do I have to tread on the edge of bridges and old roads before I crash because of these things?

B.4255 January 8, 2025 — Leitchfield, KY

Tired of being blinded and having to stop in the road way because unable to see. And these lights go up to several cars ahead. We don't need these on regular vehicles they are the same as spotlights.

B.4256 January 8, 2025 — Los Angeles, CA

Driving is already a danger as it is. But I've increasingly noticed the harsh bright lights on my drives. The blaring lights are a distraction and often times I've had to resort to flipping my rearview mirror to be able to see on the road.

B.4257 January 8, 2025 — Madison, WI

I've been driving quite often at night due to work and personal matter. I wear glasses and have never had issues with seeing at night besides one instance - when other people have excessively bright LED headlights which blind me completely. If someone is behind me, my side mirrors and rearview mirrors become totally unusable when (a) they are driving a car which sits higher than mine and (b) when they have those bright LED headlights which flash their lights directly into my mirrors. If someone is in front of me, their headlights are bright enough at this point where they can be on the other side of the road and totally blind me. It feels unsafe and at this point, I fear for my safety and others when having to drive through more rural, mountainous, or forestry areas.

B.4258 January 8, 2025 — Pittsburgh, PA

I have to cover my eyes due to the intensity of these headlights which is obviously NOT IDEAL when you are driving!

B.4259 January 8, 2025 — Portland, OR

The glare from most of these true-white LED headlights is so bad, that they look more like an array of laser-pointers to my eyes, and I only have a slight astigmatism. The featured photo basically showcases the experience, but not totally. That doesn't just happen with the windshield and/or camera lens. There's that much glare on the windshield and then just as much in my eye. I seriously can hardly drive anymore because I can't see. Way beyond that, I'm stressed out on a daily basis because of the presence of these things everywhere, constantly glaring in my eyes even when they're just in my periphery, even when I'm at the dog park. The worst offenders around Portland are the Trimet buses (annoyingly), then some Teslas, Subarus and Mazda SUVs in particular, but then most other late-model vehicles. Then lots of people are putting absolutely bonkers bright aftermarket LEDs from Amazon in their older cars with projector housings or reflectors. So some truly are laser-like and others are glaring in all directions. Others are putting bright white LEDs on the backs of their vehicles and aren't getting pulled over. Huge LED light bars are all the rave. It's depressing and maddening. Life is effing hard right now. I'm losing my mind over this.

B.4260 January 8, 2025 — Redmond, WA

Driving has become seriously dangerous at nighttime. I shouldn’t have to worry about driving blind two different ways.

B.4261 January 8, 2025 — Redmond, WA

Tesla models specifically seem to be adjusted to blind oncoming traffic instead of illuminating their lane. Tesla needs to change the "factory" setting to not blind oncoming traffic.

B.4262 January 8, 2025 — Roberts, WI

Please do something about this. I literally have to stop in the middle of the road to let oncoming vehicles go past me because I can’t see the road. This is extremely dangerous.

B.4263 January 8, 2025 — Seattle, WA

I am tired of being blind for most of my drive home.

B.4264 January 8, 2025 — Smithtown, NY

I can't see the road with a car or suv, truck that has these LED headlights. I get temporarily blinded. Why were these headlights ever allowed in vehicles on public roads? Who/whom personally approved them, should have their Surety Bonds pulled and be held personally liable and accountable with their personal wealth confiscated.

B.4265 January 8, 2025 — Smithtown, NY

It's time to sue all that approved these LED headlights for public roads. Sue them personally for all their wealth and file claims against all their Surety Bonds. They need to be held accountable and liable PERSONALLY and not the corporate construct of any State or Corp.

B.4266 January 8, 2025 — Tampa, FL

I have to wear sunglasses at night just so I'm not blinded by these headlights, cops can't tell if it's new headlights or high beam's so they can't do anything about it either

B.4267 January 9, 2025 — Goleta, CA

The more and more these new cars are made with LED lights, the harder it becomes to drive at night. Especially on roads that are barely lit, it’s very hazardous.

B.4268 January 9, 2025 — Hyattsville, MD

I drive every day and have experienced the blinding glare of a vehicle with LED lights during various times of the day. But it's truly amplified at night. There have been a number of times when driving, that another car with LED lights either entering or exiting the lane I was in, headlights hit my mirrors unexpectedly and gave a me dose of blinding, white light that made my heart speedup some beats.

Because in that those few seconds, I could see nothing and held tighter to the wheel to keep it steady until I could adjust the way I was sitting or my mirrors, so the light was no longer blinding me. Please help regulate their intensity

B.4269 January 9, 2025 — Sammamish, WA

Desperately needed

B.4270 January 9, 2025 — San Jose, CA

The new white and bright head lights have become a problem for night driving. Especially combined with people moving over to suvs and cross overs that have higher head light placement. On top of that the modern cars are coming with automatic high beams which I think people are just leaving ON, causing added issue. I drive a regular sedan, it's very noticeable for me and i have to adjust by focusing my eyes else where while trying to stay in lane using peripheral vision. Sometimes the headlight from oncoming suv/truck is so bright, especially on undivided two way road, that I can't see the road properly and I have to slow down significantly and prepare to brake if needed. I don't understand why such bright white led head lights are needed. My car has yellow lights that are angled to project just enough and I can comfortably see the road. I am not sure what to do at this point other than constantly adjust during night driving and wear sunglasses at times. Or spend a ton of money to get a higher riding vehicle to mitigate some of this, but I worry that this will add another vehicle into the traffic creating same issue for others.

B.4271 January 9, 2025 — Summerville, SC

I can’t see when there coming at me

B.4272 January 9, 2025 — Vista, CA

there's been multiple times when driving at night where i'm blinded by the bright headlights. i have astigmatism and it gets worse with the on comming headlights and those that shine from the rear view mirror making it difficult to see the road without causing a crash. i had to put on my hazards from time to time to pull over cuz i couldn't see. in the early 2000's there weren't blinding lights and flickering bright lights outside on the streets. i think they should be banned and those who can't drive without the power of jesus shouldn't be driving at all.

B.4273 January 10, 2025 — Katy, TX

Driving in big cities has become 10x worse because of the blinding brightness of new headlights. Makes it impossible to even see the road because of the glare.

B.4274 January 10, 2025 — Los Angeles, CA

It takes my eyes so long to lose that "camera flash" effect - even after a car passes me by, I'm still blinded for another minute or so afterwards. I never needed sunglasses to drive at night before!

B.4275 January 10, 2025 — Mountain Home, ID

I almost hit a car and pedestrian due to not being able to see because of the LED headlights. They need to move back to halogens so I'm not almost killing people every time I drive at night

B.4276 January 10, 2025 — Norman, OK

I am tired of being scared to drive at night due to the too bright headlights, they cause migraines and make it very heard for me to see the road while I’m driving. Often causing blind spots in my vision momentarily. It is a safety hazard and it negatively affects my life and wellbeing.

B.4277 January 10, 2025 — Savage, MN

These bright headlights are insane, and they force you to look away from the road down on your dashboard or in the ditch which causes accidents. As far as I’m concerned, there should be lawsuits against the manufacturers using these bright lights.

B.4278 January 10, 2025 — Seattle, WA

I am signing this petition because usually people with those lights are dangerous to begin with. Road rangers!

B.4279 January 10, 2025 — Vancouver, WA

Bright LED headlights are so dangerous. I am nearly blind trying to drive around town. And its not just a few cars here and there, it is the majority of the cars on the road. I live in the Pacific Northwest where it rains much of time which makes it even worse with glare everywhere. Couple that with poor road maintenance in the town I live in. You can hardly see the road stripes at night in good conditions. It has gotten the point where I am unable to drive after sunset/night or risk wrecking or hitting a pedestrian. This is huge infringement on my freedom and it is not right!

B.4280 January 10, 2025 — Yardley, PA

It's a serious problem not only for headlights but for many other light sources

B.4281 January 11, 2025 — Austin, TX

I can't drive at night anymore because of the blinding LED lights. Same goes for the streetlights in my town that they switched from a nice warm yellow glow to blinding white. Now I hear these LED lights could be harmful to humans and animals.

B.4282 January 11, 2025 — Bloomfield Hills, MI

I am a new driver and drove in the snow last night before the roads were taken care of, and not only could I not see the lines on the road, but I couldn't really see anything because of how blinding the other cars headlights were

B.4283 January 11, 2025 — Cedar Rapids, IA

Needs to change

B.4284 January 11, 2025 — Denver, United States

It's too dangerous

B.4285 January 11, 2025 — San Luis Obispo, CA

I can't believe I found this site. I try not to complain about anything but this has been a big issue for a long time. One of the main issues, which is funny but not funny, is people with these new cars they don't know how to work their light system. They've got their fog lights on they're high beams on they're low beams on and anything else that's on they don't know how to adjust it to just daytime lights. I have a friend that has a car that's maybe 10 years old the car was like brand new he didn't know how to work the lights. Now, you've got these cars that have the stripe across the front so these people are driving with both beams on, fog lights and this white stripe across the top! Not only is it blinding, especially when they're coming up behind you, it's distracting. These people know that they're high beams are on I mean they can see the back of your skull when they're behind you. It's ridiculous, it's unsafe on so many levels. I do not have an issue with bright lights per se, however driving down the freeway or especially in town, a car comes around the corner and the blind you, I mean you can't see in front of you it is so blinding. It is like someone shinjng a flashlight in your face, even at a distance. Yes,.you could kind of look away to the right side of the road but my focus is on the road hello. SOMETHING'S GOT TO BE DONE!!! People that are driving with all these beams on like they don't know how to work the cars it's too much light. Also, that white stripe is ridiculous it's distracting and unsafe. How do they not know this, many of us can figure it out but who are the people that are making this "okay"??? I mean what's the point? I have got so much to say, but I'll stop for now. I'm pissed...again it is the driver's fault too. People need to know how their car operates correctly and driving around at night with every light on that you could imagine coming at you or behind you is unsafe to the umpteenth level!!!

B.4286 January 11, 2025 — avondale, AZ

i have an astigmatism that makes these lights even brighter. i feel like i need sunglasses at night it's so bad.

B.4287 January 12, 2025 — Tivoli, NY

oncoming car headlights have become unacceptably bright, making it hard for me and my wife to drive at night.

B.4288 January 13, 2025 — Idaho Falls, ID

It's really terrible when I flash my lights at an oncoming car to tell them to turn their high beams off and then they flash me back telling me that their high beams aren't even on! Please, low beams do not need to be this blindingly bright!

B.4289 January 13, 2025 — Manchester, ENG, United Kingdom

Is a real danger to on coming traffic.

B.4290 January 13, 2025 — Miami, FL

My vision is not the best especially at night. Almost every car on the road has bright white led headlights that point directly at my mirrors, causing my vision to become more compromised than what it already is. I have been in many near accidents due to this issue.

B.4291 January 13, 2025 — Middleton, MA

i already have astigmatism these lights make driving at night so unsafe. we've all been saying this since they started coming out and nothing has been done. no regulations on the brightness of lights will end lives. i personally have to drive to work at 4:00 am on a very curvy road and if i wasn't so familiar with it, id be swerving into the other lane because of another car. its happened to me before but i just try to tell myself "just keep the wheel in the same direction and slow down" to avoid CRASHING BECAUSE OF HEADLIGHTS. my headlights give me incredible visibility and they don't blind anyone. let's go 2006 toyota sienna

B.4292 January 13, 2025 — Middleton, MA

i personally have to drive to work when it's still pitch black in the mornings on a very curvy road. even though i've driven this road for years and know every twist and curve, when a car passes me with those lights, on multiple occasions i have swerved into the other lane or cut way too close to the margin. these lights can kill people coming around even the simplest corners. its so aggravating that we've all been saying these lights are dangerous since they started appearing and nobody has done anything. we need regulations for road safety! plus, they're so unnecessary. my 2006 toyota sienna got replacement lights about a year ago and i can see extremely well without making it so others can't.

B.4293 January 13, 2025 — Salem, OR

It's becoming an issue at night or these bright headlights should be becoming a hazard for me to drive correctly and safely. I fear that when I drive and I see them, but I'm not gonna be able to see an object or the road curvature and I'm going to crash my vehicle these things need to be dimmed and not as bright for the safety of everyone around them.

B.4294 January 13, 2025 — South Hiendley, ENG, United Kingdom

Because it's dangerous . They blind oncoming traffic . And with the LED street lights being so dim it will lead to more deaths . You cannot see pedestrians dressed in black at all . And then a car passes with LED lights on . No contest impossible to see them till it's too late

B.4295 January 14, 2025 — Garrettsville, OH

I have a double astigmatism. I literally have to stop my car when these lights are coming towards me. There is no reason they have to be that bright. Very dangerous.

B.4296 January 14, 2025 — Mount Juliet, TN

I turned 16, the legal age to drive in my state, a year and 3 months ago and I'm too terrified to drive on my own because of these bright lights.

B.4297 January 15, 2025 — Alburnett, IA

It has become extremely dangerous to drive nowadays. As an almost 18 year old driving a small car, I get blinded daily on the road. Most underaged kids are driving small cars, and guess who are driving the big cars with these headlights in question? EXPERIENCED DRIVERS!!! This is a growing and dangerous problem. It needs to be fixed.

B.4298 January 15, 2025 — Calgary, Canada

These lights are dangerous

B.4299 January 15, 2025 — Richlands, NC

Driving at night is so dangerous because of the new led headlights. People will get killed if they are not banned.

B.4300 January 15, 2025 — SEQUIM, WA 98382, WA

I can't see at night when raining and the lights reflect off the ground! It also looks like they have their brights on all the time! Should be illegal and LEDs are bad for your eyes! Common sense!

B.4301 January 15, 2025 — Woodstock, Canada

Its really annoying when you drive in the night and that people hurts the eyes with that lights,

B.4302 January 16, 2025 — Bellevue, WA

The blue/purple headlights blind me in the evenings and at night. Very, VERY dangerous. I am also a walker and if any vehicle with these headlights is coming it blinds the other drivers and creates a hazard for walkers.

B.4303 January 16, 2025 — Grafton, MA

Astigmatism makes this an even bigger issue when on the road at night. Get our voices heard.

B.4304 January 16, 2025 — Portland, OR

They definitely take your ability to to see anything what gets me is people are using them incorrectly by adjusting them wrong using brights and driving lights so 6 bright LEDs 2 LEDs are to much

B.4305 January 16, 2025 — San Diego, CA

I drive at night for work and it's at the point that my eyes sometimes have blind spots caused by the constant LED lights beaming directly into them. I fear if I continue, I'll go blind one day. These conditions are not safe.

B.4306 January 16, 2025 — San Francisco, CA

The newer headlights are blinding. On rural two lane roads vehicles even miles away with their brights on look like an airplane getting ready to land in your passenger seat. Has no one in government driven in the last few years? I even drive a truck (sitting higher up) and Teslas or Subarus will still blind me. I frequently use my hat to block my field of vision and stare at the white line when oncoming traffic is close (but not all that close!), which puts a ridiculous amount of trust in oncoming traffic to not come into my lane or do something stupid. Something has to give. I'm not a fan of over regulation but this needs regulation AND enforcement now.

B.4307 January 16, 2025 — Spokane, WA

I drive at night in NH and the LED head lamps make driving dangerous. They are so painful on the eyes that I have to look at the painted white line along the median to avoid looking at the LED headlights. These need to be banned. To anyone with eyes, they are obviously damaging and dangerous.

B.4308 January 16, 2025 — Straughn, United States

I used to like driving at night. Now between the LED headlights, people failing to turn down their high beams in addition to the already-to-bright LED lights and then the use of LED spotlights and security lights on some residences, businesses and public areas often pointed in a direction that causes a driver to be unable to see the road or traffic...this is one of the most dangerous things facing me and other drivers right now. I can no longer feel safe driving at night so am forced to stay home or have someone else drive me. I should not have to compromise my driving freedom because of an unregulated and not thoroughly researched light source that poses a risk to myself and others. On several occasions I have almost drove off the road or been in an accident because of these ultra-bright LED lights. If someone or something were to be in the road while these lights are shining at me, I would never see it and possibly hurt someone else because I cannot see past the painfully bright headlights. It is an utter disregard for general human safety and health and I'm ashamed of the FDA, auto makers, auto LED light manufacturers and our politicians for not taking action on this yet.

B.4309 January 17, 2025 — Murfreesboro, TN

I live in an area that doesn't have many street lights. I hate driving at night because of the LED headlights. Whomever thought this was a great idea did not think it through. It looks like bright lights are on and it is a blinding light. It should be illegal to have headlights that bright on a vehicle. They need to either restructure where they are located inside the vehicle or find a way to dim the lights.

B.4310 January 19, 2025 — Fairfield, CT

The LED headlights on cars are blinding especially at night. The flashing LED lights on police vehicles make it impossible to see the road. I try not to drive at night anymore. These lights need to be banned.

B.4311 January 19, 2025 — Houma, LA

I've noticed an increase in very bright LED headlights. They're painful to the eye, create much more nuisance glare than traditional halogens, and they force me to look away from the roadway toward to shoulder. These bright lights are distracting, and they create a safety issue. They should be better regulated or banned to create safer roadways.

B.4312 January 19, 2025 — Kalispell, MT

I live in rural Montana. There are alot of rolling hills which is absolutely the worst when LED lights come at you. On top of that there is very little to none road lighting. I bitterly have to almost come to a stop some times do to being Blinded. My Brites are less bright then most LED regular lights. That is not right at all! I came from Salt Lake City. There is street lighting every where. You never need to use your brites. Plus you don't notice the LED in a big city as much. Your eyes are already adjusted. I propose if we have to have LED lights. They be installed as only brights. And low lights can go back to soft lights. Thank you

B.4313 January 19, 2025 — La Fontaine, IN

somebody time travel back and destroy all of them;) report back #orcawacacaca

B.4314 January 19, 2025 — Williamsport, PA

Headlight brightness has more than tripled over the past 30 years and here in PA they use line paints that wash off and have no reflectivity after only a year of being applied.

B.4315 January 19, 2025 — santa rosa, CA

LED headlights installed on vehicles driving on the roads have consistently made driving dangerous and difficult for me. The possible damage and loss of life from an accident and the long term damage to eyes from repeated exposure to these unnecessarily bright headlights should be stopped immediately.

B.4316 January 20, 2025 — Brockton, MA

These headlights make my windshield become something that obstructs my view of the road almost entirely. The only thing that remains visible as the offending vehicle passes is those glaring headlights. If someone cut infringement of me in a car, a bicyclist, a pedestrian.. I would have zero warning until those lights pass me not allowing much reaction time depending on distance.

B.4317 January 20, 2025 — Ontario, CA

Blinding on coming headlights make it hard for people to see and can easily be fixed and save life's...My kids father was killed in a car accident When they were babies...

B.4318 January 20, 2025 — Stoughton, MA

Simple, because the blinding lights never should have been allowed in the first place

B.4319 January 20, 2025 — Winchester, NH

i hate them

B.4320 January 20, 2025 — chicago, IL

Blinding headlights have motivated me to avoid night driving and use other modes of transportation like walking and biking. I will continue to plan my life around this issue as long as it is prevalent and increasing in our car society.

B.4321 January 21, 2025 — Brunswick, ME

I drive, I fucking love driving it is everything to me. But I swear to god these LED headlights are going to make me go off the road and crash and DIE. I SWEAR TO GOD. If I ever am in a accident because of these god forsaken sent from hell headlights. The blame is on the other person. And I will fight until I get all my money. And then, in c***** und******'s words. I will dig my key into the side, of their pretty little souped up four wheel drive, carve my name into their leather seats. Watch your back LED headlight car drivers. My name on this petition is COMING FO YO ASS.

B.4322 January 21, 2025 — Franklin, NH

I thought my difficulty driving at night meant that I needed to have cataract surgery. But then I realized that I don't have difficulty with regular headlights coming at me, it's only the LED headlights. On country roads I often have to pull off the road until an oncoming car passes because I'm literally blinded by LED lights. In heavy traffic at night I aim both side mirrors down to avoid LED lights from behind. This isn't safe---it makes it harder to be aware of traffic around me. I try to avoid driving at night, which reduces my freedom to take longer trips if I can't get home before dark. I find it incredible that the government has not banned these dangerous LED headlights. Why should I have to have risky eye surgery when the problem isn't really my eyes, it's LED headlights? Why am I deprived of the freedom to travel where and when I want to?

B.4323 January 21, 2025 — Lafayette Hill, PA

They are dangerous.

B.4324 January 21, 2025 — Macomb, MI

As a lifetime eyeglass wearer with little-if-any depth perception (due to crossed eyes at birth that were surgically overcorrected as an infant), all driving carries added risk compared to "baseline" vision (however you might define that...). Driving at night is the worst, especially trying to pull out of a neighborhood onto a high-speed (50+ MPH) multi-lane road, since I can barely discriminate which lane a vehicle occupies with only headlights visible. Headlights over a certain strength are truly painful to look at, especially refocused by my glasses, day or night. Yet nighttime is worse when I need to visually track those lights in many driving situations. If your headlights mean that I cannot effectively "see" to drive, then clearly overall community/social safety has not been increased; it is decreasing, and I fear for my life and that of my family when they're in the vehicle. (Whine time... Brand pet peeve #1: JEEPs. #2: All other SUVs (including the Jeeps) and full-size pickup trucks since I'm often driving a low-to-the-ground Ford Focus sedan and getting 100% oncoming headlight brightness right at my eye level. I wish all those other drivers knew how that feels!)

B.4325 January 22, 2025 — Chicago, IL

I really hope this can make a real impact. I hear about this problem and experience it everyday!

B.4326 January 22, 2025 — Collierville, TN

I think we are all saying the same thing, and there is not much more to add. I just hope that if this critical ban comes to fruition that all the loopholes are adequately addressed and it is quickly implemented.

B.4327 January 22, 2025 — New York, NY

Even as a pedestrian those lights are annoying and dangerous. If one is walking outside on dark winter evenings, sudden bright lights in one's eyes obscure everything else and make a pedestrian more likely to trip or slip and fall or walk into obstacles or get hit by drivers or bike riders who are also blinded by the lights.

B.4328 January 22, 2025 — Vermillion, SD

I have the right to not be scared of driving at night

B.4329 January 22, 2025 — Wylie, TX

I literally cannot see the road in front of me at night and even wearing sunglasses doesn't help my vision of the road when these bright headlights are in my eyes. I'm genuinely worried that I might get into a crash someday because of someone's headlights blinding me.

B.4330 January 23, 2025 — Belleville, NJ

I can't drive qt night anymore and fear getting into an accident

B.4331 January 23, 2025 — Belmont, NC

I can't see at night and they trigger migraines

B.4332 January 23, 2025 — Dublin, CA

Bright and improperly mounted/designed headlights are dangerous. People dont need spotlights to see at night, it's ridiculous. Please help make driving at night safer

B.4333 January 23, 2025 — Reno, NV

I am 33 years old and no longer want to drive at night because I am scared of both cars behind me and in front of me causing me an accident all because I couldn't see properly from their headlights. I also suffer from migraines and bright lights are a trigger for my brain to give me an ocular aura. Ocular auras make you see things in your vision that are not there and leave you with a massive headache and fatigue. Please ban these headlights that are too bright! There is no need for them!

B.4334 January 23, 2025 — United States

https://www.michigandaily.com/opinion/columns/blinded-by-the-car-headlights/

B.4335 January 23, 2025 — Val-David, Canada

Les lumières del sur les véhicules sont tout simplement une abomination pour les conducteurs et les règlementations ne tiennent pas compte de la perception humaine de ces lumières.

B.4336 January 24, 2025 — Atascadero, CA

the new bright LED lights cause intense pain behi my eyes and to my brain, as well as an after image resulting in distraction and temporary blind spots for myself. I know avoid driving at night time as much as possible for this reason. Even during the day time, some lights are still too bright to also cause this as well. I request that this issue be heard and looked into by the now thousands affected by this and hopefully addressed! Thank you for taking time into looking into this matter!

B.4337 January 24, 2025 — Riverhead, NY

In my town of the cops don't enforce the headlight laws, so it's basically impossible to drive at night anymore, you just cannot see the road at all when these people are behind you or coming the other way.

B.4338 January 24, 2025 — Templeton, CA

It's so dangerous!

B.4339 January 25, 2025 — Anaheim, CA

I SPECIFICALLY AVOID DRIVING AT NIGHT DUE TO THE BLINDING HEADLIGHTS. ITS TOO DANGEROUS

B.4340 January 25, 2025 — Cedar Park, TX

As someone who drives early morning. These lights are horrible and impede driving .

B.4341 January 25, 2025 — Gainesville, GA

These lights are going to cause serious accidents. It is very disorienting, it has caused me to swerve because I was unable to see the road and blinded even after vehicle passed me. I have witnessed the car in front of me swerve and go down into a ditch. My daughter is about to get her license, she won't be able to drive night right away due to being a new driver and our state laws for new drivers. I'm thankful for this and pray something is done about this issue before she has to deal with this. In the areas we live in, it's popular to have jacked up truck with the brightest whitest headlights as well as a

bar of lights across the roof, lighting up the wheels and undercarriage. It is a hazard when this is coming at you head on, it's is just as hazardous and blinding when you are in a small sedan this comes up behind you either on the expressway going 80mph or so and the truck is hot on your bumper. This happened to me and actually happens several times a week. The lights on this truck were so bright I couldn't judge the other lane in my mirror to get over, I flipped my rear view mirror to try to divert the light so I could and it helped none. I felt like the truck was pushing me and I was doing 80 in a 70 as it was going down hill on the expressway, trying to judge if I could get over and checking my mirrors I had to hit my brakes trying to see my own lane this apparently angered the driver who proceeded to ride my bumper, when I finally could judge enough to get over I got off at next exit and truck changed lanes with me, got off exit and followed me. He pulled beside me and had the nerve to ask what my problem was and I said his headlights he told me he had no control over his headlights that this is how truck came. Frankly I don't care if the manufacturer did it or the individual took it upon himself to modify. It needs to be illegal either way. New cars yes have extremely bright lights and that is a manufacturer issue that must be dealt with. Problem is those in charge are oblivious to how the general public live and the things they deal with unless their chauffeur drive happens to complain or their pockets get lined enough to change their point of view. Then you have those that see things on tiktok and there ya go everybody's gonna run out and get bright white lights plastered all over their vehicle so they will be liked. I simply don't want my children or anyone else harmed and you'd think our government would attempt to protect it's citizens. Maybe if we make a tiktok video about it we could get some action.

B.4342 January 25, 2025 — Van Nuys, CA

The light are blinding and unsafe to other drivers

B.4343 January 26, 2025 — Cedar City, UT

I drive around lots of mountains, and falling off of the cliff is so much more likely because these lights blind me.

B.4344 January 27, 2025 — Asheville, NC

I CANT SEE WHEN DRIVING AT NIGHT

B.4345 January 27, 2025 — Easton, MD

I've been in two bad accidents that I was not at fault for, and because of that, I much prefer driving at night when all of the irresponsible 16-19 year olds + elderly people aren't on the road. Due to the increase in LED headlights, I'm not able to enjoy this privilege anymore.

B.4346 January 28, 2025 — Fort Walton beach, FL

I used to be able to see at night but now with these new bright blue lights on cars I feel like I’m staring into a 1500 lumen flashlight. It looks like people are driving with their high beams on (even though they aren’t) I can’t see the road when these new cars are driving head on towards me not to mention my eyes hurt after driving, I’m sick of it please change the laws to prevent this s from having to suffer permanent eye damage or vision loss

B.4347 January 28, 2025 — Nalgonda, India

Hello everyone, I have also reported about Light pollution to UN body and yet to hear from them. People when they talk about pollution must now consider light pollution as well. I shall keep you all posted on any updates I receive regarding this.

B.4348 January 28, 2025 — Overland Park, KS

The modern lights are too bright. There used to be a federal regulation. It seems that has gone to the wayside

B.4349 January 28, 2025 — Stockport, ENG, United Kingdom

The Precautionary Principle dictates that LED lighting may pose health risks and absent more detailed studies to disprove potential harms, they should be banned.

B.4350 January 29, 2025 — Allentown, PA

Because of these led headlights I'm starting to lose vision in my left eye. Along with suffering from major chronic migraines as well.

B.4351 January 29, 2025 — Berwyn, United States

Everyday I drive up and back through chicago and at least once a day I get hit with these blinding lights. Usually bigger SUV's or jeeps but they are horribly blinding. I don't see why these types of headlights are legal here when they are illegals everywhere else. Talkin about LED headlights btw

B.4352 January 29, 2025 — Chester Springs, PA

I am blinded by these lights. I think the light trucks are the biggest offenders as their drivers seem to be more aggressive, such that when they are tailgating me, I am blinded in my rearview mirror, despite the self dimming feature!

B.4353 January 29, 2025 — Chico, CA

Every night this is an issue for me. Normally I can see while driving at night even with traditional headlights, but the excessive blue-ish LEDs immediately blind my night-adjusted eyes

B.4354 January 29, 2025 — Kiev, Ukraine

I don't want to get into an accident because I was blinded by oncoming traffic or rear view mirror.

B.4355 January 29, 2025 — Oklahoma City, OK

When driving at night, newer headlights frequently make it harder to see and drive, on more than one occasion I've come close to fatal accidents as a direct result of lost visibility, because the individual behind me has headlights that were brighter than they had any reasoning to be. This problem needs to be fixed.

B.4356 January 29, 2025 — Post Falls, ID

The amount of times I've lost sight of the actual road in front of me because of bright headlights can be counted on more than two hands. That is a terrifying realization. Many times it's during ALREADY dangerous weather, like snow or heavy rain. These bright headlights will catch on the rain/snow and become even BRIGHTER, obscuring the lines on the road more than they already are by the weather.

B.4357 January 29, 2025 — Sacramento, CA

More visibility on the road is always more desirable. However, when ones own personal visibility becomes the detriment and cause for danger for everyone around that person, it's no longer advantageous, but instead creates a terrifying experience for anyone on the road. We will continue to see a rise in damage and hostility among our peers until this issue is resolved. Bright headlights do more harm than good. People think it's a great idea, until their choices cause the harm or death of someone important. Who's death or injury will it take to correct this issue? Or do we as a people not care about our fellow human anymore?

B.4358 January 29, 2025 — West Des Moines, IA

It takes the fun out of night drives when I can't see what's ahead of me

B.4359 January 29, 2025 — peoria, IL

Blindingly bright headlights endanger everyone on the road. It only makes sense to have a legal limit to how bright headlights can be.

B.4360 January 30, 2025 — Blythewood, NC

This is important for safety.

B.4361 January 30, 2025 — Grandview, MO

It's stupid that we have rules against using your phone and drunk driving but not overly-bright headlights and billboards.

B.4362 January 30, 2025 — Kingsport, TN

Powerful headlights are the bane of my existence. As someone with an astigmatism, these headlights would make me ACTUALLY UNABLE TO SEE THE ROAD. People behind me in their lifted trucks, blinding the heck out of me with these lights would make me crash.

B.4363 January 30, 2025 — Klamath Falls, OR

I'm blind

B.4364 January 30, 2025 — Midlothian, VA

The second the sun dips a centimeter everyone's brights come on and introduce my retinas to the gates of heaven in an instant. No one needs to fucking see the microscopic structure of the road, the level of brightness is completely unnecessary. Either we get rid of brights or we turn our cars into fucking disco balls with superglue and mini mirrors

B.4365 January 30, 2025 — Oklahoma City, OK

I didn't ask for glasses. I didn't ask for my appointments to be after the sun went down when I was driving as a teenager. I can't see. "Be an adult!" "If you can't see, then dont drive at night." Hello??? It's 5:30 the sun is down and all I see is another giant white dodge ram flashing their brights from behind me and across the lane. I shouldn't be able to drive at night because I can't see? I can with my corrected vision. If this is how it is going to be, then ban the lights or I get to park in disability, because being visually impared is disability, and driving with a disibility. this needs to be fixed.

B.4366 January 30, 2025 — Philadelphia, PA

It's ridiculous

B.4367 January 30, 2025 — Shingle Springs, CA

I like being able to see while driving at night.

B.4368 January 30, 2025 — Woodward, IA

I would like to be able to keep my vision when I pass by a car at night.

B.4369 January 31, 2025 — Rochester, NY

I have astigmatism and LED lights make seeing so much worse at night. My eyesight becomes blurry.

February 2025

B.4370 February 1, 2025 — Essex Junction, VT

I get awful migraines from the blinding headlights

B.4371 February 1, 2025 — Hannibal, MO

The safety issues caused by oem led headlights from the factory has caused many accidents for surrounding vehicles. With the increase of manufacturers going led, ignoring the negative attributes of led and only focusing on the positives is no longer acceptable. Government regulation needs to be implemented and upheld to meet certain safety criteria to remedy the unregulated and unsafe actions auto manufacturers have blindly accepted as normal.

B.4372 February 1, 2025 — Llandysul, WLS, United Kingdom

I'm very conscious of being blinded on the road whilst driving.

B.4373 February 1, 2025 — New Haven, VT

I fear for my safety

B.4374 February 1, 2025 — Sacramento, CA

I can't see!

B.4375 February 1, 2025 — Stowe, VT

I work delivery at night. Bright lights are near death experiences for me. I can't see!

B.4376 February 1, 2025 — United States

https://www.centraloregondaily.com/news/consumer/the-led-headlight-debate-safer-or-too-bright-europe-has-a-smarter-option/article_4de7c9f6-e010-11ef-b471-87d2461b22f5.html

B.4377 February 2, 2025 — Sherwood Park, Canada

These headlights are dangerous!!

B.4378 February 2, 2025 — Tooele, UT

The headlights in the past weren't as blinding as they are now. With how blinding bright they are now I'm nervous to drive at night. There are times I feel like I could get into an accident, and when it's raining or snowing my vision is blurred and I can barely see the lines on the road. I hope this can be changed, for the safety of all.

B.4379 February 3, 2025 — Chapel Hill, NC

Bright headlights are plain dangerous! There was a reason why we kept them soft initially. Nowadays, there is very little difference between headlights and bright lights and it is becoming increasingly cumbersome. I feel less safe, especially when it rains as the reflection on the wet roads increases the blinding effects. I often find myself lifting my hand up to block headlights from coming directly into my eyes and I know this cannot be safer than keeping both of my hands on the wheel. Regulation and implementation is a must to save lives or simply to improve the quality of a night drive.

B.4380 February 3, 2025 — Julian, NC

They are blinding to other drivers!

B.4381 February 3, 2025 — Salt Spring Island BC, Canada

These LED headlights are literally blinding at night on narrow single lane roads. Dangerous and ridiculous.

B.4382 February 3, 2025 — Salt Spring Island, Canada

these LED lights pose a significant hazard to oncoming drivers.

B.4383 February 3, 2025 — Waterloo, Canada

I'm signing because high beams and overly bright headlights can be hazardous and we need government support to enforce car manufacturers to solve the problem they created.

B.4384 February 4, 2025 — NY, United States

I have very light-sensitive eyes (photophobia) due to light eye color, astigmatism, and chronic migraines. Night driving is already a more dangerous circumstance due to more limited visibility, and has become increasingly stressful with the introduction of LED lights, which are hazardously bright. Even when I use my rear view mirror's night mode, this is problematic because (a) this feature is not available for my side-view mirrors and (b) this doesn't protect me from the headlights of cars driving toward me on the other side of the road, and (c) I still also get a painful, blinding bolt of light in the eye whenever I look back to check my blind spot. I know that I am not alone in this concern, and I hope you will make changes to improve this very fixable public health concern by banning LED lights in headlights.

B.4385 February 4, 2025 — Sidney, Canada

These lights are blinding and make it impossible to see

B.4386 February 5, 2025 — Bay Shore, NY

These LED headlamps are blinding even in early morning light and dusk lighting conditions

B.4387 February 5, 2025 — Bend, OR

This is a dangerous hazard.

B.4388 February 6, 2025 — Bethesda, MD

I can’t stand driving at night feeling like I might go blind or crash because someone decides they need to have their high beams on.

B.4389 February 6, 2025 — Jacksonville Beach, FL

I'm tired of being blinded while driving at night! This is too dangerous and something needs to be done about it.

B.4390 February 6, 2025 — O'Fallon, MO

As someone who’s been personally victimized by these bright led headlights, they gotta go. I understand needing to be able to see cars at night or in low visibility but not at the risk of running other drivers off the road due to these blinding lights.

B.4391 February 6, 2025 — Plano, TX

Excessively bright headlights that aren't required to be adjusted angled down on kit lifted heavy duty vehicles in the hands of the common people is a rampant issue that desperately needs fixing. This kills people. It leaves people disabled. It ruins families. It's a burden on the infrastructure and ruins the flow of traffic daily. Do better.

B.4392 February 6, 2025 — Saltspring Island, Canada

I'm blinded by them!

B.4393 February 7, 2025 — Ames, IA

I bought a new Ford Maverick and discovered it had those bright headlights I have been complaining about for years. I asked dealer if they could swap out and they said it would cost me a fortune! How dumb!

B.4394 February 7, 2025 — Boulder, CO

Blinding headlights are a growing safety hazard, and I have experienced several issues because of them. One of the most dangerous problems I face is when a vehicle with overly bright headlights comes up behind me at night. The intense glare creates a sharp shadow in front of my car, making the road appear much darker, as if my headlights are off. At times, the effect is so extreme that I cannot see my own headlights illuminating the ground, making it difficult to see obstacles, road markings, or anything ahead of me. The glare in my mirrors is also unbearable, to the point where I have permanently adjusted my rearview mirror to help dim the brightness. And this is only one of the many challenges I have encountered, from temporarily being blinded by oncoming traffic to dealing with reduced visibility in critical situations. It is an issue that needs to be addressed to keep the roads safer for everyone.

B.4395 February 7, 2025 — Columbia, MO

While both sedans and pickup trucks/SUVs have blinding headlights, pickup trucks/SUVs headlights are also higher, so that they shine directly into the windshields of sedans and other lower vehicles (not to mention the eyes of pedestrians). The number of larger and higher vehicles on the road means that they are bigger to the problem of blinded drivers on the road. It would be helpful if manufacturers of these larger vehicles began designing headlights on these vehicles to be at the same height as those on sedans and smaller vehicles.

B.4396 February 7, 2025 — Denver, United States

Yes it's convenient for the people driving the cars, but this is really becoming a danger especially on mountain passes like here in Colorado.

B.4397 February 7, 2025 — Loveland, CO

Not only are the headlights annoying and blinding, recently I have noticed these LARGE pickup truck owners illuminating the underside of their trucks. WHO THE TRUCK approved that? That is 1000% worse!

B.4398 February 7, 2025 — Lynnwood, WA

I'm in my fifties and finally ended up quitting my job as a driver because due to astigmatism the right white or LED headlights make it so that I'm completely blind at times when driving in at night. To the point where especially if they come up behind me I have to actually pull over until they pass. When they're coming at me I have to slow way down I could be on the freeway or on the highway and it's just so bright that not only am I not seeing correctly but literally blind for a moment. And if I'm on a long drive I'll get a migraine headache out of this world. I believe they to be a safety hazard a health hazard and are causing a lot of traffic fatalities today.

B.4399 February 7, 2025 — New York, NY

Those LED headlights should be banned, period!

B.4400 February 7, 2025 — Omaha, NE

blinding headlights are dangerous

B.4401 February 7, 2025 — Woburn, MA

Headlights are getting out of control, especially on trucks that are the eye line of those driving in smaller vehicles.

B.4402 February 8, 2025 — Arcata, CA

New headlights are too bright and dangerous for other drivers

B.4403 February 8, 2025 — Beacon, NY

LED lights have been used without any thought to the effects they have. They are now everywhere since they're so cheap. Driving at night not only subjects you to extremely bright lights from cars but also from lots & lots of buildings. We need light trespass laws. Driving (and walking) at night has become very stressful. It is a health hazard.

B.4404 February 8, 2025 — Bronx, NY

I genuinely cannot see the road sometimes and I have an astigmatism in my eyes, which makes it ten times harder to see with these new lights, the old lights never had any issues

B.4405 February 8, 2025 — Cambuslang, SCT, United Kingdom

Road safety

B.4406 February 8, 2025 — Columbus, United States

These are worse than the 'brights' of old that people were required by law to switch off when other drivers approached. When these new LED's come at me, I flash my brights at them or just click them on until the car passes to let them know how I feel.

B.4407 February 8, 2025 — Cumming, GA

This is a frequent issue for me! It is so dangerous.

B.4408 February 8, 2025 — Erie, United States

The blinding headlights are so dangerous. The brightness is so bad it makes it hard to drive on the road and to see any pedestrians.

B.4409 February 8, 2025 — Fort Worth, TX

I try not to drive at night at all due to the harsh and blinding lights I encounter with oncoming traffic and even worse, drivers behind me with their bright lights. It's the newer, too bright LED's that are the problem.

B.4410 February 8, 2025 — Freehold, NJ

I used to have LED headlights on my car, but at some point I realized how blindingly bright they are, and had them removed. (I didn't want my headlights to be the cause of an accident.) Unfortunately, my regular headlights are so dull in comparison to all the other cars around me that I'm at a disadvantage. It seems there's no way to balance others' safety with my own when it comes to headlights.

B.4411 February 8, 2025 — Nashville, TN

These blinding headlights at night are completely unsafe. These agencies have to do something immediately! I can not see to drive when the cars coming at me have blinding headlights! After these cars and trucks pass me I feel like my eyes are burning and I can't see anything. And that's just one car or truck I have to pass hundreds at night to drive somewhere. Do something about it!! How can this be legal for other vehicles to completely blind me with ultra bright led headlights?? Most time I can't even see the road and feel like this will cause a head on collision because I can blinded by the headlights! Fix this now!

B.4412 February 8, 2025 — Newnan, GA

I avoid driving at night if I can. Whenever possible I drive a path divided by a median. I've had to come to a near dead stop many times as I could not see due to the headlights of an oncoming car.

B.4413 February 8, 2025 — Roseville, CA

I struggle with night driving because of blinding hesdlights

B.4414 February 8, 2025 — Saratoga Springs, UT

I almost died tonight on a snowy road, with a big pickup blinding me from behind. I couldn't see a thing! This happens far too often.

B.4415 February 9, 2025 — Bloomfield Hills, MI

I cant even drive when the sun goes down

B.4416 February 9, 2025 — Dallas, TX

With lumen maximums set, enforcement is incredibly necessary. Law enforcement should be equipped with lumen meters, as damage to the citizens' eyesight and ability to be safe on the road will result in nothing positive towards the politicians' workforce and supporters.

B.4417 February 9, 2025 — Fallon, NV

The lights are too damn bright!

B.4418 February 9, 2025 — Golden, CO

Making headlights brighter to supposedly increase safety for the driver of a given car translates into decreased safety for every other driver on the road. Ironically, that same "safer" driver is less safe overall because they are equally exposed to their fellow "safer" drivers whose cars have overly bright lights!

B.4419 February 9, 2025 — IL, United States

LED lights blinds Lives

B.4420 February 9, 2025 — Nalgonda, India

Even led lighting started to impact sport matches. https://www.msn.com/en-in/sports/cricket/it-has-more-glare-and-sometimes-former-pakistan-captain-blames-pcb-over-led-light-issue-after-rachin-ravindra-gets-injured/ar-AA1yG7oL

B.4421 February 9, 2025 — Tampa, FL

Headlights are so bright now I'm wearing sunglasses at night!

B.4422 February 10, 2025 — Augusta, GA

These newer LED lights are absolutely horrible, not only for my astigmatism, but in general the blinding effect of these lights AFTER they have passed you or moved over last so long. I have to drive rural backroads all of the time when going home from college, and I have to slow down almost to the point where I have to completely stop so I can try to focus and see the road, otherwise I would for sure run off the side. This is not only a concern of being able to see, but it is extremely dangerous to slow down on a very dark road at night when there are other cats behind you. The same way you get pulled over for going too fast over the speed limit, you get pulled over for going too slow because that's dangerous as well. Having to go from 55+ mph on a two lane road to around 30 mph very suddenly is not safe at all. These LED lights consume my entire windshield and leave me partially blinded

afterwards. Not only are these lights dangerous on rural roads, they're just a dangerous on city roads. Driving behind someone with your brights on is illegal... so why aren't these LED headlights regulated? I digress

B.4423 February 10, 2025 — Pinetop-Lakeside, AZ

I can't see at night! These new headlights are ridiculously bright. You can't even see the car behind you because their lights are so bright blinding you! There needs to be regulation on how bright headlights can be!

B.4424 February 10, 2025 — SARATOGA SPRINGS, NY

It ain't just the brightness -- it's the fact that the whiter or blue-er the light the less you can see in the shadow areas of your view AND the more blinding the light is compared to yellow light.

B.4425 February 10, 2025 — San Antonio, TX

A vehicle was stopped on the wrong side of the road, facing me with bright headlights, on a rainy night. The dark and damp conditions made it hard to see, but their bright lights were so blinding, I couldnt see that there was a pedestrian on the road in the path I would've taken to get around the stopped vehicle. It was an all around dangerous situation

B.4426 February 10, 2025 — Whittier, CA

I have astigmatism & I literally CANNOT see with these new lights. We need regulations on these lights ASAP!!

B.4427 February 11, 2025 — Plainsboro, NJ, NJ

No one should have to crouch in the driver's seat so that they avoid the glare of the headlights behind them, which I find myself doing all the time while driving at night. Also makes it quite difficult to look both ways while at a stop sign without getting visually distracted. It's bad enough there are so many overly bright LED flood lights on people's homes and other buildings, but these new headlights are especially a concern.

B.4428 February 11, 2025 — Rocky Mount, NC

LED headlights have gotten so bad that I have to almost come to a complete stops because I simply cannot see a single thing in front of me. It’s already bad enough driving at night having astigmatism, but having headlights so bright it strains your eyes, glares on your windshield so you can’t see out of it, gives you headaches, etc. No low bean headlights should be blinding people.

B.4429 February 12, 2025 — Madison, WI

In the state I live in it's legal to flash your brights at drivers who have them on. More often than not the driver will then engage their brights which are not too much brighter than their normal headlights. My vision is regularly negatively impacted by headlights that are too bright. I understand there's a mode on newer cars that allows them to drive with brights on. The sensor in their car is supposed to switch to normal lights when a certain amount of light is detected. Apparently my own headlights are not enough to engage this feature so I'm stuck in a bad situation. Regular headlights need to be dimmer. If someones headlights are bright enough to compare other drivers then the headlights are just too bright.

B.4430 February 12, 2025 — Riverside, CA

i’m sick of jerks on the road putting me and other drivers around me in dangerous driving conditions all because they want to have a slightly clearer view of the road

B.4431 February 12, 2025 — Washington, DC

These lights make it dangerous and obnoxious to drive at night and early morning; they pull your attention away from where it should be - on the road

B.4432 February 13, 2025 — Conroe, TX

These bright headlights should be banned because it's EXTREMELY dangerous. I have binocular vision dysfunction, bright lights hurt my eyes and make my vision distorted. I have to slow down and

let them pass me, so that I feel safe enough to drive. It's terrifying driving at night on freeways with those lights.

B.4433 February 13, 2025 — Greenbrae, CA

I have astigmatism and significant photosensitivity. I have had to bring my life to almost a complete standstill because of how difficult and dangerous LED headlights have made the road. I live in a rural area and get flash banged around every corner and over every hill, day and night. I have had people around here maliciously turn their lights on at me both while driving and as a pedestrian because they think it's funny (I've seen them laughing as a pedestrian). I have a headache after every drive and my visual snow syndrome gets worse the more I'm exposed. The cops do nothing and are now ADDING aftermarket ultra bright LEDs to their vehicles. I just want to exist safely and comfortably.

B.4434 February 13, 2025 — Hinesburg, VT

I try not to drive at night because of the brightness of the head lights. I have friends who will not drive in the dark at all.

B.4435 February 15, 2025 — Casper, WY

More than once, I have had to shut my eyes in the presence of those infernal things, an event fraught with danger.

B.4436 February 16, 2025 — Indianapolis, IN

I no longer feel safe driving at night because I'm constantly being blinded by these headlights. They make the road way more dangerous for everyone.

B.4437 February 18, 2025 — Meridian, ID

Many others and myself have feared for our safety when blinded by bright head lights. there's not always reflectors to help and only newer cars have night mode for their rear view mirror, these were what I was told I should do when I get blinded and obviously they don't always work. not only do the head lights blind you while they are driving towards you but also after when your vision has to adjust to such an extreme change in brightness, which may leave blind spots for minutes.

B.4438 February 21, 2025 — Philadelphia, PA

LED headlights are blinding

B.4439 February 22, 2025 — Collingwood, Canada

Oncoming cars with these lights look like they have their high beams on. When I see one coming I try to mark where the road is in front of me so I can continue driving when I am finally blinded when these cars get closer. Need regulation on this, it is such a pointless hazard.

B.4440 February 22, 2025 — Fredericksburg, VA

I drive back and forth from the colonial Beach and Fredericksburg area so I can go to work and it sucks having to drive that far and I have to pull over and wait for some car to go past so I can drive safely

B.4441 February 22, 2025 — Kinggeorge, VA

We as people do like newer and brighter things but it's ridiculous that my safety as a driver is at risk because of bright lights I can't drive down my road coming home and someone comes by with high beem leds not knowing or seeing what's in front of me because of it

B.4442 February 22, 2025 — Summerville, SC

I am an Uber Driver, and I mainly drive at night, quite often from dusk until dawn. I enjoy this schedule, and moreover this job, above all other schedules and jobs I've worked in the past. However, the only issue I have with driving at night are the blinding headlights that greet me maliciously on the roadways- and worse, negligent drivers who have their even brighter highbeams on. I have nearly wrecked numerous times, however other drivers may not be so lucky and fortunate. The soft, yellowish lights from the late 1990s and early 2000s were perfect- one could see perfectly on the road with them, without needing to flip one's own highbeams on, and could see whenever someone else's yellow headlights came across them. We need soft light back, and we need it now.

B.4443 February 25, 2025 — boslsob, Canada

I'm signing because the politicians will not do anything, the automobile manufactures will do nothing, and the police are powerless. This is frustrating to see the road safety governance fail us and let this "cash cow" grow. High beam them at the last second, it's the only power you have.

B.4444 February 26, 2025 — Frisco, TX

On top of the obvious, proven, health and safety concerns that the switch to LED lights by car manufacturers has caused, I personally also can't stand the negative psychological effects white lights have compared to warmer lights.

B.4445 February 27, 2025 — Japan

https://chng.it/t46S4fBVXG

B.4446 February 27, 2025 — Saint Charles, IL

As someone who drives a "normal" car, driving in America SUCKS. What used to be a comforting sea of yellowish-white lights is now composed of collapsing suns from Tellurides and other unreasonably large vehicles. Since I've got incandescent headlights, I just drive with high beams on all the time since no one cares about other folks' retinas anymore.

B.4447 February 27, 2025 — Salem, MA

The combination of increasingly bright headlights, vehicles getting taller, and the adoption of a "cold" hue of light is literally lethal, and is directly costing Americans their lives. Laws need to be put in place to mandate the brightness, angle, and hue of headlights to prevent drivers from being blinded. There have been many occasions where I haven't been able to see a pedestrian crossing the street until the last few seconds due to a truck or SUV with unnecessarily bright headlights in the oncoming lane, and this story is becoming more common as the years go on. It's also been proven that "cold" or "hard" lights (like the ones you see in modern cars) are far more blinding than "soft" or "warm" lights (like you see in older cars), even at the same level of lumens, which is adding to the problem. The only way to solve this problem will be to put a limit on how bright headlights can be, mandate using a warmer hue for the color of the light, and ensure that these lights are pointed at the right angle. And as much as I'm sure a lot of people don't want to hear this, the only way to enforce these laws is with yearly inspections in EVERY state. As a car enthusiast, I typically hate having the government tell me what I can and can't do with my car, but the reality is that the safety of our fellow humans needs to take precedent.

B.4448 February 27, 2025 — Taylorsville, UT

LED headlights are blinding and dangerous.

B.4449 February 27, 2025 — Washington, DC

I started driving in 2022, three years ago. I have no eye issues medically. Since 2023 after my first year driving I can no longer drive at night due to not being able to see the road after LED light exposure from oncoming vehicles and the vehicles driving behind me. My eyes are filled with spots and color dots for about 30 seconds after LED beams hit my eyes. I am not old, I'm 21 and cannot see while driving!

B.4450 February 28, 2025 — London, Canada

these lights are dangerous and make night driving(past 4pm in the winter here) dangerous for even people with mild stigmatism

March 2025

B.4451 March 2, 2025 — Mitchell, NE

Headlights are getting too dangerous.

B.4452 March 2, 2025 — Mount Prospect, United States

Blinding headlights are very real safety concern. I often must slow down when an oncoming vehicle is so blinding I cannot safely see the road.

B.4453 March 2, 2025 — Pittsburgh, PA

I work as an optician & I hear every day about these headlights. Unfortunately, there is no real solution with eyewear to do so. The only product I can suggest because I use it myself is a yellow custom made clip for my glasses. It is called a Chemistrie Clip available nationwide. The color yellow cancels the blue light to a light green. It would be even better if polarized, but alas it is not. Though it is better than nothing at all. This glare is oftentimes disabling which makes for a dangerous situation. One of our patients is a police officer and he agrees. I really hope a petition like this can get some results and relief.

B.4454 March 3, 2025 — Carmel, IN

Because of my job and generally the things I do on a day-to-day basis, I often find myself driving at night. The amount of times in one drive I have to shift my mirrors or lift my hands up to block oncoming lights is insane. I am on the younger side and haven't been driving for as long, but I've still been at genuine risk of crashing at least two times because oncoming cars completely blinded me, making it so I can't see anything. When driving through backroads, I feel genuine dread everytime I approach a hill because if the road doesn't do anything other then stay straight and clear and there is an LED headlight car coming my way, there's no way I'm gonna see it. I genuinely hate LED lights, and I encounter them so much its insane.

B.4455 March 4, 2025 — Avon, MN

I wish could hold up a giant mirror in front of every LED-equipped vehicle. Then you would see what we see. By the way, your ability to "see better" with excessively bright lights comes at the expense of everyone else seeing worse! In the last few years, I have had to severely limit how much I can drive—both during the day as well as at night. That's because all LED headlights now stab us in the eyes regardless of the surrounding conditions. Even when wearing multiple layers of variously colored sunglasses, the LED lights are aggressively eye-piercing. Thus, I can manage to drive during the day, but it adds needlessly to the stress on my body. Stressed drivers are not safe drivers. It's far worse at night. Because I need to darken the LED headlights by wearing sunglasses, this makes everything that isn't bright or reflective virtually invisible. Obviously, this is not safe, but this is the position you have put me in by allowing the proliferation of blinding headlights. Thus, I am calling on transportation safety officials to actually regulate the industry! The current rules are far too lax, allowing manufacturers to "cheat" the lumen restriction by gaming the detection method. We are being experimented upon by any and every manufacturer's "bright" idea who have no regard for health and safety. DO NOT TREAD ON ME!

B.4456 March 5, 2025 — Greenwood, IN

These LED headlights have given me black spots in my eyes while driving and make me not able to see while I am driving. They are pointless and need to be banned

B.4457 March 5, 2025 — Sterling, VA

Yeah, tired of these. Major strain on the eyes at night, heck I can't even take walks out on our little neighborhood trails they blind me there too! As well as I can't tell you how many times I've worried someone was blinking their lights at me to alert so ething to me only to later realize ITS THE BRIGHT LIGHTS FLICKERING WHEN THEY HIT BUMPS IN THE ROAD!

B.4458 March 6, 2025 — Arlington, TX

Every day I have issues with LED headlamps. They're too bright and very blue. Long story short, worst cases I've experienced are momentary blindness with eye pain/headaches. It's very scary because I wonder if it'll be the time I miss something in the road and get into a serious accident because someone had the brightest headlamps on the road. The most recent experience was the scariest. The truck was lifted with aftermarket off road LED lamps along with the factory LED headlamps. I literally could not see anything else around me but him. I had to slow down and wait for him to get around me because I was afraid I would hit someone or vice versa.

B.4459 March 6, 2025 — Eugene, OR

As a delivery driver who drive mostly at night, I've notice that headlights have gotten unbearably bright. Many times a night I have to shield my eyes with my hands to avoid being blinded by other drivers. Some of them leave spots in my vision and make seeing in the dark impossible after they

pass. Lights that obscure your view of the road ahead are a major hazard to drivers and pedestrians! The projectors headlights in the Rav4s and Subaru Outbacks are the worst offenders by far. They are blinding even from a mile away! The worst is when the oncoming driver crests a hill, and all of sudden you are engulfed in dazzling white light with no view of the road ahead. I can't imagine what older drivers must be going through. The local authorities need to step in stopping people from installing them aftermarket, and the NHTSA needs to overhaul its testing of these lights. Its a shame that this has been allowed to go on for so long.

B.4460 March 6, 2025 — Taft, TN

I drive with my sun visor down and hold my left half up to block the areas it doesn't cover. At night I don't go above 40mph because I can only see about 40 feet of road in front of me. I've almost crashed twice now. Some day ill end up driving through a red light not realizing it's there. But at least that lifted truck will be able to see the accident from 5 miles away.

B.4461 March 7, 2025 — Mount Pleasant, MI

I know of a young driver who lost her life due to bright headlights of a pickup truck. These need to be regulated now.

B.4462 March 8, 2025 — Savannah, GA

These LEDs on new cars and after markets are over the top bright. They cause oncoming traffic to become momentarily bling which is taking eyes off of the road. It’s illegal to text and drive due to taking our focus off the road. So, why are vehicle lights that are causing people to lose sight of traffic and the road allowed?

B.4463 March 9, 2025 — Manchester, NH

There have been so many instances where I have been blinded by these lights and struggle to just see the road. They absolutely need to be illegal but they would rather ban pev for saving gas and money smh.

B.4464 March 9, 2025 — Summit Hill, PA

I have astigmatism, and have almost crashed TWICE because of LED headlights, they are not only a nuisance but they are dangerous, not only to you as a driver but a health concern to your eyes, it only takes 1,000 lumens of light shone at the eyes to cause temporary blindness, LED headlights are usually 3,000 lumens, if headlights are leaving black spots in someones eyes, shouldnt we reevaluate the safety of them???

B.4465 March 10, 2025 — Beaverton, OR

As a firefighter I can tell you that extremely bright headlights can alter a driver's vision which can lead to them drifting into an oncoming lane of traffic causing a fatality accident. There is no need for these extremely bright lights and when a vehicle switches on they're bright lights it gets Evan worse. These lights have blinded me in my personal vehicle as well as in an emergency vehicle while responding to an emergency. These lights need to be federally banned in automobiles.

B.4466 March 10, 2025 — Berlin, CT

These white LED headlights need to be banned from all road vehicles You drive around and can't see anything when these cars are coming at you head on or from behind. It's extremely dangerous to drivers. I know I've been blinded multiple times each week just dropping my child off at school.

B.4467 March 10, 2025 — Hendersonville, NC

I commute 75 miles one way for work. It is dark when I leave home, and often dark on the return trip. I suffer from migraines and ocular migraines. Both are often triggered by bright lights. I understand needing to see the road, but the LED headlights are ridiculous. LED lights literally blind you for a moment and that's never safe when driving.

B.4468 March 11, 2025 — Burlington, Canada

LED are a road hazard

B.4469 March 11, 2025 — Portland, OR

Please get rid of these! It's unsafe! I go blind each time!!

B.4470 March 13, 2025 — Atlanta, GA

I had an accident cause by the blinding lights of an incoming vehicle. My car went up in the air when I hit the median, flew a couple feet and once it landed, two tires blew up. I spoke with my adjuster and she said this is becoming way too common now. Unfortunately, I can't even claim it as UM and now I'm facing higher rates in my premium after this claim.

B.4471 March 13, 2025 — Atlanta, GA

{"videoUrl":"https://stream.mux.com/4qTgWnjON18SBrhJ00puId57OV6So3rWV02cWmQWOkMT8","cloudflareUid":"2d3858e55a51258eb284f853a13c0200","muxAssetId":"ZOsqF5OaQW2ttlwJRi8kC8Xot9mJbfSfJ00z01f3O59EA","muxPlaybackId":"4qTgWnjON18SBrhJ00puId57OV6So3rWV02cWmQWOkMT8","muxPlaybackUrl":"https://stream.mux.com/4qTgWnjON18SBrhJ00puId57OV6So3rWV02cWmQWOkMT8","muxThumbnailUrl":"https://image.mux.com/4qTgWnjON18SBrhJ00puId57OV6So3rWV02cWmQWOkMT8/thumbnail.jpg"}

B.4472 March 17, 2025 — Vancouver, Canada

I can't drive

B.4473 March 18, 2025 — Boston, MA

LED bulbs are greatly cost-effective but the bulbs used for headlights need to be regulated. LEDs vary significantly depending on the wavelengths they emit. I have not tested any headlights from newer cars, but I would guess based on the pain I feel in my eyes that they are predominantly emitting blue light, which is very harmful for our eyes. There should be a limit on how much radiometric power is being emitted by headlights and high beams vs regular lights should not be a slight angle adjustment. Being slightly down hill from new cars is a very dangerous position to be in these days.

B.4474 March 18, 2025 — Chicago, IL

GET RID OF THESE DAMN BRIGHT HEADLIGHTS NOW!!!! IM SICK OF IT

B.4475 March 21, 2025 — Stuart, FL

it is terrifying being blinded by peoples headlights while driving. I drive 2 hours to get to school and there have been multiple times where I've feared getting into a car accident because other people's regular headlights are so bright that I can't even see the road.

B.4476 March 25, 2025 — Ironton, MO

{"videoUrl":"https://stream.mux.com/Yh8x3WjVHPSj2FdBCT3afY5aURWFvOLCcZW4HkB6S7s","cloudflareUid":"30ed0a8675655548ab500542ed69fbc2","muxAssetId":"fx00ybMRVZM3JmlMfXPeSbRbVPYeu3IOfuXlTB8P8y8U","muxPlaybackId":"Yh8x3WjVHPSj2FdBCT3afY5aURWFvOLCcZW4HkB6S7s","muxPlaybackUrl":"https://stream.mux.com/Yh8x3WjVHPSj2FdBCT3afY5aURWFvOLCcZW4HkB6S7s","muxThumbnailUrl":"https://image.mux.com/Yh8x3WjVHPSj2FdBCT3afY5aURWFvOLCcZW4HkB6S7s/thumbnail.jpg"}

B.4477 March 30, 2025 — Export, PA

it's not safe!!!

B.4478 March 30, 2025 — Pasadena, CA

I drive an older car that sits lower to the ground and with the prevelance of more SUVs and trucks which sit higher off the ground I find that any time I drive at night I am utterly blinded by these headlights as they are shining directly at eye level. This is more than just an annoyance and is a matter of equity and safety for anyone who uses the road. While these headlights may make it easier to see for those who drive newer and more expensive vehicles it actually makes it more unsafe for those of us who do not. I believe it is a failure of our government to not be regulating these in terms of safety to other users of the road and I implore government officials to take into account the safety of all road users

B.4479 March 30, 2025 — Somerville, MA

I thought I was going crazy but instead it is true, others are experiencing the same issues I have at night due to the brightness of headlights. Please someone do something, it has gotten too dangerous

April 2025

B.4480 April 1, 2025 — Fort Myers, FL

I get frequent migraines and these lights are a trigger. I have to move my mirrors everytime a vehicle is behind me, blinding me with these lights. It's a safety hazard because my mirrors are all out of place and I can't keep adjusting them back and forth while driving. PLEASE GET RID OF THEM!!

B.4481 April 1, 2025 — San Francisco, CA

Headlines have become so bright these days that I am having to drive one-handed during night time. My left hand covers my eyes from glare in the rear view mirror and from oncoming traffic. Worse yet, I drive a Prius and headlights from tall vehicles literally illuminate my cabin. Legislators please act. To my fellow drivers with bright lights: I want to see the road and be safe too.

B.4482 April 3, 2025 — Mount Airy, MD

I live in an area with a lot of sharp turns, hills, and ditches. It’s extremely easy to run off the road even without being blinded by LEDs. At night, and especially when it rains, LED lights make it nearly impossible to see the yellow and white, because EVERYTHING turns white. If you went back a few years and used LEDs on the road, people would tell you to turn your brights off. These lights have made it is unnecessarily dangerous to drive at night, and I’ve nearly run off the road multiple times after being flashbanged

B.4483 April 5, 2025 — Belleville, IL

Blinding LED and blue headlamps are DANGEROUS.

B.4484 April 5, 2025 — Brooklyn, NY

Overly bright lights at night are a dangerous issue that must be addressed. Sometimes I can see my own car’s shadow in front of me, even though my own lights are on, because the lights behind me are so bright.

B.4485 April 5, 2025 — Broomfield, CO

The incredibly disorienting bright white glare from LED lights on large snowflakes at night on a dark snowy road is most certainly dangerous. Who researched the level of LED safety in the snow??? This is an absolute must.

B.4486 April 5, 2025 — Chicago, IL

{"videoUrl":"https://stream.mux.com/wxU1XgPVoJpb9ZCHyCNrx2LBnA11rkyoVr00oc2QnHnQ","cloudflareUid":"005742ac6909f14920e3f0e26ff8d426","muxAssetId":"ngwqzY300SyZkBYYigEm4cvnd3fdYhvkjwJCZDH01OD9A","muxPlaybackId":"wxU1XgPVoJpb9ZCHyCNrx2LBnA11rkyoVr00oc2QnHnQ","muxPlaybackUrl":"https://stream.mux.com/wxU1XgPVoJpb9ZCHyCNrx2LBnA11rkyoVr00oc2QnHnQ","muxThumbnailUrl":"https://image.mux.com/wxU1XgPVoJpb9ZCHyCNrx2LBnA11rkyoVr00oc2QnHnQ/thumbnail.jpg"}

B.4487 April 5, 2025 — Milwaukie, OR

The worst offenders are cheap aftermarket replacement headlights and light bars. Existing rules on forward facing lights need to be enforced, and limits need to be clarified to address new technology. Nobody wants to see endlessly increasing regulation, but headlight brightness has become an arms race that puts pedestrians and other drivers at risk in order to turn the night into daylight.

B.4488 April 5, 2025 — Phoenix, AZ

If they are really concerned with our safety they'd get rid of those blinding lights. I've even seen them a bright yellow!! Enough.

B.4489 April 6, 2025 — Los Angeles, United States

The new headlights make it so unnerving to drive at night, especially for those of us with astigmatism. Like who in the heck was the "genius" that thought making head lights brighter was going to help things? Its obvious to me that no one consulted and sort of optomestrist, opthomologist or any sort of vision professional. we need to go back to the old school headlights now!

B.4490 April 6, 2025 — United States

https://www.vox.com/explain-it-to-me/407147/bright-car-headlights-leds

B.4491 April 8, 2025 — Calgary, Canada

I find that the new brightness of headlights feels blinding and irritating. How is that helpful and qualify as higher safety standards? It may help the driver but what about the other drivers that are squinting or having to look away because their eyes are blinded. In my opinion, a driver who is blinded is being handicapped by the light intensity and should anything happen as a result, perhaps a lawyer should be consulted.

B.4492 April 8, 2025 — Calhoun, GA

It appears that pickup. Trucks and SUVs that are installing larger tires and lift kits are doing so without verifying that their headlights are aimed correctly. This lack of consideration for on coming drivers is blinding drivers. It should be mandatory that when a vehicle has modifications from their stock configuration that a headlight aim be checked by an authorized third party.

B.4493 April 8, 2025 — Cincinnati, OH

Sometimes, when a vehicle has bright headlights, approaching from behind, I need to pull over & let the vehicle pass. Additionally, I have my rear window tinted.

B.4494 April 8, 2025 — Cumberland, MD

I can't drive on high-speed roads at night anymore....too dangerous, especially with enormous SUVs and pickups beaming light into my brain from above my smaller car. The reflected light in my rear-view mirror is so blinding I have to avert the mirror to drive at all! The light is AGGRESSIVE and DANGEROUS

B.4495 April 8, 2025 — Denver, CO

Other drivers and pedestrians are blinded by too bright headlights. To save lives, NHTSA needs to address this dangerous situation immediately.

B.4496 April 8, 2025 — Herndon, VA

I have experienced the torture of the headlights being so bright and couldn't drive for a day. My eyes needed to rest after being on the road for a week straight with breaks in between. When I saw this article it all made sense. I pray that this gets to the floor and change happens. It's not making traveling better. It's making it worse. Drivers can't see if it's safe to get in the next lane because of these blinding lights. It's really bad especially on highway 95 on the east corridor line.

B.4497 April 8, 2025 — Highland TWP, MI

Please limit the car lights & save our eyes

B.4498 April 8, 2025 — Madison, WI

We need safety regulations! Monster SUV and trucks seem to be the worst offenders.

B.4499 April 8, 2025 — Parry Sound, Canada

The bright lights are dangerous and it's not acceptable.

B.4500 April 8, 2025 — Phoenix, AZ

Unmentioned issue: The problem is exacerbated for those suffering from cataracts!!

B.4501 April 8, 2025 — Winnipeg, Canada

I get blinded by car drivers all the time. Often it seems they have their high beams on, but whe I flash them to remind them to turn their high beams off, they flash back with even brighter lights. Night vision is completely destroyed

B.4502 April 8, 2025 — Woodruff, SC

I can no longer drive at night because of the intensity of headlights. Please begin regulation of headlight strength to a lower level!

B.4503 April 9, 2025 — Calgary, Canada

This LED headlights madness needs to stop and become properly regulated. They′re a road hazard, no doubt about it. They′re damaging our driving, our eyes and safety of everyone involved. Now the old cars Install the LEDs and then it′s even worse. We used to be able to see if the car coming your way is moving slightly towards you and might hit you, so that you can avoid, but now it′s just you can′t even look at the corner of the car to get a sense of its direction. You just look away and pray all goes well.

B.4504 April 9, 2025 — Calgary, Canada

This LED headlights madness needs to stop and become properly regulated. They′re a road hazard, no doubt about it. They′re damaging our driving, our eyes and safety of everyone involved. Now the old cars Install the LEDs and then it′s even worse. We used to be able to see if the car coming your way is moving slightly towards you and might hit you, so that you can avoid, but now it′s just you can′t even look at the corner of the car to get a sense of its direction. You just look away and pray all goes well.

B.4505 April 9, 2025 — Chapel Hill, NC, NC

I used to be able to drive at night and not worry about it too much. The worst that could happen was some other driver leaving their brights on. These days any long trip in the dark is a recipe for migraines and it′s entirely due to the intensity and location of modern vehicle lights. I think LEDs are a great technology, but like anything else, they have to be used in a reasonable way.

B.4506 April 9, 2025 — Flemington, NJ

I thought my eyes had suddenly aged. Turns out, there has been an increase in LED headlights that coincided with an increase in my nighttime driving. The headlights are awful

B.4507 April 9, 2025 — Phila, PA

Like so many others, I too thought I was only one being blinded by car headlights in the recent years! It’s literally become painful to drive at night, from experiencing headaches to losing vision on the road, I am completely on board to banning blinding headlights!

B.4508 April 9, 2025 — Richmond, KY

It is very hard to drive now days because of the intense brightness of head light and all most to the point of being blinded and driving 70 and not knowing where you are on the road until a car passes, and praying nothing is in front of you and your still on the road until your sight comes back to you. My mirrors are not where the should be for traffic behind me for the same reason. Instead of blinding lights, inhance to paint or marker on the roads. Rain is the worst when the lines are not visible and glaring headlights are beaming. A person driving a car has no hope.

B.4509 April 9, 2025 — Scottsburg, IN

Has anyone ever thought about the seniors with cataracts and the effect these headlights hv on glare. It’s very blinding and look how many senior citizens we have. There are no lines to guide you on side streets and frontal impact wrecks are the most deadly!

B.4510 April 9, 2025 — Scottsburg, IN

Does the insurance institute and NHTSA take into account seniors driving on the roads who have cataracts? And how many seniors drive? Frontal impact crashes happen because it’s hard to stay on your side of the road when passing car when night blindness from LEDs compound the problem.

Do a study on frontal impact wrecks on side streets with no lines and seniors driving. We all aren't young anymore

B.4511 April 10, 2025 — Chicago, IL

I was hit by a driver who stated that she was blinded by bright LED headlights. Luckily I survived but this issue is life and death

B.4512 April 10, 2025 — Doylestown, PA

I drive every night from doylestown pa to Philadelphia, and i have to suffer this problem every night. Very rude and dangerous.

B.4513 April 10, 2025 — Michigan City, IN

I work nights and driving to and from work is becoming more of a challenge due to these lights! Plus it does not help when inconsiderate people do not turn off their bright lights, which are their LED bright lights. Worse invention ever for vehicles in my opinion, need to get rid of them.

B.4514 April 10, 2025 — North Vancouver, BC, Canada

BC needs regulations on maximum intensity of headlight power intensity, as the Motor Vehicle Act Regulations formerly provided. Currently Section 4.06, 1b and 5 address ″striking the eye of an oncoming driver″ with no mention of actual candle-power of low-beam & prohibited high-beam. Exact maximum intensity power maximums are badly needed currently. Thank you

B.4515 April 11, 2025 — Greenwood lake, NY

{″videoUrl″:″https://stream.mux.com/601WKHDP1gW9JW4N7NdCsYt49UlEvRzbMitfpSZYdyWE″,″cloudflareUid″:″16d1cf102da02c80f377a9d03c3915da″,″muxAssetId″:″ITyhY800qJGzdXT00hs38VMcX01Gwas9Trbdq431f1Tlro″,″muxPlaybackId″:″601WKHDP1gW9JW4N7NdCsYt49UlEvRzbMitfpSZYdyWE″,″muxPlaybackUrl″:″https://stream.mux.com/601WKHDP1gW9JW4N7NdCsYt49UlEvRzbMitfpSZYdyWE″,″muxThumbnailUrl″:″https://image.mux.com/601WKHDP1gW9JW4N7NdCsYt49UlEvRzbMitfpSZYdyWE/thumbnail.jpg″}

B.4516 April 11, 2025 — York, PA

Cannot stand when one of these SUVs with insanely bright lights is behind me. Was happy to see this petition to immediately sign. They light up the inside of my car like high beams! I often try to turn my side mirror far enough hoping it's beaming the light back into their own freakin eyeball- not to cause a wreck of course- but they've gotta see for themselves how bright their dumb headlights are! Someone's gotta make legislation limiting the bulbs!!!

B.4517 April 12, 2025 — Amarillo, TX

My husband and I both have issues with the LED headlights. I had someone behind me that has them and it took up my entire side mirror. They hurt my eyes. If somebody is blinking because of the brightness then. that means they′re not able to watch the road properly. It′s dangerous. There are times that I will see someone crossing the street, but then another vehicle with bright lights will come up and I can′t see them anymore. Can you imagine having to deal with that when there′s too close to tell that there′s someone there?

B.4518 April 12, 2025 — Fallon, NV

The headlights are ridiculous and dangerous to oncoming drivers. I drive for a living. Something needs to change. What good does it do to help one driver see better while blinding another. It looks like everyone is driving with there high beams on now. DANGEROUS!

B.4519 April 12, 2025 — Solon, OH

These new headlights are not at all safe, they blind oncoming traffic and can cause accidents. Please do not continue to install in any cars and recall all the existing ones !!

B.4520 April 13, 2025 — Montague, CA

These led lights are abviously way too bright. It shows how only one person cares about himself and not others. They are blinding even on low beam. Ill have to slow down to 30mph depending on location to let the go by. It is not safe!

B.4521 April 13, 2025 — Salt Spring Island, Canada

I find the new headlights dangerously blinding. In a rural area it's not only oncoming, it's also being blazingly lit from behind making it impossible to see out of the windshield.

B.4522 April 13, 2025 — San Diego, CA

I have to have my sun glasses on to oncoming traffic

B.4523 April 15, 2025 — Grand Rapids, MI

An AARP article maintained there is no difference in the brightness of vehicle headlights. Causes me to be skeptical of their automobile reviews. Or, maybe they aren't testing in real-world conditions. See John Draneas article in Feb 25 Sports Car Market.

B.4524 April 16, 2025 — Colorado Sptings, CO

Driving at night has become increasingly painful for my eyes and dangerous because i have to avert my eyes from the road to avoid the glare. This should have never been allowed.

B.4525 April 16, 2025 — Murrieta, CA

I drive everyday for school and work. I get off late at night usually and most of the times I have to take side roads. I always have to adjust my eyes to see in the dark which is easy and not usually a problem, until some car crosses my path with the sun for headlights. This is when I have to turn to look at the side of the rode which can be dangerous and very unsafe, however this is still better than getting blinded for a few seconds. I have also noticed the positioning of the lights is at the perfect angle and gets both side mirrors and my rearview mirror so I really am getting blinded from all directions.

B.4526 April 19, 2025 — Mt pleasant, MI

I am now on migraine medicine everyday because of these headlights and porchlights, which only helps slightly. They are literally killing me.

B.4527 April 22, 2025 — Beaverton, OR

I can't count the number of times I have been terrified for my life and for the lives of those around me because a pair of excessively bright headlights has rendered me essentially blind, especially for small things like lane markers - or worse, pedestrians. Sometimes the lights are in front of me, sometimes behind me shining at my side mirrors. I try to slow down as much as possible until I can see again, but lights can strike very suddenly, and there are many situations when one can't slam on the brakes without danger. (The middle of intersections, a fast-moving highway with cars tailgating you, and many more!) Adding to that, I get migraines from excessively bright lights. (Note that older or yellower headlights do not cause this issue!) This both means that I want to look away to protect myself (but I still need to see!) and means that in the event of a migraine there are still more reasons it makes driving dangerous. Auras obscure my vision, my thoughts become cloudy, and my reaction time slows. (In that case, of course I try to stop driving until it passes, but again, one can't do that instantly.) So far, I haven't gotten in any accidents, but there sure have been close calls, all due entirely to overly bright lights! I can't think of anything else which has put me in so much danger.

B.4528 April 24, 2025 — Arlington, MA

Lumens, Beam Angle, Beam spread, Headlight mounting height -- none of these seem to be regulated or uniform! I drive a small car, not a high SUV or truck, and the oncoming car headlight beam often shines directly in my eyes making the overly bright lights even worse! It is as if drivers are using their high-beams (and maybe they are!) I now try to avoid driving at night or use my spouse's higher-clearance car, a slight improvement, but still -- for a fatal split second -- wouldn't be able to see a pedestrian in a crosswalk directly in front of me! It is terrifying!

B.4529 April 24, 2025 — Manahawkin, NJ

Some of the issues presented are quite valuable and need much support. I am sorry not to be able to donate due to every time I put a credit card into any Computer it has been immediately hacked and I have had a really bad time contesting the phony charges which prevent the legitimate charges to be paid.

B.4530 April 25, 2025 — Sheffield Lake, OH

As more and more sources of blue light become our everyday I have noticed my eyes deteriorating faster. I was recently diagnosed with an astigmatism in both eyes. These headlights make the difficulty of driving at night almost impossible. I am terrified to drive anywhere unfamiliar once it gets dark now as these LED lights are sometime so blinding I can't even see past the car, let alone my windshield. My head aches and they even make me nauseous. I have said for years that they are out of control, but now it seems they are worse than ever. After reading the extensive history of trying to fight this and how illegal it has been the whole tine infuriates me. I rarely do things like this, but people are dying from this and I have had enough.

B.4531 April 27, 2025 — Fayetteville, AR

Most nights when I'm driving home it's impossible to see the road, so I need to line up my car with the oncoming traffic's movement. This needs to change or people like me (with poor vision) will eventually be unable to even do this indirect half-solution.

B.4532 April 27, 2025 — Salt Lake City, UT

I'm a healthy 28 year old with 20/20 vision and I am now too scared to drive at night most of the time due to the new LED headlights. I have had so many near misses driving in rural places with no overhead streetlights where the LED lights on oncoming cars are completely blinding. Sometimes the lights trigger a cluster headache or migraine for me and I have to pull over. I am a Masters of Public Health student and I thoroughly believe these headlights not only pose serious safety risks as they increase the likelihood of car accidents, but they also cause long term eye damage. We need to get rid of them!

May 2025

B.4533 May 3, 2025 — Orem, UT

I have almost been in multiple accidents due to the glare of LED headlights, particularly when the vehicle is modded or lifted and the angle of the headlights is not adjusted. Bright headlights should be taken more seriously - they're more than a nuisance, they're a full-on hazard.

B.4534 May 9, 2025 — Cambridge, MA

Blinding LED headlights not only damage my precious (to me) eyesight, they double my chances of hitting on-coming cars, parked cars, pedestrians, and animals. If driving is a a right, so should be the right to protect my own eyes and my right to feel safe , when driving. I'm more concerned about accidents from LEDeadlights than I am about alcohol, drugs, or sleep-deprivation.

B.4535 May 22, 2025 — United States

https://hudsonvalleycountry.com/are-headlights-to-bright-on-cars-in-new-york/

B.4536 May 22, 2025 — United States

https://www.activistpost.com/2024/03/organization-sues-fda-for-failing-to-protect-public-from-biologically-and-environmentally-harmful-led-lights.html

B.4537 May 22, 2025 — United States

https://6abc.com/blinding-headlights-bright-lights-while-driving-soft-foundation/13118607/

B.4538 May 22, 2025 — United States

https://carbuzz.com/news/americans-will-have-to-wait-years-for-blinding-headlight-solution

B.4539 May 22, 2025 — United States
https://illuminatipress.com/american-drivers-have-a-blinding-headlight-problem-it-could-last-for-years/

B.4540 May 22, 2025 — United States
https://www.businessinsider.com/american-drivers-have-a-blinding-headlight-problem-2023-2

B.4541 May 22, 2025 — United States
https://fox4kc.com/news/national/are-headlights-brighter-than-they-used-to-be/

B.4542 May 22, 2025 — United States
https://todayusanewz.com/are-headlights-brighter-than-they-used-to-be/

B.4543 May 22, 2025 — United States
https://4on4news.com/politics/are-headlights-brighter-than-they-used-to-be/

B.4544 May 22, 2025 — United States
https://www.activistpost.com/2023/07/behind-your-back-yet-in-front-of-your-eyes-blinding-technologies-for-vision-burnout.html

B.4545 May 25, 2025 — Boston, MA
These lights cause excruciating pain to people with photosensitivity.

B.4546 May 30, 2025 — Columbus, OH
The headlight aiming regulations need to change in the U.S. it's absolutely ridiculous

June 2025

B.4547 June 10, 2025 — Shohola, PA
The aftermarket headlight bulbs many people install are sometimes 2-3x brighter than factory, with no consideration for headlight re-alignment. These people just have absolutely zero consideration for others on the road. I can feel these types of headlights cut through my eyes to the core of the back of my head, and my eyes REALLY HURT when this happens. It is blinding and my vision is deteriorating because of these aftermarket headlights. Anyone can see the difference between factory and aftermarket, and the aftermarket headlights are ridiculously way too bright. I literally feel like I'm going to have permanent eye damage - I complain to the eye doctor every visit.

B.4548 June 14, 2025 — Bonney lake, WA
I am blinded every day for several seconds each time by these headlights. Even if you make an effort to look away, passing and turning cars WILL blind you. All we need are yellowing and dimming stickers on these headlights. It can't be so hard to make an effort.

B.4549 June 14, 2025 — Groton, CT
LED headlights are genuinely dangerous and so unnecessary they're constantly blinding me and my friends on the road, it's so annoying, GET THEM OUTTA HERE

B.4550 June 17, 2025 — Geelong, Australia
AUSTRALIA HAS HAD ENOUGH!!!!

B.4551 June 18, 2025 — New Market, AL
This has become a matter of life and death around here. I will vote for candidates that promises to introduce and support legislation regulating this increasing hazard!

B.4552 June 18, 2025 — Pawtucket, RI
I drive at night and most of the time it's scary because the bright lights are very blinding, the manufactures should be held to a higher safety standard for the safety of everyone on the road. This is what state, and government should be taking into account (saving lives)

B.4553 June 18, 2025 — Southbridge, MA

Half the time I believe drivers have their high beams on when in fact they′re just in a new car with low beams ! Its just blinding when they DO have high beams running on a new vehicle ….YOU CANT EVEN SEE THE ROAD !!

B.4554 June 18, 2025 — United States

https://www.wpri.com/target-12/yes-car-headlights-keep-getting-brighter-heres-why/

B.4555 June 19, 2025 — Austin, TX

Dangerous and painful. Require LED headlight bulbs to match the color temperature and intensity of halogen bulbs.

B.4556 June 19, 2025 — Belchertown, MA

I can’t drive at night anymore because of the blinding headlights of oncoming vehicles. The main road to our home is narrow, windy and hilly. When an approaching car with those super bright headlights appears when I am driving up a hill or as I come around a corner, I am blinded and have to stop because I can’t see where the road is going. Also, once while I was standing near a road in the daytime, a small motorized vehicle with those bright lights came toward me, after which I had a blind spot in the middle of my eyes all the rest of the day. They should be illegal!

B.4557 June 19, 2025 — Greenville, SC

Very dangerous having cars with very bright headlights.

B.4558 June 19, 2025 — Keller, TX

I have migraines that are trigger by bright lights which includes all headlights but the worst are the newer vehicles. It’s too much! Why do they have to be blinding?

B.4559 June 19, 2025 — Palmdale, CA

I drive alot and now it is very hard for me to drive at night because the headlights on other cars are so bright that you are temporarily blinded. That is not safe when you are driving and the spots it leaves in my eyes makes me blinded for even longer. Ive actually just closed my eyes before while driving until the car passed because I couldn′t see. I also sometimes put my sunglasses on to block the bright lights. Something needs to be done about this.

B.4560 June 20, 2025 — Bolingbrook, IL

And these times with blinding headlights I have to drive home with my sunglasses on

B.4561 June 20, 2025 — Lakewood, CA

This is something I’ve noticed more and more over the past few years, and it’s become a serious safety issue. Overly bright headlights aren’t just an annoyance—they’re contributing to real consequences: increased accidents, road rage incidents, and even fatalities. And the worst part? Much of it is preventable. It’s time for common-sense regulation. Manufacturers should face stricter limits on how bright headlights can be, especially with today’s high-intensity LEDs and HIDs. We also need to implement mandatory headlight inspections, similar to smog checks, to ensure proper alignment and compliance—especially for aftermarket or modified lighting systems. Fix-it tickets should be issued for vehicles running illegal or misaligned headlights, and there should be clear enforcement guidelines in place. Beyond that, encouraging the adoption of adaptive headlight technology could make a huge difference—automatically adjusting beams to reduce glare for other drivers. This is a public safety issue, not a style choice. A few smart policies could reduce accidents, improve visibility, and make night driving safer for everyone.

B.4562 June 21, 2025 — Newark, NJ

I am a school bus driver in NJ. I′ve driven over 2,000,000 since I got my license. I drove the 9-11 Commission(with another driver) when they were here in NJ. I worked as a limo driver for 3 years after 9-11 when I came back to Jersey. I′m also a car ″fanatic!″ Especially German cars. Been working, fixing, racing cars since I was avteen. So here′s the deal: These L.E.D. headlights are STUPID and DANGEROUS! If you need headlights THAT BRIGHT then you must be blind and SHOULDN′T BE DRIVING AT NIGHT! And NHTSA should′ve shut down this stupidity when it first

started!! Ford F150. Teslas. Prius. Some Hyundais. It's RIDICULOUS! I worked in DC 16 years. I know how stuff "doesn't" get done. NHTSA should ORDER ALL car manufacturers to STOP using L.E.D. headlights! On top of that, some of these headlights are $2/3000 to replace. That is preposterous! Go back to halogen bulbs for ALL cars. And if you can't see well at night, STAY HOME! This is a SERIOUS problem! Get on it and fix it TODAY!

July 2025

B.4563 July 11, 2025 — Culver City, CA

Pathetic that the greatest nation in the world is collectively blinded by unnecessarily bright LED headlights

B.4564 July 12, 2025 — Mechanicsville, MD

Please make legislation / laws to reduce the intensity of these BLINDING headlights. If you can't see at night without blinding others, you don't need to drive at night. I don't need the POWER OF THE SUN behind me blinding me because of manufacturers putting these unnecessary blinding lights.

B.4565 July 12, 2025 — WAYNETOWN, IN

I'm not gonna make it fancy, but I've hit a multiple things on the road, weather it be a pothole/animal/or even branches all due to people high beaming me or having needlessly bright led headlights

B.4566 July 17, 2025 — Twentynine Palms, CA

I've started using my police unit's spotlights to counter these idiot drivers.

B.4567 July 18, 2025 — Littleton, CO

I've had a couple of concussions and have an extremely hard time with the bright lights, especially the blue emergency lights. The intensity of these headlights and the emergency lights is blinding and excessive. After the cars with the bright headlights have passed, I still cannot see for a couple seconds, and I live in an area where there is a lot of wildlife. I don't want to hit a deer or an elk because the car that has just passed me has blinded my own field of vision. Let's focus on the dangers that these too bright of lights are causing for others.

B.4568 July 20, 2025 — Midlothian, VA

I noticed how challenged, foggy, distracted my eyes are at night every time I am out at night that I limit night driving as much as I can. Not realizing that it is these new LEDs on cars and everywhere else that are the new norm. If this is affecting my eyes at my age 49, how are they affecting our young folks? Will they be blinded by the LED lights the longer they are out on the market? Where are the guardrails for things like this!! It's wrong and evil what has been brought into our lives to improve our lives only to come at a physical cost that is in my opinion not worth it!! Bring back the incandescent lights NOW for the wellbeing of all of humanity!!

B.4569 July 21, 2025 — Long Beach, CA

For drivers who like the increased visibility from LED headlights, how about a switch (like the dimmer switch on regular headlights) so that you can use them when no one else is around? Because oncoming LED headlights blind me for a couple of minutes, making them extremely unsafe! Especially in rural area where roads are dark.

B.4570 July 23, 2025 — kissimmee, FL

The new headlights are blinding and hurt my eyes. They make it extremely unsafe to drive at night, not to mention the concern for eye damage. I have heard similar complaints from many others. It is absurd that such a product is allowed in the market.

B.4571 July 26, 2025 — Crittenden, KY

I just want to get home and bed from work with no issues. I did by a glare night glasses, but those make me more sleepy sometimes depending on how tired I am. There are times I slow down just because there's extremely bright headlights coming.

B.4572 July 28, 2025 — Bon Air, VA

{"videoUrl":"https://stream.mux.com/02ulUuziwxyjr3pNAKq54AF45Z02tAlpqiNeLERFtAX8I","cloudflareUid":"b4d3730f3e312d48d716f85b2f8720eb","muxAssetId":"c79SF00xEX6Im00pg4h1bvLgXe1VqkbIpsKDrmGU00V2As","muxPlaybackId":"02ulUuziwxyjr3pNAKq54AF45Z02tAlpqiNeLERFtAX8I","muxPlaybackUrl":"https://stream.mux.com/02ulUuziwxyjr3pNAKq54AF45Z02tAlpqiNeLERFtAX8I","muxThumbnailUrl":"https://image.mux.com/02ulUuziwxyjr3pNAKq54AF45Z02tAlpqiNeLERFtAX8I/thumbnail.jpg"}

B.4573 July 30, 2025 — San Antonio, TX

Tired of being blinded at night while driving. This is a dangerous situation that need to be addressed by lawmakers.

August 2025

B.4574 August 1, 2025 — lake forest, CA

I want to know who the geniuses are that build SUV's and trucks and puts the headlights right at eye level for anyone inside of a car. I want to know how anyone can think insanely bright white and blue LED and HID headlights (soon to be laser now as well), light so bright you will still be seeing them sixty seconds after passing one due to after image, how can anyone believe this isn't an issue? This is an extremely important issue and one that demands some sort of reigns and regulations/standards be put into place. If someone can be pulled over by the police for window tint why can't some sort of limit be established that can be enforced by police?

B.4575 August 3, 2025 — williamsburg, VA

Please ban those crazy bright headlights

B.4576 August 4, 2025 — Los Angeles, CA

I get headaches so bad I have to stop working. But who will pay the bills?

B.4577 August 13, 2025 — Wilmington, DE

I have sensitive eyes and I experience physical pain when driving at night and another car has LEDs or 30% brighter bulbs. It doesn't help that all these cars are so much taller now, so the beams are directly pointed at my face half the time.

B.4578 August 14, 2025 — Boise, United States

Nothing really caps off a long, tiring day quite like being blinded three separate times on your drive home from work. You want to rest? Let's put you through the gauntlet, see if you live to see your bed! If you can see at all! My younger sibling, who just got their driving permit, mentioned being scared because they couldn't see anything, and began going off the road trying to avoid a truck driving at them. If my younger sibling dies or gets injured over these stupid lights, I will make sure hell reaches the people who make and drive these god forsaken cars.

B.4579 August 15, 2025 — Atlanta, GA

{"videoUrl":"https://stream.mux.com/GNjzGaQGnqbNl00P6pA01KVfzj8uC1Uo2bilrN5CnGu00M","cloudflareUid":"2a4b6ddc35d0cb43cd5bd5eeb79c606c","muxAssetId":"cb4TI8MRfMYoUZw3fmxgfPM00vyL8hDPOd2oRhvq4wds","muxPlaybackId":"GNjzGaQGnqbNl00P6pA01KVfzj8uC1Uo2bilrN5CnGu00M","muxPlaybackUrl":"https://stream.mux.com/GNjzGaQGnqbNl00P6pA01KVfzj8uC1Uo2bilrN5CnGu00M","muxThumbnailUrl":"https://image.mux.com/GNjzGaQGnqbNl00P6pA01KVfzj8uC1Uo2bilrN5CnGu00M/thumbnail.jpg"}

B.4580 August 16, 2025 — Phoenix, AZ

Blue-white LED lights are used by law enforcement officers to temporarily blind suspects for capture, while the "Dazzler" devices also harm the retinal DNA of the eyes, just like these crazy headlights. I must drive at night while wearing my sun shades in order to save my eyesight from those harmful blue-white LED lights, while also removing the massive glare-storm caused by those lights. I am very

tired of being blinded by 40 percent of the vehicles on the road today and it is only becoming worse each year.

B.4581 August 16, 2025 — Phoenix, AZ

Blue-white LED lights are used by law enforcement officers to temporarily blind suspects for capture, while the "Dazzler" devices also harm the retinal DNA of the eyes, just like these crazy headlights. I must drive at night while wearing my sun shades in order to save my eyesight from those harmful blue-white LED lights, while also removing the massive glare-storm caused by those lights. I am very tired of being blinded by 40 percent of the vehicles on the road today and it is only becoming worse each year.

B.4582 August 22, 2025 — Lake Village, IN

None of the aftermarket LEDs people install in OEM incandescent housings are legal. Its a modern trend of lawlessness on the roads. We've had vehicle lighting regulations in regard to brightness, color, and placement on all motor vehicles for 58 years. I see people with red, pink, blue, yellow headlights, people pulling their amber bulbs out of their clear cab light housings and installing clear bulbs, replacing amber running lamps with red lamps, fishtank style rectangle light bars on bumbers. Either modern police do not know the law or they're just not enforcing it. Its also common sense that if tiny blue dots have been illegal for 50 years then so is all the other added nonsense.

B.4583 August 27, 2025 — Victoria, Canada

There is absolutely no reason these headlights are not properly aimed to direct the light to the road where it’s useful and not our faces where it’s not.

B.4584 August 28, 2025 — Bogalusa, LA

LEDs should be illegal! Period! I believe only emergency vehicles and motorcycles should be allowed to have them while also being regulated themselves

September 2025

B.4585 September 1, 2025 — Oklahoma City, OK

I used to work for Doordash in the evenings following my day job, but I've had to quit due to the blinding bright headlights that have taken over the road in recent years. Not only do I get headaches but I literally CAN NOT see the road when taking a left turn with a vehicle behind me that has these LED lights. I've been doing delivery service jobs for over 5 years but it's gotten to the point where I don't feel safe anymore. Many of these lights are stronger than warm high beams. It used to be illegal to pass others with your brights on, and now it's the norm?

B.4586 September 3, 2025 — Saint Augustine, FL

I am terrified to drive at night now when this was never an issue before. I feel like I am temporarily blinded from these headlights and it is extremely scary and causes me a great deal of anxiety, especially with my kids in the car. Please, please ban these headlights. I am begging you. They are so incredibly dangerous.

B.4587 September 7, 2025 — Gulfport, MS

It should not be a fight just to drive home after work at night. The fact that people are literally riding around with THE SUN in front of them is absolutely ridiculous

B.4588 September 7, 2025 — Maple Valley, WA

My boyfriend was heading home from dropping me off tonight. He said he was making a right turn and almost hit a lifted truck with blinding leds. His car is small and old, I understand how its blinding it is. Its just categorically unsafe. Outlaw blue toned LED headlights. So many safe alternatives. I would never forgive myself if he crashed on the way home from dropping me off.

B.4589 September 12, 2025 — Magnolia, TX

Being blinded by oncoming lights when driving at night happens all the time. Those lights are not on high beam either. I've been driving over 50 years and the low beams today are brighter than the old incandescent high beams. We need enforceable regulations that target manufacturers and

aftermarket sellers with penalties or product banning and fines if they are sold. We have to put safety first. I am exhausted by government and corporations that don't put public safety first.

B.4590 September 16, 2025 — Dallas, TX

These headlights blind me and I fear getting into an accident, especially with trucks!!

B.4591 September 16, 2025 — Pittsburgh, PA

It's not legal to combat blinding lights that cause migraines. If we can't tint our windshields, the headlights need made for the people with the most sensitivity to light shining in their eyes. To me this is more dangerous than a police officer not being able to see into a car. Lives are at risk driving 65 MPH with blinding headlights coming at them. I you need to do better for the people. I almost wrecked before from being blinding before daylight. Now I have to wear dark sunglasses when its not even sunny out.

B.4592 September 19, 2025 — Humble, United States

I don't know whose stupid idea it was to used these blinding headlights! At least give the option to go back to soft! No wait! They but be banned no option period! I am tired of having to slow down and put my hand up in front of me to shield just to try to drive safely while passing a car with these lights someone else is going to get killed!! Oh wait I guess this is part of the depopulation agenda!!!

B.4593 September 20, 2025 — Hockessin, DE

Please! Please! Please! Please! Please! Please! Please! Please! Please! Please! Please! Please!

B.4594 September 20, 2025 — Richmond, CA

I thought this was my own problem, because I have glaucoma. I'd no idea others were jeopardized also. I've given up driving at night altogether.

B.4595 September 21, 2025 — Carrollton, GA

I can barely see at night on a highway and I have better than average vision. can't imagine what it's like for people with astigmatism or something.

B.4596 September 21, 2025 — Los Angeles, CA

As a pedestrian with light colored eyes, I avoid going out at night due to the blinding glare of cars driving in my direction. I could not drive at night if I wanted to due to blinding LED headlights.

B.4597 September 27, 2025 — Berkeley, CA

I don’t know wtf the engineers making these cars are up to, but they need to knock it off. Not only is it more dangerous, but I suffer from light sensitivity. After a night drive I’m in pain from these stupid effing ultra bright white head lights for like an hour. And when someone pulls up behind me at a light, especially in an SUV or truck the light from my side mirror blinds me. It’s dangerous, stupid and annoying. A law needs to be made about this or it will just keep getting worse.

B.4598 September 27, 2025 — Stone Mountain, GA

Im a delivery driver in the atlanta metro area and I come home with migranes almost every single night due to modern cars bright LED lights particularly the countless drivers that drive with their highbeams on as if the normal headlights werent enough as is. I have no issues with halogen bulbs, the yellow light does not irritate my eyes, but the LEDs have become extremely problematic. Furthermore on dark dimly lit streets when cars like this come whizzing around a corner out of nowhere it poses a huge safety risk because I become temporarily blinded by the LEDs and it becomes incredibly difficult to see the road in front of me. The issues only getting worse and somrthing needs to be done!!!

B.4599 September 28, 2025 — El Dorado Hills, CA

Led Headlights must Go! It’s Dangerous for Everyone on the road! There were 4 huge trucks driving behind me and other drivers and nobody could see around us and caused an accident! When you have led’s coming at you and behind you there’s no to look to avoid them! Save lives BAD LED HEADLIGHTS!

B.4600 September 29, 2025 — Rogers, AR

“Every morning I drive to work at 5:30 am. There’s no chance for the sun to be out and I drive by at least 4-5 drivers with their led hi-beams on. There’s this bridge I have to go across and every time there’s someone there to blind me and I almost run off the bridge at least once a week.

October 2025

B.4601 October 4, 2025 — Greenwich, CT

I am 73 years old, and my eyes are already growing sensitive to bright lights and glare. The new white lights are a hazard, as they further compromise my vision unnecessarily. These lights, coupled with a noticeable increase in the number of drivers in my hometown using their bright lights without dimming when approaching another car, creates an untenable driving situation.

B.4602 October 4, 2025 — Medford, MA

Warm light is less blinding.. LEDs are cold light. If you are a photographer you’d know. New tech is not always good tech.

B.4603 October 8, 2025 — Matawan, NJ

I thought this was a me issue, I clearly see it is not. I’ve had to come to complete stops on the road several times because of cars coming towards me with extremely bright lights, the cars in the rear view are no better. I’m always wondering do they know their lights are blinding, I can’t possibly be the only one. I am not.

B.4604 October 10, 2025 — Roswell, GA

Just had to come to a complete stop making a left turn because the dam truck made the inside of my car disappear. I used to be a trucker and even a normal cars led lights would blind us

B.4605 October 10, 2025 — United States

If I die in a car accident because some insecure shithead decided that only they should be allowed to see while driving, my ghost is haunting all of you with LEDs

B.4606 October 12, 2025 — Roswell, GA

I cannot believe how dangerous it is to drive at night nowadays. Why the hell has Congress not acted on this? Doesn't anyone on here know a Senator or member of the House who can draft a bill? Please, whoever is reading this, do everything you can! I try never to drive at night because of the idiots who manufacture/use blinding headlights. Thank you.

B.4607 October 13, 2025 — Taunton, MA

I drive an SUV so the issue has nothing to do with being in a sedan/being lower to the ground -- these new lights are just awful, period!

B.4608 October 14, 2025 — East Providence, RI

I hate the super bright headlights, it's like getting flash banged while trying to drive at night. I always think think it's idiots driving with their highbeams on, but it's just their headlights. It's absolutely terrible!! Nobody needs lights that bright. Half the reason you have the headlights is so other people can see you coming, but that's no good if you're blinding them. Ban those things!!

B.4609 October 16, 2025 — Milwaukee, WI

{"videoUrl":"https://stream.mux.com/f7IYDEFtbSMlBOZgVkmsuCdiy6lx86AxsyOkJO4uBvI","cloudflareUid":"dbcd7f12d9d8c96984d4aaed1954df36","muxAssetId":"2AfpNdFH016v015XMjj5ZbhDAT026AAqQN02vqybgeJBIzQ","muxPlaybackId":"f7IYDEFtbSMlBOZgVkmsuCdiy6lx86AxsyOkJO4uBvI","muxPlaybackUrl":"https://stream.mux.com/f7IYDEFtbSMlBOZgVkmsuCdiy6lx86AxsyOkJO4uBvI","muxThumbnailUrl":"https://image.mux.com/f7IYDEFtbSMlBOZgVkmsuCdiy6lx86AxsyOkJO4uBvI/thumbnail.jpg"}

B.4610 October 17, 2025 — Steelville, United States

My wife and I travelled 22 miles this morning while I took her to the Elementary School where she teaches. The driver behind me was in a large Ford pick up truck. He had six headlights on it, and they were incredibly bright white LED lights. I was blinded so badly I could not see correctly to determine where the cars were that were meeting me. This is a serious problem, whethere you are blinded in your rear view mirror, or from the cars meeting you, or both. I finally just had to pull off and let him go by, before we had a serious accident.

B.4611 October 19, 2025 — Kingsville, Canada

I am would like to request clarification regarding the responsibilities related to the regulation and enforcement of vehicle lighting compliance requirements. Specifically, I seek to understand who holds the primary responsibility for ensuring adherence to applicable vehicle regulations: • The car dealer (upon sale of the vehicle), • The car / truck owner (after purchase), or • Legal enforcement authorities like the licensing body A clear understanding of this responsibility is important for both compliance and accountability. I highly dought that the owners of pickups that raise the height levels to look cool, don't follow the head light re-aimed or turned to proper safety requirements for on coming traffic. That would also include the added off road lighting to other SUVs or laser sharp lighting of luxury sedans. Government provides guidance or reference for new vehicles that is relevant legislation or policy outlining this matter yes. But who enforces them the police ? Who tests for compliance license renewal agency ? Thank you in advance for your assistance. I look forward to your response.

B.4612 October 20, 2025 — Kent, WA

In my area many drivers without factory "blinding headlights" are now using high beams at all times. Many more have "upgraded" to blinding lights. Like others I am often completely blinded while driving. I have counted up to 6 seconds on the freeway. 6 seconds at 60mph= 528 feet. 528 feet = 1/10 of a mile. That's 1.5 football fields.

B.4613 October 20, 2025 — Louisville, KY

These lights literally make it to where I no longer am able to drive at night.

B.4614 October 20, 2025 — Louisville, KY

I can't drive at night now due to these LED lights. They are in ALL new vehicles and people are also putting them in older vehicles. They need to be illegal to sell for vehicles and manufacturers should be fined heavily for putting them in new vehicles. Please listen to us!!!!!!!!!!

B.4615 October 21, 2025 — Calumet, MI

The blinding lights need a level of control as the owners of these vehicles leave the high beams on always.

B.4616 October 21, 2025 — Detroit, MI

Led lights are starting to be the only type of light bulbs on shelves. They give me head aches, vertigo, and eye strain. I have to work under them for 50 plus hours a week, and then turn around get blinded my them in traffic. The law enforcement is worried about phones as a distraction when they need to BAN LED LIGHTING! They are causing more harm than good!

B.4617 October 21, 2025 — New York, NY

I have had to stop driving at night, which is a huge problem because that's when im on my way home from work. On more than one occasion, I was totally blinded by the headlights of on coming traffic and the traffic behind me. I get very nervous when night time catches me out driving. Whoever thought such bright lights were a good idea must have a chauffeur.

B.4618 October 21, 2025 — United States

https://landline.media/blinded-by-the-light-are-newer-headlights-putting-drivers-at-risk/

B.4619 October 22, 2025 — Avondale, AZ

I just absolutely hate these incompetent people on the road driving with their brights on I remember people used to be pulled over, over this but now it's completely normalized, I'm from Arizona and you

can only imagine the combination of idiotic drivers and narcissistic bright users is only gonna make the road much for dangerous for Arizonans.

B.4620 October 23, 2025 — Edmonton, Canada

Blinded by oncoming and traffic from behind via reflection. It hurts my eyes, I have to try to not look at oncoming traffic which is dangerous in itself and it blinds you for a second which is also very dangerous. Bring back the soft lighting we had before or regulate how leds are installed. And no led installations in halogen bulb headlight housing.

B.4621 October 23, 2025 — Las Cruces, NM

I drive a fuel truck, and I find it absolutely ridiculous that i am sitting a good 8 or 9 feet up and am getting blinded more than a half a mile out. The closer you get the worse it is.

B.4622 October 24, 2025 — Lexington, SC

The standard for testing the safe limits of brightness of headlights unfortunately no longer applies, because the headlights of the past were of a different (warmer) part of the light spectrum, and the new headlights are much cooler, which means they require much more lumens to be detected by the old testing equipment. It's causing problems not just in the aging population, but I know at least 5 friends that are under the age of 50 that complain of how difficult it now is to drive at night, and that as a result, they are avoiding being on the road after dark.

B.4623 October 24, 2025 — San Diego, CA

I care about this issue because of personal experience with these lights while driving, and also because the LEDs in general have negative effects including on the retina of the eyes.

B.4624 October 25, 2025 — Hubertus, WI

Automatic high beams also need to be outlawed. They dont work properly and the driver must be held responsable for the use of high beams, there are laws to enforce about proper use of them.

B.4625 October 25, 2025 — Laguna Beach, CA

This is one issue we all can agree upon. LED headlights have become a driving hazard at night and on rainy days. Many times I have to put my hand up to block blinding headlights while driving, slow down and wait till I can see again. I try not to drive at night, but on overcast or rainy days it can be just as bad. We need to bring back soft, warm headlights

B.4626 October 26, 2025 — West Bloomfield, MI

Driving at night has become increasingly dangerous because of the new cars that come with LED headlights. Anytime a car with them is coming at me I have to look off the road into the bushes or close my eyes completely. Not to mention driving in hilly areas makes the problem so much worse. I thought to my self maybe im just getting older but then i see a car or truck with halogen (old style) lights and i can see the road infront of me just fine and dont even have to squint. I feel this also puts pedestrians at cross walks in danger because say i have to turn left at a intersection and the cars to my left have LED lights while im turning i can barly see the road im turning onto let alone if there was someone trying to cross the road. Its absolutely astonishing that LED lights where ever allowed in the first place as a standard option on cars. Cant tell you how many times that a oncoming car is a foot or two over the line into my lane but i cant see untill they are literally passing me. Add auto high beams and cornering lights to cars with LED headlights and its just a joke how bad they actually work at turning off in time. Oh and not mention all my mirrors are completely unusable at night because they have to be aimed all the way down due to cars behind me with LED headlights.

B.4627 October 27, 2025 — Fox lake, IL

Unregulated aftermarket LED headlights and new vehicles with LED headlights make driving at night more danger than need be. Sure the driver can see more but what are you hoping to see? When passing these vehicles I am blinded temporarily and it scares me. How is this legal?!

B.4628 October 27, 2025 — Palm springs, FL

Headlights are so bright in new cars that in the last 3 years, I have never been in a car at night without getting a headache from all of the lights shining in my eyes. My friends have said someone needs to

invent sunglasses that only work on headlights because driving at night is unreasonable. My breaking point was someone driving behind me on 295 had headlights so blinding all 3 of my mirrors were white-ed out and I literally could not see in my blind spots. I am not exaggerating or being dramatic, both of my side mirrors and rear view mirror were just pure light reflecting back. This driver stayed stayed behind me for several songs and I cried from the pain of lights beaming into my eyes & fear of not seeing drivers around me, before I had to blindly move into the right lane (the highway ahead was empty so it was not busy) and hoped that no one was there as I physically could not take the lights going into my eyes anymore. The highway was indeed empty so everyone was safe. This experience was not the first I have had like it, and so I have sworn off driving at night hindering my own social life because I would rather not be on the road then subject to lights so bright that I am not the safest driver I can be. I am begging our government to help us & revisit the regulations around headlights.

B.4629 October 28, 2025 — Blue Springs, MO

preach cuh

B.4630 October 31, 2025 — Cleveland, OH

Too damn bright! Like helloooo McFly!! ....(D.o.t.) What are you? A bunch of slackers?

November 2025

B.4631 November 4, 2025 — Lancaster, NY

Having astigmatism and having to drive at night with LED headlights blinding me from the front and behind makes it nearly impossible to drive at night

B.4632 November 4, 2025 — Lexington Park, MD

As someone who often commutes in rural areas at night due to shift work, I have found LED lights to be my biggest enemy on the road. They make me uncomfortable when driving, and I much prefer the incandescent bulbs of older cars to the new, honestly just as effective, if not less than effective LEDs of newer cars.

B.4633 November 5, 2025 — Asheville, NC

The led headlights are very blinding. Sometimes I can't even see the road in front of me when a car with led's is coming toward me. It's hard to believe congress has not done something before now for the safety of drivers like they do with everything else.

B.4634 November 5, 2025 — Potosi, WI

The fact that I AM constantly caused PHYSICAL EYE PAIN multiple times a day because morons allow or install LED headlights on vehicles is just mind blowing. How have we regressed so far that manufacturers and buyers have ZERO EMPATHY for other drivers. Not to mention the eye problems people will have in the future from all this super bright LED (blue) light everywhere we go. THIS IS ONE OF THE DUMBEST THINGS HUMANS HAVE DONE. STOP LED HEADLIGHT PRODUCTION NOW.

B.4635 November 6, 2025 — Honea Path, SC

I'm so passionate about this I feel like I'd vote for anyone who would ban the bright headlights. It's so dangerous, especially if you have an astigmatism.

B.4636 November 6, 2025 — Nehalem, OR

Thanks for voicing this! I thought it was just me! I even try to communicate to drivers by switching on and off my brights, but no response.

B.4637 November 7, 2025 — panama city, FL

These lights are a serious problem for people with epilepsy,seizure disorders and migraines. Emergency LEDS are also a serious problem

B.4638 November 8, 2025 — Marquette, MI

You don’t need to have astigmatism to be blinded by these new headlights. We need there to be regulation on how bright lights on a car are allowed to be. It’s a safety issue and we all know it.

B.4639 November 9, 2025 — Decatur, AL

I don't often drive at night, but I'm starting to actively avoid doing so when possible as the LED headlights have become so bright that I can't see the edge of the road anymore. it's insane to think that blinding other people with what's effectively a pocket sun is any safer than having lights too dim to see at all. I have seen people get into head on collisions and have almost ran off the road myself from being blinded. Something needs to be done

B.4640 November 11, 2025 — Hurricane, WV

I CANT FUCKING SEE AT NIGHT!!! THE LIGHTS ARE TOO BRIGHT

B.4641 November 13, 2025 — Montague, MI

Being flashed all of the time with these ultra bright LED lights causes me genuine anger towards the people driving the cars. It hurts and most of the time I have to move my visor down to block seeing the cars in front of me. It doesn’t help when unnecessarily large trucks have these lights as well since they more easily blind shorter cars. Lights on cars need to be more regulated - they’re getting ridiculous.

B.4642 November 13, 2025 — Thornton, CO

Driving at night is difficult already, these brighter headlights and after market headlights make it more difficult. Often I am blinded, cannot see and see spots after. These brighter lights are causing more safety issues and harm. We need to adopt the auto adjust headlights that Europe has but its gone on so long that I fear it will be hard to undo. I.even see people using fog lights, off road lights, colored lights and aftermarket light bars. Noone cares about fellow drivers anymore and driving has become more dangerous than ever. When are automakers going to change this ? Its unfortunate that negative statistics, including death, may be the only way to get thier attention. Its almost worse than texting while driving...

B.4643 November 14, 2025 — Jackson, CA

I don't understand why it's ok to allow bright headlights. It's a public safety concern that needs to be addressed. Driving home in the winter is getting more and more dangerous with the Leds glaring off of the rain. I'm afraid.

B.4644 November 14, 2025 — Las Vegas, NV

Night driving has become more and more difficult because of the bright headlights. I usually drive in the middle lane on major streets, to be further away from oncoming vehicles. I now use yellow sunglasses at night, which makes the brightness more bearable. When driving in my neighborhood, where the road is narrow, it's very bad. I often have to pull to the side of the road because I am so blinded by the oncoming, brighter headlights, that I can't see the road. Then, I need to wait a bit for my vision to adjust back to normal. Excessive headlight brightness has also caused occasional eye strain and headaches. This is very frustrating and debilitating. If he's with me, I sometimes need to have my husband take over the driving. This is particularly bad with the bright blue lights. I never had a problem with the way headlights used to be. Seems like the car designers never heard of - "If it ain't broke, don't fix it!" Let's go back to what worked before, please!

B.4645 November 14, 2025 — Millington, TN

The ever increasing headlight glare that we have to put up with while driving at night is simply outrageous! This is a glaring safety issue that our government simply appears to ignore.

B.4646 November 14, 2025 — Windsor, CT

The new blinding led lights are hazardous. I was so severely blinded by them that I almost drove off a small country road from these lights on an oncoming car. Is our government going to wait until people die to ban these hazardous headlights? They must also be removed from cars that already have them installed!

B.4647 November 15, 2025 — Newton, MA

I am 29 years old. I have 20/20 vision and have never had any trouble seeing in low light. I've always enjoyed driving at night. Yet, in recent years, it has become increasingly harrowing due to the unbelievable brightness of most headlights. At times, I don't feel safe on the road at night. I'm really fed up. This is urgent; lives are at stake.

B.4648 November 15, 2025 — Round Lake, United States

I agree with those voicing deep concern over too-bright headlights, police lights, etc. and find them to be an increasing widespread hazard. A ban would be welcome.

B.4649 November 16, 2025 — Adrian, MO

I am always driving at night on rural two lane blacktops when my shift ends at midnight. I am an older lady and work full time as a guard. It is very hard to see when cars and trucks pass by on this dark road and these newer type headlights are extremely blinding. This is painful for my eyes and I have to nearly come to a stop and look away toward the ditch when these vehicles pass by, and then it becomes hard to adjust my eyes back to the darkness. Additionally, when cars come up behind me at night with bright headlights I have to speed up to try and put more distance between my car and the approaching vehicle. This makes my drive more dangerous because there are a lot of deer and animals that tend to cross the road at night. But I have to drive this way because the bright lights are reflecting in my mirror and blinding me. I don't feel safe in trying to avoid close proximity with these bright headlights. On my drive home I also travel on US interstate 49 in order to get to the next town on my route. During my drive time on this 4 lane highway it is becoming more common that the drivers in the oncoming lanes are flashing their bright lights appearing that they are blinded or confused by the lights of oncoming traffic and can't distinguish if drivers are using their high beams or low beams. This behavior in turn blinds me more as I meet these passing cars. This driving home 5 nights week from work takes a toll me and strains my eyes considerably and puts my safety at risk. I would like to see the headlight standards changed to prevent these hazards and more testing done to include eye safety standards and more information on the measured effects of the electromagnetic field with these new brighter LED headlamps and their use and effects on the environment. Additionally, my vision is bothered considerably by the blue street lamps that are very blinding and distracting. I tend to see more of these in various places. All of these type of bright blue based LED lights are not pleasant and cause side effects such as stress headaches and an increase in accidents. I think the visually impaired and many older drivers are especially handicapped by these lights and are prevented from doing normal daily activities. This problem needs to be examined and more regulation in place that is mindful of consumer safety on the road.

B.4650 November 16, 2025 — Austin, TX

I drive professionally driving students long distances. I have repeatedly flashed my bright lights at drivers thinking they had there bright lights on, when in fact they would show me they didn't. They just have LED headlights which are blinding.

B.4651 November 16, 2025 — Casa Grande, AZ

Driving at night has become difficult and dangerous due to the blinding effect of very bright led lights of on coming vehicles.

B.4652 November 16, 2025 — Cleveland, OH

The bright LED lights on cars is blinding and is a SAFTY hazard making it difficult to see the road when they are coming at you.

B.4653 November 16, 2025 — Dayton, OR

I purposely avoid driving at night because of more intense headlights on so many cars now.

B.4654 November 16, 2025 — Grimes, IA

These headlights are blinding - makes it SOOO dangerous & difficult to drive at night.

B.4655 November 16, 2025 — Houston, TX

Drive at nite and the lites hurt my eyes

B.4656 November 16, 2025 — Indianola, IA

The headlights are used to transfer energy from car to car like direct energy weapons . Have pictures to showing light transfer.

B.4657 November 16, 2025 — Los Angeles, CA

I care about this issue deeply because I've noticed from personal experience that the effects of this light really causes a lot more anxiety, nausea, and headaches more than I ever have felt before, and really not understanding why or where it was coming from. This information definitely confirms what I Have been suspicious of for many many years thank you for this, and I will spread the word.

B.4658 November 16, 2025 — Louisville, KY

I am no longer able to drive at night due to the glaring lights hitting me in the eyes . They have literally blinded me numerous times hitting me right in the eyes, whether driving behind me or head on. Accidents at night are a frequent event in the area in which I live. Not everyone has the option not to drive at night as they must get to work or other required events. Please support the decision to require lessening the brightness of these headlights before more people are killed or seriously injured! Betty Louisville, Kentucky

B.4659 November 16, 2025 — Miami, FL

I'm sixty four and after cataract surgery LED headlights are way too bright and bothersome to safely drive at night…

B.4660 November 16, 2025 — Ocean City, NJ

I am 79 now and even though my eyesight is good I am finding it very difficult since the advent of these ultra bright headlights

B.4661 November 16, 2025 — Ocean City, NJ

I am 79 years of age now and even though my eyesight is still good I am finding it more and more difficult to drive at night with the advent of these ultra bright headlights on the new cars…I have given up highway driving at night as these lights completely blind me which makes it difficult to visit my grandchildren who live almost 2 hours away as I have to plan to NEVER leave for home when I know I will have to travel in the dark. Also, these headlights are so blinding in my rear view mirror that I must flip it up and also aim my side mirrors away which is very dangerous. I have taken to turning my drivers side mirror far enough out that I hope it reflects back into the eyes of the driver who is passing me on my left thus an

B.4662 November 16, 2025 — Saint Charles, MO

{"videoUrl":"https://stream.mux.com/pQtSyiJPx9AyXf3jvyRq2TuXOzlFGet6zeUj9fOB2HU","cloudflareUid":"245690545a3fd14fd98e2cbbc6cb21d7","muxAssetId":"cM028jCG02DlpRO15CWzTTjc7RcP2hX01ihR01zPde5H1WM","muxPlaybackId":"pQtSyiJPx9AyXf3jvyRq2TuXOzlFGet6zeUj9fOB2HU","muxPlaybackUrl":"https://stream.mux.com/pQtSyiJPx9AyXf3jvyRq2TuXOzlFGet6zeUj9fOB2HU","muxThumbnailUrl":"https://image.mux.com/pQtSyiJPx9AyXf3jvyRq2TuXOzlFGet6zeUj9fOB2HU/thumbnail.jpg"}

B.4663 November 16, 2025 — San Antonio, TX

Not only do LED headlights endanger drivers on the road but LED lights contributing to light pollution have had a catastrophic detrimental effect on our natural world as well as on the future well being of human society by denying our children the ability to be inspired by the awesome and mystifying nature of the heavens by limiting the ability to see such natural wonders in all their splendor to the privileged and the remote places away from cities where few of our future generations have a chance to see such God given miracles of our universe.

B.4664 November 16, 2025 — San Bernardino, CA

The bank is sending me a new debit card. I will make a donation when my card arrives. I hate LED lighting! It makes me sick.

B.4665 November 16, 2025 — San Deigo, CA

LED are blinding when driving at night. Please stop producing them in cars and street lights.

B.4666 November 16, 2025 — Santa Rosa, CA

Aiming sealed beam headlights used to be a required part of mandatory vehicle inspections in California. Can't the newer headlights be properly aimed toward the right?

B.4667 November 16, 2025 — Sebastian, FL

I care because I drive. The problem is not only the brightness, but the color temperature. I have noticed that the brightness of the normal headlights on some cars is the same as the brightness of the high beams. I have heard/read that some countries have self-dimming headlights and that this might be a solution for us here in the USA. That is a non-solution; furthermore, in my experience, the automated headlight controls are not that accurate.

B.4668 November 16, 2025 — Stone Mountain, GA

Blue light resembles strobes all is annoyance to true vision - all about money

B.4669 November 16, 2025 — Tucson, AZ

I drove home at night last week, I thought my eyes were actually failing me, I lost vision with the oncoming traffic and the horrific lights that literally blinded me, I could barely see the huge street signs at main intersections, I thank God for one thing, it isn't just me , these headlights, especially in trucks , should really become a traffic hazard, horrible, horrible injurious injustice placed on the American people who had no say

B.4670 November 16, 2025 — Tucson, AZ

I've been driving all sorts of vehicles since the mid 1970s, both as a civilian and in the military. The headlight situation we have on today's roads kills people. A modern society should have the sense to make the situation less deadly, make the lights less blinding.

B.4671 November 16, 2025 — West Islip, NY

I drive at night. Just last night in my own suburban neighborhood I had to pull over, stop the car and avert my eyes to my lap- until a car drove past . The car was 2 blocks away. I waited 15 - 30 seconds before I could resume driving on my street. Ive NEVER seen such blinding light emitted from a car headlight... something wrong is happening !

B.4672 November 16, 2025 — shrewsbury, MA

This is actually one area where regulation is severely needed. As a sedan owner with non LED lights it’s a real issue. Completely blinded every time I have to drive at night. And the trucks that are higher up and the newer SUVs with a whole line of lights on their grill... it’s maddening.

B.4673 November 17, 2025 — Herriman, UT

There have been multiple instances where I've nearly been in an accident because I've been blinded by someone's aggressively bright headlights. In rainy conditions its 10 times worse.

B.4674 November 17, 2025 — Santa Cruz, CA

My eyes have gotten significantly worse since the 'bright blue lights' have been installed. Automakers must comply for our health and safety! No blinding bright blue lights...

B.4675 November 17, 2025 — Spokane, WA

LED lights were the worst invention for headlights. They just blind you.

B.4676 November 17, 2025 — Spokane, WA

My wife asked the city to put a shield over the city street light so our home was not illuminated with LED, this really helped. Driving at night is terrible, often I need to hold my hand up to block the oncoming LED vehicle headlights, these LED lights are a violation of my human rights and change is needed. I nearly purchased LED’s for my vehicle so I could see better but I can’t add to the problem so good conventional headlights will remain on our vehicles as we cannot create discomfort for others

on the roads. We changed our indoor lights to incandescent and enjoy the warmth and sunlight like quality.

B.4677 November 17, 2025 — san fernando, CA

the lights are absolutely blinding and i no longer feel safe driving at night. the older yellow lights are no a problem.

B.4678 November 18, 2025 — Fairfax, CA

Blinding headlights are a menace! And they are dangerous. If most drivers took the time to lower them for an oncoming car (which they rarely do), it would be different. On dark rural roads I sometimes have to actually stop so I don't drive off the road. Not only that, if there is an oncoming car and one behind you shining in your side view mirror, it's a nightmare.

B.4679 November 18, 2025 — Pasadena, CA

I used to think I was having a problem with my eyes until I found out from my brother that these were new headlights being manufactured for the new cars. With so many drivers tailgating and pulling right up to your bumper, the bright lights shining off my rear view and side view mirrors are painful and blinding. It's beyond comprehension how this headlights were approved to install on cars. If a car is coming towards me, I have to look off to the side to avoid being blinded but then that sacrifices safety on the road. Damn if you do, damn if you don't. So glad for this petition.

B.4680 November 18, 2025 — des moines, IA

I find myself hating my drive to work in the morning. More and more super bright headlights blinding me every day. Not all LED setups are bad, some are tolerable. The problem I run into the most is the hillbillies in their lifted trucks with aftermarket LED headlights and fog lights. Newer Chevy and Ford trucks are also horrendously bright - especially if a lift kit has been installed. It's damned frustrating and I'm tired of seeing spots.

B.4681 November 19, 2025 — Berkeley, CA

No matter how well oncoming drivers can see with their super bright blue light LEDs, I don't think they are safer if their lights are blinding me.

B.4682 November 19, 2025 — Las Vegas, United States

It is ridiculous these new BLINDING headlights even pass inspection. I am a Senior and my kids and Grandkids complain too. So it is a hazzard for all ages!!

B.4683 November 19, 2025 — Santa Rosa, CA

I just had to have my eyes operated on last week to remove cataracts. I understand there is a growing rate of cataract surgeries as well as those who now have macular degeneration because of LED lights. My eyes have become increasingly light sensitive now because of LED lights. I have a very hard time driving at night. I have heard of truck drivers who try to drive with yellow tinted glasses to protect against the LED oncoming traffic lights, but the glasses make they drowsy. So they can't use them. Something must be done to stop such bright lights before more accidents happen and more eye surgeries are necessary.

B.4684 November 19, 2025 — St. Petersburg, FL

An industry has grown without any regulation. I witness that people buy cheaper lights to use to save money, that are totally inadequate for the task. People are using light bars which are flood lights NOT approved beams for traffic use. This needs to be regulated, we NEED YOU to make this safe please.

B.4685 November 20, 2025 — Honeoye Falls, NY

I shouldn't be having problems driving at night, but these newer led headlights are genuinely hard to tell if the high beams are even on or its just their low lights. LED headlights are way too bright and allowing people to attach light bars makes it even worse.

B.4686 November 20, 2025 — Sacramento, CA

During late fall and winter months, it's very difficult for me to drive anywhere, even nearby grocery stores.

B.4687 November 20, 2025 — St Augustin, FL

{"videoUrl":"https://stream.mux.com/Nf9u6WR5CAhqOmoWKUSL02cG00JaUawxGdzlTmdGvYgg8","cloudflareUid":"c1e44408b91564cb9f295c09efc5e5ea","muxAssetId":"9Fd021yTN502UkOFezktGMDqYqh9KG002J743X7btgpRBQ","muxPlaybackId":"Nf9u6WR5CAhqOmoWKUSL02cG00JaUawxGdzlTmdGvYgg8","muxPlaybackUrl":"https://stream.mux.com/Nf9u6WR5CAhqOmoWKUSL02cG00JaUawxGdzlTmdGvYgg8","muxThumbnailUrl":"https://image.mux.com/Nf9u6WR5CAhqOmoWKUSL02cG00JaUawxGdzlTmdGvYgg8/thumbnail.jpg"}

B.4688 November 20, 2025 — Syracuse, NY

If nothing else, not allowing blinding bright low-beam headlights would be a help.

B.4689 November 20, 2025 — Vancouver, Canada

New car's headlights are dangerously bright. Headlights are supposed to make driving at night safer not more hazardous

B.4690 November 21, 2025 — Columbia, SC

When I drive during the day or night, I have to leave the anti-glare switch on my mirror down because so many vehicles have painfully, distractingly bright lights. Many of my associates have mentioned their migraines are also exacerbated by these bright white LED lights at night. Others have mentioned to me "I realized that.. LEDs are why I hate driving at night now. I don't feel safe."

B.4691 November 21, 2025 — Stephens city, VA

I get really bad headaches and sometimes migraines when I drive at night. Lights are so bad that I often get spots in my vision because of how bright they've gotten. Please regulate these overly bright lights

B.4692 November 21, 2025 — Youngstown, OH

They keep getting brighter and brighter. There needs to be a limit. Otherwise we'll soon have headlights that start forest fires and cause permanent retina burns. If someone needs that much light, put the lights under the car, facing the ground, rather than pointing at eye level.

B.4693 November 22, 2025 — United States

I absolutely HATE bright headlights. I have blue eyes, and people with blue eyes are known to be sensitive to bright lights. It makes me beyond angry, especially when I'm being tailgated by an idiot in a huge truck and all I can see in my rear view is the grill of their truck and the blinding headlights.

B.4694 November 23, 2025 — Sanford, FL

Please ban blinding headlights and blinding street lights. So many times I have encountered drivers blinded by blidning headlights weaving on the road. I have had to pull over because of blinding headlights destroying night vision. Blidning street lights make it very difficult to see at night because they cause pupils to constrict and then right after passing them it is hard to see. Please ban these kinds of lights and make driving safe again.

B.4695 November 24, 2025 — Arroyo Grande, CA

Its dangerous, how are these not illegal?

B.4696 November 24, 2025 — Minnesota, MN

I work 6 to 11 at my job (5 Below staff member.) Coming home at night and being utterly blinded on the drive home is becoming a daily occurrence. And it needs to end. I don't feel safe on these roads.

B.4697 November 24, 2025 — Sacramento, CA

I'm a truck driver, I drive line haul night I've been complaining about this specific issue for the last seems like the last 6 or 7 years it's been escalating, seems like the new factory vehicles coming out every year were the main culprits eventually after market high performance automotive headlamp manufacturers of different brand names jumped on the band wagon flooding the shelves at all the auto part stores, online, etc. It's flat out rediculous now by the time I get off work in the morning my retina's are on fire. Those factory and after market projector headlamps should also be banned, is

going to give someone an epileptic attack the way the light changes colors and floats up and down. I notice not only the new headlamp bulbs out of control bright, but some people are now driving around with after market off road light bars mounted on their grills, I can't see a thing not even the fog line. Let's bring the bright headlamps back down to basics that's safe for everyone and keep it enforced so it stays that way, that also means no more off road light bars unless they are covered up..

B.4698 November 25, 2025 — Abingdon, VA

It is increasingly unsafe to drive at night. Super-bright LED headlights make it almost impossible to see the road in front of me, which means that it's impossible to see if there are any obstacles (animals or pedestrians) in the road. LED headlights should be banned, and the automotive industry must take accountability for the danger into which they have put everyone on the road.

B.4699 November 27, 2025 — Henrico, VA

I am fully capable of driving with having a seizure disorder, doc verified everything before allowing me to drive. I absolutely cannot drive past sunset. Ever. Even when I'm in the passenger seat I have to wear sunglasses. Let me repeat I HAVE TO WEAR SUNGLASSES AT NIGHT BECAUSE OF THESE LIGHTS. My granny and grandpa can't drive at night. My fiancé who has no ailments gets migraines after driving at night. It's awful. People have been killed, car accidents in intersections, not being able to tell how far a car is, literally just being blinded by light every time I leave the house. I'm not sure about you but if you have seizures, these lights are extremely dangerous. They have caused seizures before when I was not medicated. Please take this seriously the children with epilepsy at younger ages are more likely to die from a seizure so please for the love of God and our country, make some changes for your people. I really miss going out at night and being able to drive to pick up a $2 sonic drink, go to the ocean to hear the waves. Drive when I need to let off steam. Travel out of town to see family. All of this is no longer a possibility. It may not seem like much to some but our freedoms have been stripped from our lives. Please take this seriously- sincerely SICK OF THIS

B.4700 November 28, 2025 — East Patchogue, NY

I drive a regular car and the suvs and other higher vehicles actually blind me on the highway in both directions but are especially dangerous when they are directly behind me. ! So unsafe and hurtful. Even other regular cars going in the opposite direction on highways and streets with the Bright white lights are harmful and hurtful. So relieved someone is alleviating this dangerous problem.

B.4701 November 30, 2025 — Arlington, MA

LED lights kill.

December 2025

B.4702 December 3, 2025 — Monroe, MI

MY EYES -that one sponebob fish

B.4703 December 3, 2025 — SC, United States

These LED headlights are a constant nuisance! Something needs to be done! I get blinded from my side mirrors as well as on-coming traffic forcing me to adjust my side mirrors to the point that my mirrors become useless. The fact that these lights have not been taken care of yet after being available for so long is insane.

B.4704 December 4, 2025 — AZ, United States

LED auto headlights make driving at night dangerous and need to be banned. I've been complaining about this for years, and it seems each year it gets worse with more new cars on the road. Thank you!

B.4705 December 4, 2025 — Chapel Hill, NC

I'm a runner and walker in addition to being a driver and I'm blinded by LED headlights which most approaching drivers do not dim.

B.4706 December 4, 2025 — Stamford, CT

I have to wear sunglasses at night when I drive because modern headlights are blindingly bright. It is dangerous and intrusive. I don't even know how this happened I thought there were regulations about this sort of thing.

B.4707 December 5, 2025 — Calgary, Canada

Bright Headlights are blinding and very dangerous! No one needs these ! They are unsafe and cause accidents!

B.4708 December 7, 2025 — Concord, NC

{"videoUrl":"https://stream.mux.com/dOZIzA98muBe6UZC00NZa00z074v369EZLzjS01EVVbUTw","cloudflareUid":"598651b4e52d0af65ad1e83f2042b54c","muxAssetId":"zZn84LZ2lEgKUtoJb702ht32C28Lpse2VzhSY6FbgczM","muxPlaybackId":"dOZIzA98muBe6UZC00NZa00z074v369EZLzjS01EVVbUTw","muxPlaybackUrl":"https://stream.mux.com/dOZIzA98muBe6UZC00NZa00z074v369EZLzjS01EVVbUTw","muxThumbnailUrl":"https://image.mux.com/dOZIzA98muBe6UZC00NZa00z074v369EZLzjS01EVVbUTw/thumbnail.jpg"}

B.4709 December 8, 2025 — Hendersonville, NC

For example, tonight, for a few seconds, I Couldn't See The Road At All!!!!

B.4710 December 8, 2025 — Portland, OR

you can never see anything . always squinting to be able to see and on top of it everyone who has leds always keeps there high beams on just because they feel like it.

B.4711 December 9, 2025 — Cincinnati, OH

They are too dang bright

B.4712 December 9, 2025 — Fairbanks, AK

I live in Alaska where darkness is a thing that lasts for months and driving at night is not optional. I have been blinded countless times by overly bright headlights and "Moose Lights". There have been times that I have been forced to pull over and stop because the light that I passed was so bright that it literally blinded me and it took quite a few seconds for my vision to return enough to drive. In addition, I had spots in my vision directly after these incidents that have not gone away. Each time equals more damage and I am tired of being assaulted by lights that should not be allowed on motor vehicles.

B.4713 December 9, 2025 — Kenai, AK

I work night shifts. I have a diagnosed astigmatism and driving to work every night literally blinds me. I'm afraid to drive and the blinding headlights don't make anything better. I just want to drive safe again without the fear of crashing..

B.4714 December 9, 2025 — Marlboro, NJ

Not sure why there needs to be a petition. This issue is clearly one-sided. Standardized the darn bulb!

B.4715 December 9, 2025 — North Tonawanda, NY

Regs need to be changed, manufacturers are blatantly gaming the system to have much brighter headlights than they are supposed to, and brighter than most people can handle. It has made driving at night less safe.

B.4716 December 10, 2025 — Austin, TX

I can't see at night

B.4717 December 10, 2025 — Chatham, MA

just tired of being blinded while driving at night. It's not bad enough that the headlights are piercing but most also augment the pain by driving with the super white LED fog lights. I had to come to a dead stop recently in the road after turning the corner onto my own road as I could not see any of the sharp curve in the road ahead as a vehicle approached the intersection from the opposite direction.

B.4718 December 10, 2025 — Coal Township, PA

THESE NEW LITES ARE REALLY A BLINDING HAZARD. THEY ALSO DO NOT LIGHT THE ROADWAY THE SAME AS THE OLD HEADLIGHTS. THEY ARE REALLY A STEP BACKWARD UNLESS YOU ARE IN THE VEHICLE REPAIRE BUSNESS. THANK YOU!!!!!!!!!!!!!!!!

B.4719 December 11, 2025 — Newburgh, NY

I'm a healthy adult male without eye issues; and over the last year or two I have been blinded and dazzled nearly every time I drive at night. New model cars have low beams that are indistinguishable from bright lights on a car less than five years old. This is literally a public safety hazard.

B.4720 December 11, 2025 — Scappoose, OR

Bright headlights are impeding on my ability to travel freely. Something must be done.

B.4721 December 11, 2025 — Van Nuys, CA

I can’t drive at night without wearing dark sunglasses. Even walking with LED headlights coming toward me is disorienting and very unsafe. LED headlights are horribly engineered and flash their brights every time they go over a bump or are on an incline. This is unacceptable and must be responsibly regulated. Bright white LED headlights must be banned!

B.4722 December 12, 2025 — Columbia, SC

I Cannot see or stand driving in the evening and night because of the amount of ridiculously bright lights, I’ve had to come to a complete stop in the middle of the road and curves several times due to the blinding lights in these vehicles, if the government wants to ban something ban bright headlights! They’re a safety risk and I fear that one of these nights I won’t be able to see and I will miss a turn for the last time…even then I feel nothing would change …

B.4723 December 12, 2025 — Oregon City, OR

BRIGHT HEADLIGHTS + ASTIGMATISM =BAD

B.4724 December 13, 2025 — Olathe, KS

Extremely bright headlights from oncoming vehicles are blinding for night drivers in city and suburban streets.

B.4725 December 13, 2025 — Salinas, CA

Government officials are supposed to protect our best interests, not force bad technology down our throats for their profit by limiting choice and competition in the free market - In the name of "climate change" is not a "thing" it's just a fact of reality. focus your energies instead on cleaning up pollution in our toxic food, water, and air.

B.4726 December 14, 2025 — Bradley, IL

{"videoUrl":"https://stream.mux.com/rAPMOtWZpzhTtCf7QXWyxEiAMksmLpRXM1xk02rfD00EI","cloudflareUid":"5af6cad87b6d6d46841c91e19599a4df","muxAssetId":"UgtFPLJ2v0001xcFclZlBKx014zLDS8402JLPGzTey8NrR00","muxPlaybackId":"rAPMOtWZpzhTtCf7QXWyxEiAMksmLpRXM1xk02rfD00EI","muxPlaybackUrl":"https://stream.mux.com/rAPMOtWZpzhTtCf7QXWyxEiAMksmLpRXM1xk02rfD00EI","muxThumbnailUrl":"https://image.mux.com/rAPMOtWZpzhTtCf7QXWyxEiAMksmLpRXM1xk02rfD00EI/thumbnail.jpg"}

B.4727 December 14, 2025 — Sweetwater, TN

They are blinding!

B.4728 December 15, 2025 — Columbia, SC

While the LED headlights are quite troubling, the blue LED lights on the police cars are absolutely BLINDING. Because of their blinding effect, I have run off the road twice. Thankfully I've only driven onto grassy areas, but it could have been much worse had I been crossing a bridge, a street with sloped sides and no guard rails, or if I subsequently drove into an oncoming vehicle in an opposing lane. Please help save lives and ban ALL blinding headlights.

B.4729 December 15, 2025 — Reno, NV

I have been blinded multiple times by these headlights and basically driving blind is dangerous especially where I live and there's a lot of road construction they shouldn't be allowed to have headlights this bright

B.4730 December 16, 2025 — Bartlesville, OK

Driving at night was always my happy place. I loved watching the moths around the lights. Stargazing has always been a hobby of mine. I love the night so much. These LEDs are literally ruining the best parts of life.

B.4731 December 16, 2025 — Los Gatos, CA

headlights these days make it extremely hard to drive. in a populated city blinding headlights are always in sight when I'm driving. I can't live like this

B.4732 December 17, 2025 — Fargo, ND

LED lights blind me on the road at night, when I already have trouble seeing at night! Very dangerous, I support this cause

B.4733 December 18, 2025 — Albuquerque, NM

I have had multiple freeway and highway experiences in which the modern and unreasonably bright headlights of others have place my life and my children's lives in danger. It is excessive and ridiculous, with many modern headlights being brighter than "brights" or indistinguishable from them

B.4734 December 18, 2025 — Saint louis, MO

So they can see a bit better, everyone else is blinded. New standards need to start now.

B.4735 December 19, 2025 — Candler, NC

i am constantly being blinded by led headlights. i spent money on night driving glasses (i should not have to) to try and help. its hard to believe i have to get my vehicle inspected every year when this is more dangerous than anything on the inspection list. its more proof that its just another money racket.

B.4736 December 19, 2025 — Washington, NJ

Just less than an hour ago (~7:30PM), an oncoming car was blinding me, and it wasn't until it passed me that I noticed a kid dressed in all black walking on the shoulder. Luckily was fully in my lane, where Im supposed to be, paying attention, and driving the speed limit, so I would not have hit them either way, but it was startling to see nothing but white lights, then to just suddenly see a person just a foot away from your car walking on the shoulder. Last week a vehicle had such bright headlights, that even though they were 4 blocks away, up a hill on a straight road, their lights reached the bottom of the hill and made shadows that looked like something was moving in the middle of the road, when nothing was actually there. Just the dance of these laser beams we call headlights, shinning all the way across from the other side of town. The roads are salted now that it's winter. The blue lights illuminate the salt on the windshield, and turn it into a one-way mirror. If you are on a faster road and try to spray the salt off the windshield, the wiper fluids splash over the roof and hit the vehicle behind you. So you have to either pull over, or deal with the lack of visibility until you reach a stop light or find a moment where no one is behind you to so you can clean the salt off and try to peer through the blinding blue light of a thousand suns.

B.4737 December 20, 2025 — Apo, AE

I really can not deal with the lights. They hurt my eyes! It's a safety risk, what if I get blinded and kill some one? We need regulation

B.4738 December 20, 2025 — Brewer, ME

Ban ALL aftermarket LEDs too

B.4739 December 21, 2025 — Davis, CA

Strong lights blind you, reduce visibility for other drivers and can increase likelihood of crashes and be dangerous for pedestrians.

B.4740 December 21, 2025 — Saint Louis, MO

The ridiculously bright LED lights need to be banned. Driving at night has become extremely scary due to these lights being very blinding. There is absolutely no reason anyone needs these bright lights.

B.4741 December 22, 2025 — Bakersfield, CA

It kinda sucks tbh i cant play steal a brainrot if i die!

B.4742 December 23, 2025 — Maple Valley, WA

Most headlights are too bright and dangerous beyond the threshold of safety. It's a combination of factors such as the regular headlights are too bright or maybe they have their brights on and don't know it, or maybe they do know it or maybe they don't care or maybe they're headlights are not aimed correctly. All these different factors contribute to how dangerous and out of control this issue is on a larger scale not to mention how angry I get when I just want to drive to work in peace, but I can't!!

B.4743 December 24, 2025 — Canada

For years now I have complained about blinding LED lights. But I bought a new Mazda CX-30 so I know it's blinding others on the road. The lights are so bright other drivers think I am on brights when I am not. When you're behind a vehicle at night and their headlights are in your drivers and or passenger side mirrors it's blinding and so distracting. Why can't they create something so you can flick the mirrors down like the rear view mirror so you do not get blinded at night by vehicles behind you. Especially truck models like the Ford F150 as an example. I end up having to drive with my right arm so I can drive with my left arm in the window to block the lights on the vehicle behind me. Sure these lights are super bright which helps you see better at night but the level of brightness is insane today. I have wondered for years why I get bad headaches. Now I believe it's LED lighting. So I just ordered incandescent light bulbs to see if it makes a difference. Thank you for the opportunity to sign the petition and comment. ❤️❤️

B.4744 December 24, 2025 — Cartersville, GA

I have an astigmatism and at night I literally cannot see when trucks with bright lights pass by

B.4745 December 24, 2025 — Hollywood, FL

Since these lights have come out in the cars they have been blinding me and causing crashes for others

B.4746 December 24, 2025 — Johnson City, TN

I've been sitting here for about an hour after having to drive at night and encountering extremely bright LED headlights repeatedly. My eyes feel like I've been staring into the sun. Whenever I am forced to drive at night now, there are several moments where I just flat out can't see, because someone's headlights have completely blinded me. This is such an obvious safety issue. How is nobody on top of this yet?

B.4747 December 24, 2025 — Kansas City, KS

Im about to commit acts of vandalism against vehicles with blinding headlights. Please help prevent me from having to due this.

B.4748 December 24, 2025 — Lincolnton, NC

Due to the amount of LEDs around me I have stopped driving at night. They are blinding and dangerous.

B.4749 December 24, 2025 — Lynn Haven, FL

My wife collapses as soon as she comes through the door from driving 30 minutes at night. It gives her a severe headache. I find them painful, like being forced to stare into the sun and have to look away.

B.4750 December 24, 2025 — Newton, NH

These LED lights are detrimental to our health. What message are we sending to our children if we don't demand to stop this. While driving at night I always have to look down to the right side of the road because they blind me

B.4751 December 24, 2025 — Pell city, AL

The new head lamps make driving unbreakable. Please sign and share

B.4752 December 24, 2025 — Rochester, NY

Read my article in Forbes discussing this highly important safety concern! As a trauma physician I witness the dangers every month. Lives lost and patients injured.

B.4753 December 24, 2025 — Tucson, AZ

I can't believe with all our regulations that this ever got approved. The headlight are absolutely blinding and therefore dangerous!

B.4754 December 25, 2025 — Chipley, FL

I don't drive at night anymore due to the LEDs; they make me instantly angry having to look at them which affects my mood

B.4755 December 25, 2025 — Oklahoma City, OK

These newer blindingly bright lights cause so much stress on the eyes, giving eye pain to headaches along with making it near impossible to see. Let us not forget light pollution disrupting nature and causing more animal deaths on the road

B.4756 December 25, 2025 — Zanesville, OH

Please ban LED headlights. They cause me to have visual impairment when approaching oncoming traffic that have the LED headlights.

B.4757 December 26, 2025 — Hamburg, NY

Alarmed at what I'm learning about LED'S, other man-made lighting. Vehicle headlights are a disaster! Struggle terribly with them on the road.

B.4758 December 26, 2025 — Hillsboro, OR

From the onset of the LED explosion, I have been adversely affected by them. Painful to my eyes, headaches, dizziness, sleep interruption etc. For the most part, people who know me suspect I am being a bit of a hypochondriac. It is especially challenging at night when headlights are so painful, I have a difficult time even looking at the oncoming car. It is dangerous and unnecessary to have LEDheadlamps, and I suspect there are many more people who feel the same way but just grin and bear it. Please ban these unnecessary lights in vehicles or at the least, tone them down.

B.4759 December 26, 2025 — Troy, OH

It's unfortunate but not surprising anymore that our Government is not helping us. Most people, especial those in authority, just don't care about… well, much of anything anymore, including life. Sad. When driving against bright headlights I have no choice but to do what I have to do to physically see and drive safely. If they have the right to drive with bright headlights then so do I, so I have to turn on my high beams to see. This also has the side effect of letting them know their headlights are too bright. Spread the word.

B.4760 December 27, 2025 — Seminole, FL

For quite some time now my eyes have cringed at the sight of these led headlights. In the beginning, I thought the other drivers had their bright lights on! I am thrilled that this petition is in existence now. The brightness is so intense at night that my vision becomes greatly reduced. It scares and concerns me for my safety. I do not have a good feeling about these type of headlights. Thank-you for all your efforts to help save lives.

B.4761 December 27, 2025 — Shelby township, MI

The LED headlights are blinding with glare that I can not while driving, and the daytime lights make it difficult to see and focus on pedestrians and other traffic while driving. The LED lights caused me to experience and suffer from Ocular Migraines, now three times per week and more. These LED lights are dangerous causing visual impairment and distraction, and blinding bright lights with glare that is blinding, that causes accidents and catastrophic accidents.

B.4762 December 28, 2025 — Auburn, WA

Blinding LED headlights have often caused me migraines. They are unsafe and impairing to other drivers. How can this be legal??????

B.4763 December 28, 2025 — Jackson, WY

I'm in my 30's with better than perfect vision and can not drive at night due to the blinding oncoming headlights. Being near any kind of emergency vehicle is doubly dangerous as their blinding and flashing lights obscure the road, other vehicles, and being able to see anything for a while after passing them.

B.4764 December 28, 2025 — Lancaster, NH

I keep saying why do people need to see up a raccoons a_ _ a mile away. They are blinding me. When someone goes by me at night with LED lights I am blinded. It is not a good feeling when you are wondering if you are still in your lane because you can't see anything other than extremely bright lights. They need to be banned. i never had problems driving and still don't with regular lights they don't bother me but the LEDS are horrible. Please get rid of them.

B.4765 December 28, 2025 — Laredo, TX

LED Headlights are a danger to people with astigmatism, and not only that but can also limit how much of the road you can see which can cause accidents. Please ban these.

B.4766 December 29, 2025 — Danbury, CT

Do the right thing by your constituents. Help us to be healthy and not blinded at night by these lights. Do the right thing!!

B.4767 December 29, 2025 — Kohler, WI

Something needs to be done about this issue. It has only been getting worse over the years. There are also people now replacing more of their old headlights with these LEDs with out purchasing and replacing the reflectors; without replacing those they actually turn out to be worse than the headlights on these new vehicles that are just as bad or worse. Need to get recalls out on these newer vehicles. Own a car that is almost not possible to drive at night due to this issue. Have almost been in an accident every week being on second shift due to this issue. It is now getting so bad with these newer vehicles to the point we are even having issues driving a fullsize truck at night which has never happened to us in our 15 years of driving. The brights are also an issue as well cause of people not being able to shut them off while driving past you or passing. Please do something about this already. It really is out of hand.

B.4768 December 29, 2025 — MOUNTAIN HOUSE, CA

Whether its someone coming towards you, or someone right behind you, they still blind you and are a nuisance to everyone.

B.4769 December 29, 2025 — San Jose, CA

i find the bright lights unacceptable & have to divert my eyes which can be very dangerous. and to add to the problem too many drive with their brights on when not necessary

B.4770 December 30, 2025 — Flower Mound, TX

I cannot tell if people's brights are on or if it's their headlights. i am 26 and have perfect vision yet go blind every night i drive after sundown.

B.4771 December 30, 2025 — Leander, TX

Due to the BLINDING headlights of a truck, I almost hit a pedestrian who was wearing a reflective vest. The headlights if the truck were so bright, that the light canceled out the reflective tape on the pedestrians vest. BAN THESE BLINDING HEADLIGHTS.

B.4772 December 30, 2025 — NJ, United States

So sick of almost getting into accidents at nighttime because of these. Why is something like that now just a casual thing??

B.4773 December 31, 2025 — Boston, VA

{"videoUrl":"https://stream.mux.com/LoLoX56x2019HOYVSV4ePVg00FZ79p02RKrTxFL1bYWQMU","cloudflareUid":"0c4d7524ff3b176f6f2b24e6b9a7b82f","muxAssetId":"BwemoPpifJB4bD82BcR5ugDCZEuxfNo9IJmtDdS300A00","muxPlaybackId":"LoLoX56x2019HOYVSV4ePVg00FZ79p02RKrTxFL1bYWQMU","muxPlaybackUrl":"https://stream.mux.com/LoLoX56x2019HOYVSV4ePVg00FZ79p02RKrTxFL1bYWQMU","muxThumbnailUrl":"https://image.mux.com/LoLoX56x2019HOYVSV4ePVg00FZ79p02RKrTxFL1bYWQMU/thumbnail.jpg"}

B.4774 December 31, 2025 — Brooklyn, NY

This is a major issue in safe driving for all ages.

B.4775 December 31, 2025 — Warrenton, VA

i can barely see anything i always think people have there high beams on and it's even worse for my gf she needs glasses and can see very well and these lights or worse reflecting off her glasses. they need to change these type of lights they have on new cars and make it illegal for people to change there lights as well

Comments left in 2026

January 2026

B.4776 January 1, 2026 — Boston, MA

Are LED manufacturers trying to destroy my country, or pushing the slightly less nefarious agenda of stimulating auto-wreck insurance companies and Lens Crafters? It's unbelievable how so many people keep wanting to go back down an old, broken road. - Nych Hansen

B.4777 January 1, 2026 — Danville, VA

These lights are extremely blinding and have been the specific cause of several near accidents by a friend when I was a passenger. They should be outlawed outright. Period. Jerk drivers nowadays don't bother to dim them either. They should also force manufacturers to put all of them at the same height from the road, most especially those huge pickups that jerks drive to make themselves proud and better than everyone else, that have billion candlepower headlights blasting in your rear view mirrors that blinds everything, the road, your dashboard, your windshield, the interior of your car, as well as in the front of your face. Respectfully submitted, except for the jerk idiots who don't dim their lights even when the low lights are too bright to start with. Spencer D. James Danville, VA

B.4778 January 1, 2026 — Minneapolis, MN

Digital light (led) and sound are unhealthy. I have been reffering to it as fake light and sound for years now. Get ahold of robert f kennedy and have him include this in his MAHA research

B.4779 January 1, 2026 — Republic, WA

I have been adverse to light of any kind at night to sleep since I can remember. I covered windows with new garbage bags, place towels and wash cloths to cover or stuff into places light was escaping. Then came LED lights. I got ahold of a roll of my husband's electrical tape and put little bits of it over anything LED. An LED light might be tiny, but to me it is like a laser light going through my eyelids. I was a young grandma, about 10 years ago, when I had to go to an eye specialist for a potential problem. I didn't have a problem, but I found out I have a genetic disorder called ocular albinism. I

have no melanin in my eyes that create color to my iris. I have nothing to filter the amount of light that gets in my eyes. I wear very dark sunglasses. I can see like a cat at night. Until this diagnosis my husband thought for 35 years I might have a mental disorder I'm so consumed with LED lights at night; also wherever we travel. When bright blue LED headlights come at me at night I almost panic because the light is so overwhelming bright. When the oncoming driver forgets to take them off high beam , I have to glance away from them because the light is staggering. If LED is so disruptive to so many of us, why is this argument being fought so fiercely? Tonight we heard Mark Baker for the first time. What a relief to hear others have this problem……I am not alone.

B.4780 January 2, 2026 — Cataula, GA

I have always lived in rural areas and have driven thousands of miles during my life. I also have a very good driving record. I thought it was an eye issue with the brightness of headlights at night but after having eye exams found it was not my eyes but the new LED lights being used in cars and trucks. It has created a dangerous hazard for drivers meeting oncoming vehicles! The agency that regulates this should change the old specifications immediately!

B.4781 January 2, 2026 — Rio Rancho, NM

I have almost entirely stopped driving at night because of the danger and discomfort caused by overly bright headlamps, both in front and behind me.

B.4782 January 2, 2026 — Sarasota, FL

Both the headlights on automobiles and the outside overhead lights are damaging my eyes. I'm unable to drive at night with the blinding on-coming car lights. Many times, I have to close my eyes due to the pain which is a hazard to both me and other drivers.

B.4783 January 2, 2026 — Seattle, WA

There is clearly enough evidence on the link between blinding headlights and accidents (including fatalities) to NECESSITATE regulatory action on this. Please get on it.

B.4784 January 2, 2026 — Washington, DC

Because LED headlights are so bright and glaring, I can no longer attempt to drive at night on highways. They have become a serious safety hazard. The headlights on the ridiculously large pickup trucks and SUVs are equivalent to spotlights shining directly into drivers eyes.

B.4785 January 3, 2026 — Brooklyn, NY

i have pretty bad astigmatism, and blinding headlights make it nearly impossible to drive at night. the smeared lines from usual traffic lights and headlights are already bad enough—i and others like myself don't need more issues. it's dangerous and severely reduces visibility. i can't believe it's legal.

B.4786 January 3, 2026 — Deer Island, OR

Over the past two years, I have noticed a dramatic increase in the use of painfully-bright headlights. As a result, I avoid nighttime driving at all costs, for these lights make it SO difficult -- impossible, sometimes -- to see the road in front of me. Even a short drive after sunset leaves me with terrible eye pain and a headache. In addition, when these headlights are shining into my car from behind, especially when I'm on the freeway, I cannot change lanes, as the surrounding brightness is blinding. Adjusting my mirrors can help in some situations, but when multiple vehicles are lighting everything up to an unsafe degree, I'm stuck until they pass. Many people are, I believe, using their headlights to bully others, particularly when they're tailgating. (Ironically, doing so often prevents drivers from moving over for them.) With the growing use of blinding headlights, I've also noticed that more people are choosing to drive with their high-beams on. Not that many years ago, the majority of drivers were relatively courteous; now, I can't say the same. These headlights need to be banned.

B.4787 January 3, 2026 — Franklin, TN

Delivery driver. Over the course of the last couple of years the vision damage has been noticeable. Despite the degradation of my eyesight, the brightness and absurdity of these modern headlights has only gotten worse. It's destroying vision and lives.

B.4788 January 3, 2026 — Lake City, PA

Car headlights are too bright now. We need regulation to help people for safety sake. Bring back inspection that checks alignments.

B.4789 January 3, 2026 — Parry Sound, Canada

Some drivers are using them as a weapon. Bullies strobing high beams from behind to intimidate a driving going the speed limit.

B.4790 January 3, 2026 — Wailuku, HI

I had cataract surgery in hopes of minimizing the glare made from the blinding headlights, esp. from trucks. Somewhat helpful but still blinding and unsafe.

B.4791 January 4, 2026 — Portland, OR

Whether the headlights are too bright or they are aimed too high, they are a serious issue. When driving I sometimes can't see anything but headlights. Everything else is black in contrast to the lights. It is more than difficult to have multitudes of drivers trying to drive safely in this situation, it is extremely dangerous. In addition the bright lights cause eye strain, headaches, and migraines that make it hazardous or impossible for some people to drive.

B.4792 January 4, 2026 — San Francisco, CA

Head lights keep getting brighter and brighter. I understand the safety the government and insurance companies thinks this is.....but is it really? And is the moth effect (looking at the right of the shoulder actually safer?) . I think not. Yellow tinted glasses also dont work for everyone. Keeping a clean windshield in the rain with glare is utterly impossible. Not all roads have freshly painted lines on the right side. Its ALOT of up keep for counties. I was driving a road last night actually, it was raining, my windshield wipers were just about on high. A truck (new very nice Ford F-150) was driving towards me. My line to follow (as AAA recommends) on my right side was barely visible in rain and the dark and up keep is minimal on maintenance of those lines. The trucks lights were so bright (just his regular driving lights) that I was blinded then saw stars for the next few seconds (almost blinded). My choices, slow down, stop, or keep driving praying I didnt go into the ditch on this county rural road continue on while seeing stars in my vision. How is that safer? How does that take lowering accidents at night down? Not all Americans can afford nice new cars. Some (alot of americans in this economy) cannot. On a multiple lane freeway/ highway with a huge median in between on coming traffic its fine. But how is this safer for the under dog who drives a car more then 10years old because thats what they can afford? Rural driving without street lights and its pitch black? Yeah safer for the other guy, definitely not safer for my and my family. Car manufacturers need to stop. I personally have stopped as much as possible driving at night, but on the off chance I HAVE to drive after dark and am truly blinded by these lights i am putting myself and my family at even more higher risk, how is that safer? What happens if I do drive off the road because the lights temporarily blinded me? Is the insurance company going to say its my fault? Put into laws each state and county needs to keep fresh reflector lights mandatory, bigger higher up trucks should NOT have these bright lights and manufacturers need to dim higher up vehicles. Isnt this what your actual high beams are for? . Please stop! This is NOT safer. You are creating more problems then actual solutions. Create a solution that benefits everyone on the road!

B.4793 January 4, 2026 — Seattle, WA

Those super bright headlights in the opposite lane hurt my eyes every time. I can't see the road ahead of me with that thing blinding me on the left. One of these days, it'll make me crash, and (if I live) I'll never be able to prove why or recover damages from the driver who really caused the crash by using those dangerous accessories

B.4794 January 4, 2026 — Williamsburg, VA

Wear glasses and have a stigmatism. It's already hard enough driving at night without being completely blinded. Every single time one of these drivers are driving the opposite direction I fully cannot see, and have to drive based on instinct and faith when they are driving past me.

B.4795 January 5, 2026 — Carmel, NY

As the population ages, this issue becomes much more important. While there are laws on the books regarding headlight strength, it seems that they are never enforced. PLEASE update the laws to include current technology.

B.4796 January 7, 2026 — Broomfield, CO

I haven’t heard a single person mention these bright lights with positivity. It needs to stop!

B.4797 January 7, 2026 — Commerce, MI

C'mon, we're not asking for solutions to world peace or agreement on climate action. This is the sort of problem that our federal representatives and organizations should be able to address in a manner amenable to the manufacturers and improve safety for all of us. I guess that sort of lack of action is one of the many reasons why we generally have such low opinions of our governing representatives.

B.4798 January 7, 2026 — Denver, CO

I am tired, mad due to BLINDING headlights out there! Hope somehow sense prevails and this menace goes away

B.4799 January 7, 2026 — Hansville, WA

I carry a piece of cardboard to hold up and block my view of oncoming traffic. I wear sunglasses at night. I turn my mirrors so I can't see behind me (just switching to night mode is not sufficient when a truck rides my tail with its high beams on). All these actions are dangerous to me and those around me - but not as dangerous as being completely blinded. It doesn't help that many drivers habitually leave their high beams on and hope they will automatically dim for an oncoming car. That technology rarely works properly. Modern headlights are a threat to everyone's safety.

B.4800 January 7, 2026 — Portland, OR

We often get angry with government for not addressing the big issues in life in meaningful enough ways but both the government and the people often forget that there are many smaller, solvable immediately solvable problems that will raise everyone's quality of life. This is one of those. The headlights are out of control, and they make car travel dangerous for drivers and pedestrians.

B.4801 January 7, 2026 — Prosper, TX

it is ridiculous that this hasn't been addressed already

B.4802 January 7, 2026 — Silver Spring, MD

The headlights are too bright. Me, my spouse, and my three young adult children all struggle with the very bright lights vehicles are using. We are all concerned we could get into accidents because the lights are blinding.

B.4803 January 7, 2026 — United States

Matrix headlights are a solution that can completely solve this issue and it and Audi has proven it in the EU with the R8 LMX along with other manufacturers. These brighter headlights offer beam shaping so oncoming cars don't get blinded, but the road head remains we lit for the driver. It's high time the US updated its lighting regulations not only stop drivers from being blinded on the road, but to allow the new Matrix headlights here as well so we all can enjoy well lit roads and a safe driving experience

B.4804 January 7, 2026 — Valparaiso, IN

I just don't understand why this problem has persisted for so long. So many measures taken to promote road safety but yet the blinding lights are allowed.

B.4805 January 7, 2026 — Winchester, OH

The LED headlights are blinding, potentially causing accidents, especially on rural roads. Senior citizens are especially vulnerable who may have any stage of cataracts. Ban the LED headlights!

B.4806 January 8, 2026 — Airdrie, Canada

Our vision is washed out on the roads and everyone is in danger. Everyone being able to "see more" does not mean adding brighter lights. Driving at night is now a real danger to both drivers and pedestrians. It has to change.

B.4807 January 8, 2026 — Alpharetta, GA

LED headlights have almost caused me to run off curvy sideroads several times due to blinding. When shining in my sideview mirror, I am unable to see traffic coming, and therefore cannot merge into the adjacent lane safely. They are extremely dangerous.

B.4808 January 8, 2026 — Blackwood, NJ

As someone who suffers from photosensitive migraines (caused by bright/flashy lights) I wish we could do something to reduce headlight blindingness.

B.4809 January 8, 2026 — Brooklyn, NY

I am sick and tired of these mf headlights on these mf roads

B.4810 January 8, 2026 — Elba, AL

Being blinded has nearly caused me to run off the road or into other drivers. Wearing glare-cutting shades helps only a little. I've done all I can do short of just not driving after dark.

B.4811 January 8, 2026 — Evansville, IN

I find these 5000 plus lumens headlights coming at me to be blinding. Add to that is the "lifted" pickup truck following me throwing their 5000 lumens directly onto my mirrors, which then aim it directly into my eyes. All this brightness is totally unnecessary to see the road and surrounding area at night. All it does is cause my pupils to contract causing night blindness. I am forced to look away and toward a darker area.This means that I could miss seeing the child step into the road in front of me, or, i don't see the car in front of mt braking. These lights should be regulated and/or banned. At first it was just the aftermarket lights that a few vehicles had. Now, it is a problem with most automakers. Please do something to make our roadways safe again.

B.4812 January 8, 2026 — FELTON, DE

I have gotten to a point where I just don't go our at night to drive because of these headlights. They are blinding...to the point where I can't see the road for seconds after the car passes. AND, all the clowns with the LED light bars and extra lights I just pull off the side of the road if possible to let them pass. I don't know what idiot thought this would be a good idea but they are dangerous. We live in the country, so those back roads have no shoulder on which to pull off. So, as I was taught when I was starting to drive, I try to look off to the shoulder to stay on the road. This is dangerous, the lights are creating a dangerous situations on the roads. I am glad they drivers can see the flea on the but of a dog in the next state, but I can't see the next 10 feet. Please make them change.

B.4813 January 8, 2026 — Lake Stevens, WA

sad that this issue hasn't been addressed by the government already and we need to do stuff like this

B.4814 January 8, 2026 — Lincoln Park, MI

Those bright headlights hurt my eyes while driving even during the daytime. These lights should be banned because I feel that some drivers purposely installed them because they get a kick out of blinding people and Semi trucks are the worse and these lights pose a danger to society. I pray to God they're banned! Thank you for this petition.

B.4815 January 8, 2026 — Marshalltown, IA

It is extremely frustrating and a bit dangerous when faced with oncoming vehicles that have extremely bright headlights, even when on low beam. Also many vehicles are so tall that the headlamps are placed higher up on the front end making the situation worse.

B.4816 January 8, 2026 — Mountain View, CA

Lamp intensity emission and lighting brightness (where it can dazzle other road users) should be limited. The regulation needs to consider older road users (a 60 year old needs 3x the light compared

to a 20 year old to see at night). The regulation should balance headlamp brightness (more light is safer) and night vision of other road users. The regulation should also consider dazzling and eye damage of children and pets, and scenarios where headlamps are not aligned (e.g. a vehicle cresting a hill).

B.4817 January 8, 2026 — Oklahoma City, OK

I avoid driving at night if possible because of the blinding effects of oncoming traffic. While oncoming traffic passes me, I have no choice but to go straight and hope nothing is in front of me. This never used to be the case. Large and tall vehicles like trucks are especially egregious. If behind me, they illuminate the interior of my car (VW Golf) as well as the interior lights. We need new regulations limiting GLARE, not just total light output. The glare from LEDs is far higher than traditional lighting sources. There are several methods/equations for measuring/calculating glare. Pick one, and use it. Thank you.

B.4818 January 8, 2026 — Palm Beach Gardens, FL

Driving at night has become a serious hazard due to the blinding bright lights on newer vehicles. The glare turns the road blazing WHITE making it impossible to see. The bright lights literally hurt my eyes, causing me to look away with intense anxiety and terror. I avoid driving at night as as much as as possible.!!

B.4819 January 8, 2026 — Plano, IL

I drive 630 miles at night 5 nights a week. The high beams left on even drivers with halogen bulds needs to be addressed. Addressing a color limit, like 5000k maximum and a required aiming check with enforcement of dimming high beams would help greatly.

B.4820 January 8, 2026 — San Antonio, TX

Modern headlights are way too bright, they blind my view and are a major distraction.

B.4821 January 8, 2026 — Topeka, KS

I can't believe we have to sign a petition in order to force common sense regulations regarding headlights. This should simply be a function of regulatory agencies that should operate on maximizing safety for motorists.

B.4822 January 8, 2026 — United States

been waiting FOREVER for someone to pipe up about this! Thank you to the authors of this petition.

B.4823 January 8, 2026 — Wichita, KS

LED Headlights are terrible!!!!! It makes me dread driving at night

B.4824 January 8, 2026 — Woodland, CA

STOP THE LED HEADLIGHT MENACE! I can't begin to tell you how many times I've almost driven off the road or into oncoming traffic due to getting blinded by the LED headlights of oncoming traffic. Please, please ban them.

B.4825 January 9, 2026 — Las Cruces, NM

Driving at night is already dangerous and adding the too bright LED lights has made it increasingly hazardous. It's not hard to understand human eyes are not meant for bright white light, we need an amber shift. It will make it safe. do something right and make the changes.

B.4826 January 9, 2026 — Mound, MN

I must drive at night 4 days a week. It has become increasingly difficult in the past couple of years to see the road and anything in my driving path due to extreme brightness of oncoming headlights. I believe it is due to high beam and auto dimmers that do not work effectively. The LED lamps and dual or triple beam lamps are reasonably bright when on low beam but are blinding on high beam. The auto dimmers do not work until they read incoming direct light and it is often way too late to correct the blindness. Further, it is obvious the technology is flawed because you can watch an approaching vehicle roll over bumps and rises in the pavement as the headlamps flicker on and off from low to high. When a vehicle is behind you the same occurs. As the vehicle with high beams on rolls over

uneven roadway the auto dimmers do not read the light ahead when they are pointed upward or downward and the lights alternate from high to low as there is no direct light to the sensors. The same situation occurs when the vehicle is rounding a curve. Drivers are immediately blinded by the oncoming vehicle because the auto dimmers do not sense the oncoming vehicle until it is too late. Additionally, you can recognize the same issue in the daylight because the headlamps come on automatically when the ignition is on and the lamps usually (not always) run on low beam because the sense the incoming daylight. I have noticed many newer vehicles with multi beam LED's that do not drive with the auto dim engaged or with only low beam on and there is no problem with excessive brightness, so, this has to be a technology issue with the auto mfgrs and the headlamp mfgrs. I am constantly blinded by oncoming vehicles and don't know how to react. If there is a pedestrian near, I would not see them. I can't see the lane markers or anythin ahead of me. I have a new windshield so, it isn't haze on my glass causing this. I have expressed this concern to others who laugh and say I'm gettin old and it's my perception. Then what about the other vehicles that don't project such intense brightness? I am very concerned. We must insist on better regulation of this area of auto technology for everyones safety. DG in MN

B.4827 January 9, 2026 — San Jose, CA

It's not just how bright the headlights are; the spectrum emitted also matters. White light has too much energy in the bluer end of the spectrum, which impairs vision at night more than the redder end of the spectrum. Any change considered by our government should be informed by science.

B.4828 January 9, 2026 — Savannah, MO

Newly replaced LED lighting at my work office is giving me headaches and eye fatigue. I can't stand it and it is even affecting my moods and outlook on life in general, I can truly see a health difference in how I feel and act every day. The LED vehicle headlights are horrible to see oncoming as I drive. I couldn't count the amount of oncoming drivers that I've flashed my lights at thinking they were on bright but in turn, I get their already too bright lights flashed back at me, even blinding me more! The worst thing is the "home mechanics" that replace their own headlights with LED bulbs and have no clue how to aim the headlight housing to make sure it's not shining in everyone's eyes! It's out of control.

B.4829 January 9, 2026 — Scottsdale, AZ

I think these LED ALIGHTS ARE DANGEROUS ON THE CARS AND AROUND ROADWAYS. My first reaction is to close my eyes when the LaeD headlights come

B.4830 January 9, 2026 — Scottsdale, AZ

I think the LED lights are dangerous on cars, streetlights and around roadways. My first reaction is to close my eyes to protect them from these lights but I need to keep them open while driving. These lights hurt the eyes.

B.4831 January 9, 2026 — WESTBURY, NY

I thought I was alone about this issue

B.4832 January 10, 2026 — Tampa, FL

Driving at night is dangerous enough without this cascading problem. also , many vehicles that are raised do not re-adjust headlight aim. I believe this needs to be top priority for national highway safety. It could save thousands of lives yearly.

B.4833 January 11, 2026 — Fishers, IN

I'm tired of being blinded by a lot of newer cars on the road. It's so dangerous for other drivers and completely unnecessary.

B.4834 January 11, 2026 — Norman, OK

We need to go back to halogen headlights as LED's have TOOOO MUCH BLUE in them, even the so-called 'WARM-2700k" LED's

B.4835 January 11, 2026 — Wichita, KS

Just fix this stupid, dangerous problem already.

B.4836 January 12, 2026 — Bethlehem, PA

Driving at night has become distressing because I'm half blind when cars approach me

B.4837 January 12, 2026 — Cincinnati, OH

Something needs to be done about the bright head lights. I see more people just using their high beams because they are tired of the bright lights in their face.

B.4838 January 12, 2026 — Marinette, WI

As someone who has to drive around during nighttime, I frequently have to hold my hand in front of my face to keep from being completely blinded by these horrible headlights. I feel as though I need to wear sunglasses at night just because of this. There is no need for everybody to be driving around with the equivalent of highbeams on at all times.

B.4839 January 12, 2026 — Temecula, CA

LED lights are the #1 threat to every single human life driving on our streets, using crosswalks, cycling in bike lanes. Not only is the driver, but every man, woman, and child they carry - faces the serious threat to their lives (quite likely on a daily basis)! Because the pending tragedies are so blatantly obvious, yet ignored - it's not spurious to conclude - the NHTSA, Auto Industry, Insurance Industry, Health and Safety Professional Societies and on, and on, and on are utterly useless on this issue - Where are their voices? Yes, I've experienced the blinding, incapacitating effects just as the many testimonials from fellow posters, here. The ONLY SOLUTION is IMMEDIATE RECALL of these products. do it that - now, before another life is lost.

B.4840 January 13, 2026 — United States

https://www.cnet.com/health/personal-care/tip-for-driving-safer-at-night-for-any-driver/

B.4841 January 14, 2026 — Brighton, CO

I agree with the blinding head light issues. We need a band on houses that have all very bright lights on their houses too. Talk about light pollution & very inconsiderate people.

B.4842 January 15, 2026 — Altoona, PA

These bright lights are so dangerous for other drivers at night. It's gotten so bad. I get completely blinded. Imagine people with an astigmatism, glasses don't really help with that. I cannot express how terribly dangerous they are.

B.4843 January 15, 2026 — Frederick, MD

These lights make it nearly impossible for me to drive at night. The lights are piercing and it takes my eyes seconds to adjust. They are not good for us.

B.4844 January 15, 2026 — Silver Spring, MD

LED headlights are blinding, like everyone is driving with their brights on. They are unsafe for oncoming vehicles.

B.4845 January 16, 2026 — Camas, WA

I'm a newer driver I hate driving at night because I can't see because of these cars it's not just annoying it's dangerous

B.4846 January 17, 2026 — Carbondale, CO

Often times I'll flash my lights at someone driving towards me to let them know they're blinding opposing traffic with their brights on- only to discover a moment later as they flash me back with an even more blinding, unholy light that they weren't driving with their brights on at all, that's just how bright their headlights are normally. This is madness! I'm sure they're glad that they can see as clearly in the dark as they can during the day, but I and so many others driving opposite to them are about to fly off the road!

B.4847 January 17, 2026 — Linden, IN

I can't see with these lights in front of behind I've almost crashed from this and it worsens my chronic migraines

B.4848 January 18, 2026 — Ft. Lupton, CO

The LED headlights are especially annoying for people like me who have to wear special glasses. The bright lights actually hurt my eys. Then it takes a few seconds for my eyes to readjust to the darker conditions of the road. This can't be safe!

B.4849 January 18, 2026 — Plain Dealing, LA

My Wife and I live in a rural area. We both have stigmatism and myopia. The blinding white lights from modern vehicles make it incredibly difficult to see the incoming traffic, and pedestrians and animals on the side of the road. I can otherwise see normally with older vehicles approaching. I would really like to see modern headlights dimmed for the safety of everyone in the road.

B.4850 January 18, 2026 — Rock hill, SC

I was blinded by someones LED headlights on a rural road (wazhaw Hwy) this last Autumn doing 55MPH and the result for my car and the buck was not pretty. I never saw the deer, just blinding headlights and this has been getting worse and worse every year where lights get brighter and brighter and I started to look into the lack of regulations by the NHTSA that has allowed this to get out of hand where as the mentality has now fixed at "As long as I can see every crack in the road, screw every one else." If you are driving any regular car, trucks and tall SUV are the worst. I get it, I have a truck but it's not what I am driving most the time. The hilly rural roads out here without any street lights make it a much more challenging scenario. My night vision is very strong but when you are blinded intermittently repeatedly, no matter your clear vision, it is extremely dangerous. I started to reserach into this more to see if others are having the same issue and found this petition among other things. Must start somewhere.

B.4851 January 18, 2026 — Salt Lake City, UT

The bright white leds are blinding, can we regulate them or add braille to the roads? :D

B.4852 January 18, 2026 — State College, PA

I am increasingly blinded by oncoming cars and oversized pickup trucks especially when it's raining. These Tesla , Honda, Nissan, Mitsubishi, etc. cars with their LED light strips all have horizon projection cutoff lines at just about the eyelevel of oncoming traffic which means if they are approaching me coming even slightly uphill I am seeing the high beam intensity of every one of them. These cars also in many cases have side projection which keeps the blinding light in your eyes right up to the point of passing them. The pickup trucks headlights are literally at or above your eye level and I'm driving a mid-sized SUV, not a small economy car. Finally we have the fools with the "colored LED replacement bulbs" for older halogen socket mount headlights. Those headlight assemblies were designed for a bulb with a single small 1/8" point source of light to be focused by a back reflector and projector lenses to the road surface. These designs do not work with these LED replacements because they have LED elements along a 5/8" length around a 1/2" tube turning those headlights into a brilliant glowing orb splaying light everywhere except the road surface. What happened to the National Highway Traffic Safety Administration (NHTSA), which is supposed to issue Federal Motor Vehicle Safety Standards (FMVSS) overseeing new vehicle / product development adherence to established safety standards?

B.4853 January 19, 2026 — Sacramento, CA

I almost get in accidents about 2 times a week from blinding headlights that keep me from seeing road reflectors. I assumed that more people were driving with their brights on, but have realized this is a horrible new headlight design. They try to angle them down, but roads angle the entire cars' bodies to where they blind me anyway, not to mention the simple, obvious fact that vehicles come in different heights. Get these blinding lights off the road, they decrease visibility for literally everyone blinded by them. I've tripped as a pedestrian because they are so blinding too.

B.4854 January 20, 2026 — Burlington, NC

My drive home at night is always terrifying and painful due to headlights. It baffles me how these things are legal. They're far brighter than "brights" were when I first started driving, and it used to be a big deal if people forgot to turn off their brights when passing others. Now nearly every car that passes me blinds me, and I very often have a migraine before I'm halfway home.

B.4855 January 20, 2026 — Washington, DC

I see, read and drive perfectly during the daytime. But I have mild (so far) but newly forming cataracts. The brilliant starbursts from LED lights of on-coming vehicles in the immediate opposing lane are utterly disabling. The road immediately in front of me is utterly erased. The feeling of being aggressively attacked by these lights is utterly demoralizing.

B.4856 January 22, 2026 — Portland, OR

These lights are incredibly bright and dangerous. I have been blinded by them from cars both driving towards me as well as in my rear-view mirror. I really wish they were illegal on public roads.

B.4857 January 26, 2026 — Portland, OR

These headlights are incredibly dangerous. There are several days/week that I am blinded enough by the bright LED headlights that I can't see the road in front of me and my eyes are irritated afterward. I believe the intention was to improve visibility for the driver but what good does that do if we are all blinding each other?

B.4858 January 27, 2026 — Bonney Lake, WA

Blinding headlights are one of the reasons why I don't want to drive.

B.4859 January 30, 2026 — Platte City, United States

LED lighting in general is disruptive to vision and circadian rhythms, and nighttime LED lighting and headlights are even worse. I've been driving and had them overwhelm my vision completely and create safety issues. Maybe 10 or more seconds where my vision is effectively useless on the road. My eyes never really adjust to the night anymore because of these lights.

B.4860 January 30, 2026 — Wichita Falls, TX

I have been driving for 10 years. The first five years were alright, but from 2020-2025 the blinding lights are gonna kill me! I cannot even see my place in my lane when they pass me on a 2 way highway 65mph. Its terrifying to just pray and hope my steering stays straight and I don't head-on into them. Its like pointing lasers into our eyes. Glad they can see better, but I guess good luck to the rest of us.

B.4861 January 31, 2026 — United States

https://www.cnet.com/health/personal-care/tips-safe-driver-night/

February 2026

B.4862 February 1, 2026 — Portland, OR

I'm a 30-something, able-bodied person who still is regularly blinded by headlights when driving in the dark. If it feels dangerous for me to drive in the dark, I can only imagine what older adults and those with disabilities are feeling. It's time for regulations to catch up with the new technology, and for car manufacturers to take accountability for the products they are selling to consumers. I support using sustainable lights such as LEDs, but urge regulators to perform more research on how to safely install them in vehicles - both in brightness and in height - so they can be safe for other drivers.

B.4863 February 2, 2026 — Austin, TX

I have a 2010 sedan, and the led lights on these SUVS routinely blinds and distracts me! They might as well be using their brights! There is no need for this amount of light in all cases I have seen; it is solving a problem that does not exist.

B.4864 February 3, 2026 — Springfield, MO

Auto companies have been getting away with taking the ultra-bright high beams of yesteryear, and installing them in place of [what should be] regular, low-beam headlights. Fast-forward about 10 years, and virtually all new vehicles and about 85% of vehicles on the road are now operating with this new "technology"...that is to say, with their brights essentially just turned on at night all the time. How this has been phased-in and silently accepted by "most people", I have no idea. It's just good to know that there are hundreds of thousands of people who are finally becoming sick and fed up with it. I'm done having to shield my own eyes at night because of these things. LED lights have their place...but definitely not in the headlights of vehicles.

B.4865 February 4, 2026 — Framingham, MA

I am a Ride Share driver so I drive at night mostly. I have complained to my eye doctor asking for glasses to help with this because it has become a major problem for me. I was told there is nothing I can do about that specific glare and she gets constant complaints regarding the issue. I cannot count the number of times I have been driving a passenger that the lights have blinded me for at least 10 seconds having trouble seeing while driving not being able to see the road or what is front of me. I would say this is a major issue just as major as cell phone use. It only takes a couple of seconds with your eyes not on the road to hit something or someone, and it's a shame that lawmakers are ignoring this problem but have signs up and pull people over for cell phones it's the same problem but worse because I choose not to use my cell phone for safety reasons, but I can't do anything about other people's headlights only the law maker's can please take this seriously. The glare is so bad that it literally seems like a person is high beaming you or flashing their lights going over bumps very dangerous.

B.4866 February 9, 2026 — Sacramento, CA

I had a Chevy Bolt and had people flashing their lights at me to turn my high beams off all the time when I just had my headlights on. I felt horrible, and I hated it. I have a different car, now, but with both cars I've experienced the glare from oncoming traffic. It is so glaring and scary to drive past oncoming traffic with lights like that. It's actually painful to me because I get vestibular migraines and it hurts my eyes and triggers a headache. No fun. Can't, for the life of me, understand how they're getting away with lights like this in cars.

B.4867 February 10, 2026 — Sioux Falls, SD

It's so dangerous driving at night now. I used to love it but now I hate/dread it.

B.4868 February 11, 2026 — Vancouver, Canada

Brighter isn't better when it's blinding everyone else on the road. Absolute disgrace that these were ever approved and currently the standard lighting system for every new vehicle on the road.

B.4869 February 12, 2026 — Alpharetta, GA

I never had a problem driving at night until they changed the headlights! They hurt! Please help us.

B.4870 February 12, 2026 — Baltimore County, MD

Please let's not fight…just get rid of the 4,000 lumens of light. Bring back the standard 1,000 lumens. There is life in safety. 💡 Thank you for doing the right thing.

B.4871 February 12, 2026 — Chandler, AZ

Headlights, even on low beams, are causing me painful eyestrain at night. I was formerly an avid night-time driver, but as lights have transitioned to brighter and whiter light, the visibility for all drivers--especially but not solely the other drivers on the road--has reduced. This is before considering the distraction of glare, eyestrain, and migraines.

B.4872 February 12, 2026 — Ferndale, MI

This is a safety issue that is getting worse and auto manufacturers need to step up. Automatic high-beams are simply a bad idea. LED headlights need to be regulated and properly governed.

B.4873 February 12, 2026 — Largo, FL

Headlights are way too bright, especially for raised cars. They blind other cars especially sedans and cars lower to the ground.

B.4874 February 12, 2026 — United States

https://commonwealthtimes.org/2026/02/11/led-headlights-are-terrorizing-our-streets-our-automakers-and-government-have-no-plan/

B.4875 February 13, 2026 — Bellevue, WA

I live in a rural area with steep hairpin turns and blind corners. I commute 1.25 hours each way. 4 days a week. This is a real issue in my life.

B.4876 February 15, 2026 — Salt Lake City, UT

These headlights are more dangerous to other drivers. Normal headlights are fine.

B.4877 February 17, 2026 — Asheville, NC

I am a young person consistently frustrated by the headlights of others. I like to drive small sedans, and especially here in the south, lifted pickups and modern SUVs with absurdly bright headlights make my 6:00 AM morning commute the worst part of my day. How these are still legal is so beyond me

B.4878 February 17, 2026 — Bellevue, WA

I am a granddaughter, daughter, niece, sister, cousin, fiance and a mother of 2. My life and my childrens life′s matter, and vehicles are already not safe but when you add stadium lights on vehicles it makes everyone unsafe. I fear everyday as a driver and a passenger that I will get into an accident because I′m blinded multiple times everyday. There are times I can not see the lines on the road and no amount of looking to the right corner of the ground fixes the blinding lights I′m being subjected to. You have to get a license so you can be a safe and legal driver, there are drivers who should not have a license because they are unsafe and then they get a car from a dealership with stadium lights or they buy LEDs off amazon or some other website. There is no reason to have such blinding lights on vehicles and I urge people who care about the safety of others or the safety of yourself sign this petition, write to the state you reside in voice your concerns the roads need to be safer and we should not have to put our life′s on the line because others find it necessary to use these blinding lights.

B.4879 February 17, 2026 — Chipley, FL

A significant portion of this issue is aftermarket equipment. Particularly LED direct replacement for Halogen equipped vehicles. The headlamp lens and housing is not designed for the different optics of the LED replacement and thus projects a far different pattern causing a blinding light to illuminate opposing traffic. Another issue related to modern vehicle headlamps is the yellowing resulting in increasing opaqueness thus attenuating the headlamp output and diffusing the light in a different direction than intended. We need legislation to force automakers to construct these headlamps to maintain design performance for at least 30 years. I still drive my 32 year old K1500 and 34 year old Town Car but fortunately t hose were popular vehicles of the day and aftermarket replacements are available but some vehicles have no alternative. Polishing the lens helps for a short period but in the polish process the only protection these poorly thought out products is removed, that being the polycarbonate coating. If we can′t get manufacturers to make headlamps of glass again we should at least force them to make the entire lens from polycarbonate. I would like to see glass headlamps return but manufacturers are scrutinizing everything in the manufacturing process to reduce weight so my wish is unlikely to become reality. Both are particularly dangerous on narrow rural roadways with many not even having pavement markings and they often have significant drop off at the pavement edge so an inexperienced driver overcorrects and winds up either colliding with a stationery object or the oncoming vehicle. Thanks in advance for any help you can provide to resolve these dangerous issues.

B.4880 February 20, 2026 — Carroll, OH

Almost died today, all because some truck wanted to look cool and have unnecessarily blinding lights. Having photosensitive eyes is problem not for just themselves but for the other driver too, it can easily change lives and we need to crack down on these b bright leds. No one needs a spotlight as a headlight,

B.4881 February 20, 2026 — Myrtle Beach, SC

If you can’t see without bright headlights, you shouldn’t be driving in the first place

B.4882 February 24, 2026 — New York, NY

Fuck LED lights

B.4883 February 26, 2026 — Greenville, SC

I still have great vision and I have a great driving record, and I hope to hold on to both of them. However driving at night actually has become dangerous in my opinion due to blinding headlights on so many vehicles. I realize LED headlights can be effective but only when taking into consideration

the safety concern for oncoming traffic. I have read that mostly older drivers, 65 years of age and older are complaining. This is not the case in my opinion. I have also read that as of 2022 there were more than 55 million drivers in this category. Well with that in mind wouldn't it make sense to stop blinding drivers (pedestrians, cyclists) with super bright headlights. Even a AAA contributer said people need to adjust to the brighter lights. I say headlights need to adjust to people. I am but one voice, but may it please be heard. Roger Davidson

B.4884 February 27, 2026 — Hamilton, OH

I have astigmatism just like a very large portion of drivers. I am anxious to even drive a quarter mile from my house to get gas most of the time because most people have led headlights that effectively turn my entire windshield a harsh, blinding white. I know for a fact I am not alone, and I also know that it makes no difference how they are aligned, nor whether they were installed by the manufacturer or the buyer. It effects my vision both short and long term, as well as my mental health, and the general safety of myself and everyone around while driving. It is ridiculous that anyone should think they'd really need lights that can be seen through a cow. I also feel it necessary to add that people who do not know how to turn off high beams, or even how to turn off their headlights at all in broad daylight, should not have a license. PLEASE, make the roads visible at night like they used to be before someone actually dies because of some Tesla/Jeep driving bozo with lights that would make the sun blush!

B.4885 February 27, 2026 — Ocean springs, MS

This is extremely dangerous. Something must be done.

B.4886 February 27, 2026 — Orlando, FL

The increase of headlight brightness will never stop. More and more cars will get brighter and brighter headlights to combat others. Eventually everyone will be blinded and unable to drive at night. Going back to 1000 lumens of light should be the standard and limit.

B.4887 February 28, 2026 — Lahaina, HI

LED car headlights are an absolute nuisance. They are far too bright, really annoying, and completely unnecessary. For decades we all drove at night just fine with regular brightness from standard headlights. Now, these days we are constantly blinded by excessively bright headlights from all directions. It's progressively gotten worse over the past 10+ years or so and is a pain to drive at night. If car manufacturers have to use LED technology for cost savings and longevity, etc., then decrease the brightness back to what car headlights were in the past and make the color temperature like previous generations - a comfortable golden amber light color. Supposedly, car manufacturers started producing LED headlights to increase their safety scores. Making car headlights brighter for safety actually has the opposite effect by blinding other drivers. So, how is that safe? Plus, in darker surroundings these annoyingly bright lights become even brighter. As pedestrians, runners, drivers, etc., we all have the right to not be blinded at night and subjected to this obvious, problematic nuisance.

March 2026

B.4888 March 2, 2026 — Houston, TX

The LED headlights that are installed in new/newer vehicles are horribly blinding to drivers going the opposite direction. I often have to slow my speed in order to avoid hitting esplanades or veering into another traffic lane and have still experienced a number of close calls. I'm sure that the drivers of these vehicles with the super bright LED lights can see the road and vehicles in front of them perfectly while those of us driving in the opposite direction are nearly blinded. I have an older vehicle with non-blinding halogen headlights and often wonder if my headlights on bright would even come close to blinding oncoming drivers to the extent the non-bright setting of many LED headlights do.

B.4889 March 2, 2026 — Lewisville, TX

LED headlights habe become dangerously bright, to the point that other drivers can't see where they're going. I've had to fully stop on multiple occasions because I was suddenly blinded by another car's lights. They actually physically hurt my eyes to look at, even peripherally. They shouldn't be legal!

B.4890 March 3, 2026 — anaheim, CA

I can no longer drive at night because of these on coming blinding lights. All my cars have traditional headlights.

B.4891 March 5, 2026 — Orlando, FL

{"videoUrl":"https://stream.mux.com/yNvgDMTPlEDEDspRyJryJQPW78wub4kWUNRUT2G8KeU","cloudflareUid":"daa64b1f75a7033d41b490e51e5f4dbe","muxAssetId":"dGUqJ31JGyOkPNeSQnfHPzybF5JOaSeIouUr3QJs7z4","muxPlaybackId":"yNvgDMTPlEDEDspRyJryJQPW78wub4kWUNRUT2G8KeU","muxPlaybackUrl":"https://stream.mux.com/yNvgDMTPlEDEDspRyJryJQPW78wub4kWUNRUT2G8KeU","muxThumbnailUrl":"https://image.mux.com/yNvgDMTPlEDEDspRyJryJQPW78wub4kWUNRUT2G8KeU/thumbnail.jpg"}

B.4892 March 5, 2026 — Valparaiso, IN

These lights are absolutly blinding and a nightmare for migraine sufferers. They also wreck periferal vision, which means they must either cast a wider beam or leave a person with greater blind spots. Any outdoorsman will tell you certain lights are better for illuminating what you want to look at without completely destroying your night vision. I don't know how people who live in the mountins funtion. When traveling mountin bends, I have almost had to stop the car at times until I can see the edge of the road when these harsh LED headlights hit me in the face as someone comes around a curve. For so many reasons these lights need to go. I can't comprehend how these lights are being allowed especailly so high on some vehicles.

B.4893 March 6, 2026 — Piti, GU

When I drive home from work, I am constantly blinded by the bright LED headlights on all the new cars. Whether they are oncoming, or behind me, the light is blaring and blinding and by the time I get home I'm seeing spots! This has to be a health hazard!

B.4894 March 8, 2026 — Tabernacle, NJ

I hate driving at night with all the LED headlights blinding me. I bought blue-blocking clip-on's for my glasses which help, but really, LED's should NOT be blinding. We need to go back to Halogen lights on vehicles. People are dying because of the LED's.

B.4895 March 10, 2026 — Charlotte, NC

If all I can see in front of me or behind be is a white flash, your lights are actively making driving less safe. The fact that this has been legal for any amount of time is ridiculous and disgraceful to the automotive industry and our country as a whole. Do better.

B.4896 March 10, 2026 — bellingham, WA

The lights outside the cars and now inside are blinding I have a hard time seeing and focusing.

B.4897 March 11, 2026 — Ashland, OR

I no longer leave my house after dark because driving my family around half blinded by the headlights of other drivers feels increasingly unsafe.

B.4898 March 11, 2026 — Columbia, SC

Ophthalmologist agrees and will bring this to the SC statehouse! I must wear yellow tinted glasses at night just to get home safely in the dark. I live on a narrow road that leads to a boat ramp and big trucks carrying wide trailers with boats have no idea how close their cargo gets to the centerline and my car. Please help us!

B.4899 March 13, 2026 — Salem, OR

Driving at night on county roads is a hazard with these new LED headlights. There is a span of time when oncoming traffic actually blinds you and you can't see the road. Additionally, having these lights behind you is like having a spotlight in your face from the reflection in the rear view and side mirrors.

B.4900 March 14, 2026 — Bremerton, WA

I have astigmatism. I did not choose to be born this way. We CAN choose to change the laws to make it safer for me and the other ONE-THIRD of Americans who have some form of astigmatism.

B.4901 March 14, 2026 — Lincoln, NE

It's become dangerous to drive at night because of this issue. I normally don't get involved in these things, but this situation is out of control.

B.4902 March 16, 2026 — Stehekin, WA

Lack of regulation against overly bright headlights discriminate against the elderly in our country. I have been forced to stop driving at night because headlights blind me. That means I no longer am free to go to movies, concerts, or other nighttime events. I am stuck at home unless I want to pay more than $50 to take Uber.

B.4903 March 20, 2026 — Bethlehem, PA

I just found out about this petition and I'm so thankful! Driving at night has become so stressful and dangerous because of the blinding headlights! I have to put my hand up to block the lights and even have to look away from the road sometimes! I just can't believe this has become so dangerous and the automobile industry hasn't done anything to stop it! Does it take a massive lawsuit!?!?! I pray whatever it takes, happens soon! Before more lives are injured or lost due to these unbelievable bright lights!!!

B.4904 March 23, 2026 — Camden, NJ

I work graveyard shift, so I travel frequently from dusk til dawn. Driving over the years has become dangerous because of the brightness of headlights has become so intense. I'm constantly flashing my high beams assuming they have on their high beams only to have them return the flash. It's becoming extremely difficult to see anything ahead of you. Especially if you are driving a smaller, low riding vehicle you are being blinded by bright lights in your side view mirror as they don't dim, causing another distraction.

B.4905 March 23, 2026 — Carrollton, GA

When a newer car is approaching me at night, I cannot see the street surface, only their headlights. I'm afraid I'm going to hit an animal. Your ultra-bright headlights make everyone else less safe.

B.4906 March 23, 2026 — Huntington Beach, CA

Bright LED headlights are dangerous for everyone. If your lights blind me, I become a less safe driver until I can see again.

B.4907 March 23, 2026 — Sioux City, IA

This is very important, lives are on the line.

B.4908 March 24, 2026 — Fuquay Varina, NC

As someone who drives a smaller car, I'm tired of having to risk danger by turning my rear view mirror up so that I am not blinded anymore by the LED lights of the car behind me. Bring back warmer headlights!!!

B.4909 March 24, 2026 — Port Charlotte, FL

My personal preference for vehicles, is smaller, fuel-efficient cars and motorcycles. I'd like to continue driving these both for personal enjoyment, and resource saving reasons, however these LED head lights have been out of control for sometime. There needs to regulations on either the brightness or the height of the lights for these giant SUV's blasting the entire length of a street with their headlights.

B.4910 March 25, 2026 — Mattapan, MA

It's absolutely blinding especially when you have them coming at you and behind you. It's going to really hurt someone

B.4911 March 26, 2026 — Shawnee, KS

This transition from Hal lights to LED′s needs so much more regulation. I′m in my 20′s and the light produced from these headlamps are making it dangerous for me to drive at night. I′m getting blinded in all 3 mirrors by the truck/SUV coming up behind me. I have genuinely had to hold my hand up to my rear view mirror more than once because of the intense light destroying my night vision, I can′t see the road. The new models auto-dim. That′s absolutely not a solution. The vehicle coming behind me is not going to auto dim until they begin to pass. Only when their lights are even with my headlights (when it doesn′t shine into my mirrors anymore) will they auto dim. LED headlamp manufacturers need more regulation to their product because it′s causing significant potential hazards, rather than just illuminating them. This needs to change.

B.4912 March 27, 2026 — Davenport, OK

these lights are incredibly dangerous. 9/10 when i′m driving at night i can hardly tell where the road is at because of the blinding light of Jesus coming straight at me. i have astigmatism and glasses that have helped to somewhat correct it and the headlights on the newer vehicles have made it seem like it′s gotten worse. i refuse to drive at night now because i am afraid to come up on the LED headlights and cause an accident because i couldn′t see where/what i was going/doing.

B.4913 March 27, 2026 — Reseda, CA

I live in Los Angeles, California, and I cannot express to you how much more dangerous these headlights have made driving at night. There are more cars on the road here in the city at night so there is no avoiding these lights behind you or an oncoming traffic next to you at all times. It makes driving nearly impossible, and our accident rate has skyrocketed.

B.4914 March 28, 2026 — Novato, CA

I literally think twice before driving at night now due to headlights glaring into my eyes. Im 30 for f′s sake.

B.4915 March 28, 2026 — Summerville, SC

Lights bright can’t see. No bueno

B.4916 March 28, 2026 — United States

I can′t SEEEEEEEE

B.4917 March 29, 2026 — Breckenridge, MN

Driving at night has never been fun, but heading straight towards blinding headlights has increased the risk of nighttime driving. I′ve had to lower the brightness of all in-cab lights just to see the road while there are bright headlights in front of me as well as blinding me from my rear view mirrors.

B.4918 March 29, 2026 — Pasadena, TX

i sometimes drive at night when i commute from my hometown to my school, and the amount of bright lights coming from behind or coming towards me from the opposite side of the highway makes it difficult for me to see. I drive a small sedan, so a lot of these bright lights are directly eye level with me. The ones coming from ahead shine straight into my windshield, and the ones coming from behind are level with my rear window, which then reflects off of my mirror and directly into my eyes, creating unsafe driving conditions. These LED headlights are excessively bright and are not properly aimed. When I’m driving behind somebody with LED headlights, I can see that their headlights light all of the lanes of the highway, and would probably light the other side were it not for the solid divider. There is no need for headlights to be so bright that they provide light to the entire freeway across 4-5 lanes of traffic.

B.4919 March 30, 2026 — Bellevue, WA

As someone with less than ideal eyesight mixed with astigmatism these headlights blind me. I work nights and drive home in the dark year round. I live in a rainy climate so visibility is already low. This makes it very dangerous for me and others in my community. Not to mention most with these lights throw on their high beams on top of that on well lit streets

B.4920 March 30, 2026 — Birmingham, AL

these lights are extremely dangerous and way way too bright!!! i drive at night on my way home from my job and sometimes have my kids in the car when we go places and it's already dark, there's no reason i should be worried about swerving off the road from being blinded by these awful lights!!! they are not necessary!!!!!!!! i have also started having ocular migraines from the insane brightness. these lights should be banned for good. we need to go back to the warm toned lights because they are so much better for our eyes.

B.4921 March 30, 2026 — Cincinnati, OH

im going blind bc of these mfs this is basically free lasik

B.4922 March 30, 2026 — Toccoa, GA

I can no longer drive at night it's not safe for me unfortunately. The lights are so bright and living in the country there are not many street lights to help counteract the one direct bright light. I've almost run off the road so many times.

B.4923 March 30, 2026 — West palm beach, FL

Its ridiculous i cannot drive at night anymore because the lights from on coming traffic blind me. I don't understand how this is legal. How were manufactures allowed to produce such garbage. No wonder our president is a pedophile. The USA is failing everyone in every aspect.

B.4924 March 31, 2026 — Athens, GA

These lights are blinding. Not just to people who have eye problems but to normal everyday people. There is no need to have lights OR highbeams that are so bright they can 10 miles away. I've almost gotten into multiple accidents with these lights, they're extremely dangerous.

April 2026

B.4925 April 1, 2026 — Churchville, PA

This needs to change!

B.4926 April 5, 2026 — Indianapolis, IN

Driving at night has become increasingly difficult for me over the past few years, and it is because of the intensity of other driver's LED lights. When a vehicle with LED lights is behind me, I cannot use my rear view mirror to scan my surroundings and it is hard to drive with that blinding white light stuck in my peripheral vision. When the vehicle is approaching me from the other direction, I have had to slow down or sometimes stop all together because I am totally blinded and unable to find the edge of the road/make out my lane. It can be terrifying when this happens on the winding country roads I often drive. While I believe that these brighter lights aid the drivers who's vehicles use them, they are extremely hazardous to every other driver on the road. I support legislation to regulate to the intensity and change the color spectrum of these lights to keep roads safe at night.

B.4927 April 7, 2026 — surrey, Canada

It is absolutely ridiculous these lights are allowed on the road they are clearly way too bright i have seen them they are a hazard! Can be distracting and momentarily blinding!!!

B.4928 April 8, 2026 — Sneedville, TN

LED headlights are BLINDING on low beam and very unnecessary. My halogen bulbs on high beam are barely as bright as most led lights on low beam. They hurt my eyes and head and I shouldn't be forced to endure the pain just to get to work in the mornings.

B.4929 April 9, 2026 — High Point, NC

These blue lights cause more accidents with other cars than with a deer. Please ban them forever

B.4930 April 10, 2026 — Citrus Heights, CA

So blinded by headlights last night during a rainstorm that if some one walked in front of me I wouldn't have know until they bounced off the hood of my car. Just as bad during dry weather. Please let's provide some kind of design guidance and usage regulation to these torches.

B.4931 April 11, 2026 — Nampa, ID

I love driving at night and I used to do it all of the time but I cannot do it anymore. I have astigmatism and it's already difficult to see. If I leave the house past 8pm I am struck with the light of God every time. Plus, when someone is tailgating me, it's already annoying but now car manufacturers have given these losers the tool of unnecessarily bright headlights. Today there was a massive rain storm which was nice until cars with led lights passed me. I could not see at all. Even the cars in front of me had to stop to wait for them to pass. It's such an intrusive addition to cars. Nothing like having a nice night drive and a random persons lights blaring in your car to remind you they're there. I have a 1998 SUV and I use incandescent bulbs. They work perfectly until cars with led lights are around. There is no point in having them. I should not have my life at risk because someone thinks it makes them see better. It's selfish.

B.4932 April 15, 2026 — Los Angeles, CA

Back 10 years ago when I put LED lights on my car I got a ticket because my lights appeared blue. Fast forward 10 years later and all manufacturers are installing blue BLINDING LED headlights, I can't take it anymore. These are no longer considered lights and are literal lasers, it's mainly the Tesla owners and more than half of them drive with high beams on.

B.4933 April 15, 2026 — Salt Lake City, UT

I have to drive to work hours before the sun rises through country roads everyday for work and sometimes the lights are so bright that I can't see any of the road infront of me.

B.4934 April 18, 2026 — Salem, NH

I have no problem seeing in the dark, it's however very hard with these headlights. It's very blinding, I was on my way home and there was someone with these very blinding headlights and when I was turning the curving road I could not see the person walking off the street because of the headlights that were in front of me. Thankfully he got off the road before I got near them but it was still a close call situation.

B.4935 April 19, 2026 — Canton, MI

I honestly feel unsafe driving at night.

B.4936 April 21, 2026 — Hollis, NH

I can't see anything when I drive anymore, I can't believe I haven't got in an accident yet because of it

B.4937 April 24, 2026 — Riverton, UT

I drive an old 2005 truck with halogen headlights. LED headlights in recent years have become so bright that they completely wash out the light from my halogens, so I can't see the road in front of me; it's downright dangerous when the road is wet and catches the glare from everyone else's lights. The worst is a highway with an 80 mph speed limit, no street lights, and oncoming traffic -- it is actually terrifying. I upgraded my bulbs to the brightest halogens I could find, and it's still not good enough. I can see perfectly clearly when I'm out in the middle of nowhere at night with no other cars around, so I know my headlights should be sufficient. They *used* to be sufficient around town. I really want to avoid replacing my halogens with LEDs, because I don't want to be *that* truck with the blinding headlights, but the situation is only getting worse and more dangerous for cars with dimmer halogens. The competition for brightest headlight manufacturer has gotten out of control and has long exceeded safety limits. We need restrictions on headlight brightness, with actual enforcement. In my state, driving without a seat belt is a primary offense. Blinding headlights is actually dangerous to other drivers and pedestrians around them, so it should also be a primary offense.

B.4938 April 28, 2026 — Niagara Falls, NY

The biggest issue here is most people are wearing glasses or contacts. Why would you give somebody who already can't see without assistance a way to make everyone else need the exact same assistance? I can see perfectly fine with Halogen bulbs which are the standard bulbs we used in our cars before LEDs. The reason that Halogens were great was because of the fact you can see without blinding the rest of the city. Now you have to make sure you have tints on all of your windows just to see the road at night or you have to buy special shades that eliminate the glare from the lights and again that's not

right considering most of the people using these bright lights are the same people who legally cannot drive without their glasses in the first place

May 2026

B.4939 May 4, 2026 — Fishkill, NY

I consider myself to be a very well-versed car enthusiast and technican, having put many miles on 80′s Japanese cars with fixed glass headlamps, 90′s/2000′s German cars with properly good halogen and Xenon headlights, and a handful of new cars with LED headlights. I can say without absolutely certainty that most modern headlight systems are not only largely unnecessary, but also excessively expensive, impressively obnoxious, and often improperly adjusted. Additionally, I find it very interesting that even when adjusted correctly, most new cars with LED headlights have a small but very noticeable spot of absent lighting, which conveniently appears to be the location of the IIHS ″glare illuminance measurement″ sensor (approximately 110cm from the ground and 3m from the center of the vehicle). In the event that it is intentionally engineered into the headlights, manufacturers would then become eligible for a″ good″ or ″acceptable″ IIHS headlight saftey rating while circumventing a problematic glare during real-world use. That′s certainly incentive for them to do such a thing. Needless to say, I′m completely on board with having more strict regulations on headlight systems, as well as encouraging car dealerships, manufacturers, and inspection stations to ensure that every car leaving their lot has properly adjusted headlights.

B.4940 May 4, 2026 — Whitehall, PA

I have had 3 sugeries on my wyes for detached retina. Since that happened, I am EXTREMELY light sensitive. Oncoming highbeams are hard to deal with , however most older non-modified lighting systems are more than adequate. They may be difficult to deal with but I can adjust. My issue, and ALL manufactures have begun to assault everyones eyes and privacy. I should NEVER be able to see dirt particles in my cars carpeting at 4 am. Ford F 150, 250, 350 etc are among the worst offenders. However, GM seems to want to show the world they have the biggest D!*& in the world and Fiat aka Dodge is a pathetic tiny brother in this automotive pissing contest. I drive 200- 400 miles a day. I need my 44 year perfect driving record to stay intact a d I′m beginning to worry about that. I am looking into a class action lawsuit targeting this exact issue. Is that an idea others would support?

B.4941 May 10, 2026 — Albany, NY

The roads have become a hell of blazing white and blue lights. I am always driving one handed with one hand blocking my side view or my left field of vision. Friday night I approached a light where SUV′s were streaming at and around me in all directions and I was too dazzled to see the stop light and suddenly the car ahead had to brake, I braked swerved and hit them. Even in the day this is a problem.

B.4942 May 13, 2026 — New Orleans, LA

{″videoUrl″:″https://stream.mux.com/pLRRye42hsBHBSaiC6nrVG4YG1KOt92fwboUIVhJu2U″,″muxAssetId″:″I2VlJrFi5qRnJO6Dbg5Ba5lXS5CsqsblPRMvKzsjRQ00″,″muxPlaybackId″:″pLRRye42hsBHBSaiC6nrVG4YG1KOt92fwboUIVhJu2U″,″muxPlaybackUrl″:″https://stream.mux.com/pLRRye42hsBHBSaiC6nrVG4YG1KOt92fwboUIVhJu2U″,″muxThumbnailUrl″:″https://image.mux.com/pLRRye42hsBHBSaiC6nrVG4YG1KOt92fwboUIVhJu2U/thumbnail.jpg″}

B.4943 May 13, 2026 — Paris, TX

{″videoUrl″:″https://stream.mux.com/4SYJ5sgWvixrEgsVBtfIirOh5V3R6Fx2lkHJPLvCAuI″,″muxAssetId″:″xTqulbApyN9Xx2jCIazD8502G2dU1H10024rn7t4ZFxq00″,″muxPlaybackId″:″4SYJ5sgWvixrEgsVBtfIirOh5V3R6Fx2lkHJPLvCAuI″,″muxPlaybackUrl″:″https://stream.mux.com/4SYJ5sgWvixrEgsVBtfIirOh5V3R6Fx2lkHJPLvCAuI″,″muxThumbnailUrl″:″https://image.mux.com/4SYJ5sgWvixrEgsVBtfIirOh5V3R6Fx2lkHJPLvCAuI/thumbnail.jpg″}

B.4944 May 14, 2026 — Hialeah, FL

All over the U.S. and in Florida, Citizens are complaining about these ultra bright lights, both from vehicles and new street lights. State and local officials need to address this problem. Congress needs to act to ban, lower intensity, or install covers/shields.

B.4945 May 15, 2026 — Marietta, GA

This is one of the few "BANS" that I am in support of. These "new" headlights are so bright they blind oncoming traffic. I only wish this could have been done sooner!

B.4946 May 20, 2026 — Glasgow, SCT, United Kingdom

Bright LED lights, in particular Daylight Running Lights need to be banned. As well as being hideous monstrosities, DRLs are DANGEROUS. Any dirty lowlifes caught using them should be thrown in jail.

B.4947 May 23, 2026 — Tucson, AZ

Driving with LED headlights on the road is extremely dangerous and extremely unnecessary. I just want us to all be safe.

B.4948 May 24, 2026 — Kalispell, MT

For people with astigmatism (me) trafic lights can blind me, how do people expect 30% of the population to drive? Blind?

B.4949 May 24, 2026 — winchester, VA

Every night I am blinded by constant led headlight blindness. Several times every night I have to nearly slow my car to a near stop becase I cannot see the road because of the hight brightness of led hardlight glare and when it is raining thousands of drivers cannot see to drive because of idiots who constantly use their high beams. It takes much longer for the eyes to recover after passing an idiot with LED headlights. I see others run lterally off the road because of the brightness. DAMMIT THIS HAS GOT TO STOP. DESIGN LOWER BRIGHTNESS AND COOLER TEMPERATURE LIGHTS AND MANDATE THEM.

B.4950 May 26, 2026 — Brooklyn, NY

Being blinded as a pedestrian is a mood killer, being blinded behind the wheel is a life ender.

B.4951 May 28, 2026 — Arcata, United States

It is incredible that blinding headlights are not regulated. Proper illumibation is a crucial piece of infrastructure and blinding glare causes innumerable traffic accidents, taking lives. Regulate the glare! Limit the lights that can be sold and regulate car manufacturers. This will save lives. As a driver, the blinding glare of thoughtless drivers makes me feel deeply unsafe onbthe road. As a pedestrian, I cannot give enough middle fingers. Save lives and regulate these glaring LEDs!

B.4952 May 29, 2026 — Gainesville, FL

If you can’t tell whether the person behind you has their high beams or not, then that’s a problem

B.4953 May 30, 2026 — Phoenix, AZ

I drive a lower vehicle and the amount of times ive almost crashed because of someone with there stupid brights on is insane this has to be fixed immediately

June 2026

B.4954 June 1, 2026 — York, SC

I signed this petition because I lived this problem firsthand. For nearly two years, nighttime driving felt genuinely unsafe due to starbursts and halos from oncoming headlights. What I eventually discovered is that modern headlights made a treatable medical condition called Higher Order Aberrations significantly worse, and almost nobody knows this condition exists or that it can be fixed. I have shared my full story here for anyone who may be experiencing something similar: https://www.reddit.com/r/Dryeyes/comments/1tjuhzu/dry_eyes_starbursts_halos_glare_and_g

hosting_with/ Sign this petition. And if your symptoms go beyond just headlights, please read my story. There may be more going on than bad headlight design.

B.4955 June 6, 2026 — Glenside, PA

IM ONLY 25 AND I CANT SEE AT NIGHT ANYMORE why does one car need to be able to see 10 cars ahead of me genuinely ENOUGH

B.4956 June 8, 2026 — Colonial Heights, VA

As someone who has a brain tumor that has caused optic nerve damage, I am extra sensitive to light, which I already have been. I have a medical condition, so this causing harm to me and others with like conditions should be considered an ADA violation.

B.4957 June 14, 2026 — Yreka, CA

If someone can't drive with yellow car lights from the 1990's. They shouldn't be driving! All of my car lights are yellow and soon, bulbs will be so bright that I'll be expected to install brighter lights to compete with everyone on the road for vision when in reality we could just equalize everyone on the road with a firm ban on white headlights. Yellow headlights work perfectly fine when there isn't a million white ones that are 3x brighter surrounding you. It's ridiculous that the current "safety" option here in the USA is just "buy brighter & whiter headlights like everyone else and contribute to the suffering". NO, that is not the answer...

B.4958 June 15, 2026 — United States

LED Headlights have made driving at night with an astigmatism extremely hazardous

B.4959 June 16, 2026 — WI, United States

Anything brighter than halogen lights should be banned. They may help the driver of the car see a mile away but other driving are needlessly blinded. It's painful and causes complete blind spots until they pass. Anyone who needs lights that bright just shouldn't be driving at night.

B.4960 June 21, 2026 — Los Angeles, CA

Dude, I cannot drive when the full force of Ra is artificially summoned directly in front of my eyes...

B.4961 June 25, 2026 — Hampton, VA

LED lights are blinding painful to the eyes and trigger migraines and other complex medical conditions that impair drivers already suffering from mild to debilitating conditions reducing their overall quality of life and independence

B.4962 June 26, 2026 — Denver, CO

Recently I asked my eye doctor what she thought about the extremely bright LED headlights on newer model cars. She said, "I think they should be outlawed."

July 2026

B.4963 July 2, 2026 — Estacada, OR

I work graveyard hours and drive a smaller car. It gets very challenging trying to keep focus while getting blinded by all these overly bright lights. There are times I need to put sunglasses on or fully move my mirrors to see the road. I'm for working on cars but better regulations for headlight brightness, color and or angle is a for sure needed thing for drivers.

B.4964 July 4, 2026 — Salt Lake City, UT

the head lights are so bright that i half to wear a couple lairs of sun glass when i drive and even then it's not always enough because some of those lights are worse than others and when any of those cars pass me in the other lanes i'm blinded by there lights threw the side vision mires and i half to flip the rear mire up to prevent being blinded from behind and with the lights being so bright that you can't see i don't feel safe on the road any more and i don't drive unless it's absolutely necessary like to work or the food store or other things like that and there use to be a brights law but these new lights are many times brighter then are brights are so by them allowing them on these car the brights laws are

not being enforce any more and any one that needs lights that are that bright just to see the road probably should be driving at night in the first place

B.4965 July 9, 2026 — Houston, TX

I used to love driving. Now it is hell. I wear contacts. And have ADHD. I am properly medicated, but it is amazing to me how quickly I can go from a state of peace to complete rage due to the overwhelming stimulation from all forms of > 3000K (kelvin) LED lights. Headlights are the worst offenders but a close second are unregulated business wall mount exterior lighting, followed by parking lot lighting with no filter, high mast lights and general street lights. And these lights are on often during cloudy and hazy days. We have over polluted our environment with light sources that do not blend together well. Not only do they blind directly, but they also affect me peripherally. I can take about 10-15mins of constant assault before getting triggered. And I live in Houston TX, so my commute and daily life has become hell from these lights. Additionally, the glare and contrast issues are a HUGE problem in inattention blindness with these lights—this leads to not being able to notice pedestrians and cyclists. Additionally people like me have to wear sunglasses now to drive at night, magnifying the inattentive issue. I get being energy efficient. But how hard was it to change a HID headlight bulb and how often did they burn out? And why do we need bright headlights in urban environments with street lights? What happened to hi beam / lo beam tech? There is no argument for these lights that makes sense other than having them as the high beam only bulb on the basis of safety as you can see very far on rural roads with the higher Kelvin bulb. But again this is why we had and still have hi / low beam. As a compromise, I'll yield and let the hi beam bulb stay at a > 3000K kelvin bulb. But everything else needs to be low kelvin or (preferred) not LED at all. The light pulses, negatively affecting folks with astigmatism, ADHD, corrective lenses, etc. We used to be a society that cared about each other. All I see now is people loving that they can see "far" with these fancy headlights. I hope with education people can realize how debilitating these lights are to people, creating more harm than good. Hopefully we return to common sense on this issue and realize that the brightest lights are not the best or safest solution to safety, but instead managing contrast and glare are the utmost importance when it comes to safely lighting our rainy and dark skies.

B.4966 July 10, 2026 — Stoke-on-Trent, United Kingdom

I live in the UK, where there's lots of national speed limit country roads with zero streetlights. I was driving down one last night when a car coming the opposite direction genuinely blinded me. I couldn't see the markings on the road. I had to swerve to avoid crashing into the hedge when it passed. I hate them.

B.4967 July 25, 2026 — Bournemouth, ENG, United Kingdom

Please get rid of rhe rich blue LED lights . It's making many of us unwell and is disabling. They're also dangerous.

B.4968 July 30, 2026 — Salt Lake City, UT

because of the blinding headlights i half to wear a couple lairs of sunglass to compensate and even then it's not enough because some of those lights are worse than others and i also half to tilt my rear version minor to prevent being completely blind by those lights and when the cars with those blinding headlights pass me on the right or left lane i still get blast by there headlights in the side version minor and except when it's absolutely nasser witch would be going to work or something i won't go out side of my house because you can't be out side for even 5 min's without being blasted by those kind of light so it's like i'm a prisoner in my own house because of those kind of light

B.4969 July 31, 2026 — Cranberry, PA

LED headlights are way to bright and they make me want to speed up to get away from the car that is blinding me. Which would be dangerous.

August 2026

B.4970 August 10, 2026 — Brisbane, Australia

These LED headlights, street lights and the saturation of them in most buildings is a nightmare. I heard a lighting expert say it will be the next asbestos.

B.4971 August 14, 2026 — United States

Nobody needs headlights so bright that it blinds other drivers. It can leave visual tracers when driving on opposite lanes and is extremely aggrevating when one comes up behind you, which can lead to distraction and road rage. Distraction, anger, and visual impairment are all circumstances that lead to unsafe roadways. This feature is merely a selling point for car manufacturers at the expense of the safety, and indeed the sanity, of the general public.

B.4972 August 15, 2026 — Blanchester, OH

In the past I loved to drive at night but now it is impossible. We now have to contend with pick up trucks with off road lights on the highway. Bright enough to light up a city block. No laws anymore. What happened. Even public vehicles are blinding. Why?

B.4973 August 15, 2026 — Queens, NY

These LED lights are blinding! Whether these cars are behind me or in front of me in the opposite lane, I cannot see properly. How these manufacturers continue to install these lights are baffling to me. I hate to say this....but when there is a car with these LED lights behind me I position my car to get behind them and ride with my high beams on. If I cannot see, they should not either. Yes, it's wrong to do this, but to me, very satisfying.

B.4974 August 19, 2026 — Tucson, AZ

How many times have the emergency responders at the seen of a tragic car accident have to hear, "... but I was blinded by the on coming car's headlights couldn't see her in the road." Get the stats, there are thousands of records- this is a fact. We all know what it feels like to drive home after nice dinner and feel assaulted by the painful glare of headlights- one after the other. We count our blessings as soon as we get to our carport, and there's that sign of relief that we didn't hit someone, within each time we were blinded by those headlights. But what are the odds that it won't happen the next time a 2 ton truck, brand new SUV, or luxury sedan, is on the same road. This is a fixable public safety problem and one long overdue. Just how many people were killed by those headlights? Might be very interesting to run an ad next to our local car sales, just listing the number.

B.4975 August 23, 2026 — arnold, MO

Car headlights are dangerously bright. Cars and trucks with their headlights so bright should be ticketed and pay a fine. It should be against the law for such bright lights. And the number of them on the roads is increasing everyday. I know everyone sees them also. They are blinding and make it extremely hard to see around. Politicians should regulate this problem please

B.4976 August 23, 2026 — arnold, MO

Law enforcement should enforce the ' glare control' negligence. Why aren't they.? Please do something before I get in a fatal accident from someone's headlights glaring in my face. XOXOXO

B.4977 August 29, 2026 — Seaside, OR

I can't go out at all anymore due to this problem. I can only go out at 3 am; I have to put on sunglasses the instant I see something bright approaching and the level of hyper-vigilance that I have to maintain against these damn things is causing me PTSD and literally killing me.

September 2026

B.4978 September 1, 2026 — Chardon, OH

When I see an oncoming vehicle with pre LED headlights, you can really see the difference. No pain, no need to flash my brights at them, no residual bright light bubbl9

B.4979 September 4, 2026 — Nottingham, United Kingdom

I hope they revert back to the old brightness! These lights shine like the sun...

B.4980 September 6, 2026 — phpaisley@Gmail.com, United States

I work late evenings and am constantly being blinded on my way home. These lights are a hazard.

B.4981 September 8, 2026 — La Jolla, CA

Anyone who thinks LED headlights aren't a problem are liars OR have their license revoked because they're clearly blind or just straight up oblivious

B.4982 September 11, 2026 — Fayette, MO

The lights are too bright proving damaging to human safety on the roads and posing a threat to animals as well.

B.4983 September 24, 2026 — Plainfield, IL

A. I have astigmatism in both my eyes, so every time I get blind by those freaking LED headlights I can't see for minutes after being blinded. It is really annoying to get give basically flashbanged while driving to/from work. I'm scared that one day I'm going to be so blinded that I'll crash because some jackass in front of me or behind me had their LEDs on.

B.4984 September 24, 2026 — des moines, IA

I've signed this petition once but wanted to share a new story as I believe this will become a more prevalent problem in the future. I was driving to work this morning in the dark and being blinded constantly as per the usual. An oncoming vehicle with ridiculously bright white headlight obscured my vision enough that i could not see the deer that I hit until it was right in front or me. My vehicle was disabled and required a flatbed and now I have nothing to drive until I can get things worked out with my insurance company. Normal yellow lights would not have caused this problem. I've been driving this vehicle for 12 years and never had issues seeing wildlife with oncoming headlights until LEDs hit the market.

October 2026

B.4985 October 1, 2026 — Phoenix, AZ

France has had soft yellow head lights for many decades. There is no evidence they may cause an increase in auto accidents. I have driven at night in this country and you are not blinded by on coming cars you can actually see what is going on. How refreshing is that.

B.4986 October 2, 2026 — Webster, MA

The headlights on jeeps, trucks and SUVs are blinding and will cause accidents and deaths if something isn't done about them.

B.4987 October 3, 2026 — Fall River, MA

Driving at night on rural roads is increasingly difficult with the extreme blinding lights of oncoming traffic. Especially trucks with upper and lower overwhelming lighting only needed on work sites.

B.4988 October 8, 2026 — Goshen, NY

The real danger on the road to EVERYONE is not seatbelts. It is the blinding hazard created by high intensity lights. These need to be modified or banned entirely.

B.4989 October 8, 2026 — MN, United States

I have LED flicker sensitivity, which has affected my work life greatly. It is almost impossible to purchase laptops without flicker and temporal dithering, because the presence of these features in a display is not required to be on any specification sheets provided by manufacturers. To continue to work as a software engineer, I have had to resort to building my own laptops from old parts. LED street lights, headlights, and stop lights also affect me, and although I am only 49 I now avoid all night driving in urban and suburban areas. This summer I discovered that my parents, who do not have any LED sensitivity, have also stopped driving at night because of the increased headlight glare. My father has 20:20 vision but now he cannot drive at night. This is affecting ordinary people with perfect vision. There are plenty of other ways in which people are losing sovereignty and autonomy. This failure to regulate LED lights is just one more factor chipping away at the rights of regular people.

B.4990 October 11, 2026 — United States

https://www.slashgear.com/2282678/us-nhtsa-headlight-brightness-glare-rule-change-plans/

B.4991 October 12, 2026 — Trenton, NJ

The headlights of today's world are 100% debilitating to the human eyes. How very sad to be at a red light and to have to attempt to look in every other direction to try to not be blinded with others cars at full stop. I am 66 years old and can not believe I (we) have to adjust our lifestyle every Fall/Winter based on BLAIRING HEADLIGHTS!! Different shapes, different colors. Who in the world approved a headlight that goes completely across the front of a car and think this was okay for oncoming drivers. Please I ask you to stop this craziness and return normalcy to these situation. It is a menace to society driving at night and needs to be addressed and changed back with restrictions. This is wrong plain and simple. Linda Ruggieri

Appendix C — Appraisal of Peer-Reviewed Scientific Literature

This appendix contains peer-reviewed articles only. The criterion of inclusion is the status of the publication, and not the kind of article or its subject matter. Empirical studies, systematic reviews and meta-analyses, analyses of standards, and theoretical and derivational papers are each within it, provided the item appeared as an article in a peer-reviewed scholarly journal. The Foundation states the criterion in that form because the appendix is offered as an appraisal of a literature rather than as a collection of health studies, and because several of the propositions this comment advances are propositions of physics and of measurement rather than of health, for which the relevant published work is theoretical. Items of press reporting, organizational publications and standards documents are not included here; standards and guidance are listed separately at Appendix D.

Each entry is given in a structured form, and the structure is adapted to the kind of article. The Foundation adopts a structure for a reason it states openly. The response of May 24, 2024 recorded that a commissioned review found the overall quality of the evidence to be low, and Part V.A.2 explains why that characterization is less informative than it appears. The Foundation does not attempt to argue that any item below is stronger than it is. For an empirical study it sets out the design, the population, the measured exposure, the measured outcome, the result with its reported interval, what the study establishes, what it does not establish, and the considerations bearing on confidence in either direction. For a review, an analysis of standards or a theoretical derivation, those fields that have no counterpart are replaced by fields stating what the article is, what it establishes, what it does not, and the matters bearing on the weight it should be given. A reader who wishes to discount an entry is invited to do so on the record supplied, and to identify which element is deficient.

The final field of each entry states the question the item is offered to bear on, and that field appears in every entry whatever the kind of article. This matters more than any other part of the form. The Foundation does not offer this literature to establish that light-emitting diode products are unsafe. It offers it to establish that questions within 21 U.S.C. § 360ii(a)(4) are open and material. The evidence sufficient to show that a question warrants federal study is not the evidence that would be required to show that a product should be restricted, and conflating the two is the principal way in which an inquiry of this kind is closed prematurely.

C.1 Barrett and Jeffery (2026) — supplementation of LED workplace lighting with broad-spectrum light

Citation. Barrett EM, Jeffery G. LED lighting (350–650 nm) undermines human visual performance unless supplemented by wider spectra (400–1500 nm+) like daylight. Scientific Reports. 2026 Jan 23;16:3061. doi:10.1038/s41598-026-35389-6. PMID 41577976. PMCID PMC12830801.

Design. Controlled intervention. Before-and-after repeated measures in the exposed group, with an independent parallel control group. Ethical approval University College London research ethics committee 16547/001; conducted in accordance with the Declaration of Helsinki; written informed consent obtained.

Population. Twenty-two adults of both sexes aged 23 to 65, eleven exposed and eleven control, all screened for normal corrected visual function and general health. All had worked in the LED-lit environment for more than two years. Conducted in London from October to December, when daylight hours fell from approximately 10.4 to 7.5 and most subjects commuted after sunset.

Exposure, as characterized. The working environment was radiometrically characterized rather than assumed. Exposed group: ceiling-mounted LED arrays delivering 1000 lux at a working height of 0.9 m, correlated color temperature 4000 K, TM-30 fidelity index Rf 91, irradiance 3.6 W/m2. Control group: 900 lux, 3000 K, Rf 85. Illuminance and spectral irradiance were measured at nine mapped grid locations across a space 9 m by 18 m.

Spectra were recorded with two spectrophotometers covering the short and long wavelength ranges. The LED spectrum ran from approximately 350 nm to 720 nm with a peak at 450 nm and negligible output above 700 nm. The building glazing carried an infrared-blocking film, demonstrated by infrared photography; interior infrared images were black. The intervention was the addition of 60 W clear incandescent desk lamps for two weeks, whose spectrum extended from approximately 350 nm beyond 1700 nm.

Outcome and measurement. Color contrast detection thresholds on the protan and tritan axes, measured by ChromaTest in a darkened windowless room lit only by the test. Thresholds were determined over five repeated trials, typically 70 to 100 presentations. A practice trial preceded testing to avoid learning effects; none were observed. Measurements were taken at baseline, at the end of the two-week exposure, and at two further follow-ups. The paper is internally inconsistent about when those follow-ups fell. The methods describe testing at baseline, again two weeks later, removal of the lamps, and retesting at four and six weeks, which places the follow-ups two and four weeks after withdrawal. The legend to the results figure instead describes the measurements as taken at two, four and six weeks after the lighting was removed, which cannot be right for the two-week measurement because the methods place that measurement before removal. This entry uses the methods reading.

Result. Thresholds improved in all exposed subjects on both axes, at $p < 0.001$ throughout. The reductions relative to baseline, with the number of subjects contributing to each, were: at the end of the exposure, 28 percent protan and 24 percent tritan, $n = 11$; at the first follow-up, 24 and 21 percent, $n = 10$; at the second follow-up, 25 and 26 percent, $n = 6$. The control group showed no significant change on either axis over the same two-week period, $n = 11$. The authors contrast this with earlier work using narrowband 670 nm exposure, where improvement was biased toward the tritan axis and persisted about five days. Error bars in the published figures are standard errors of the mean.

Analysis. Repeated measures design with a non-parametric sign test, adopted by the authors because of substantial between-subject variability in absolute thresholds.

Attrition, which the Foundation gives its own field because the comment relies on the persistence finding. The exposed group was eleven at baseline and at the end of the exposure. It was ten at the first follow-up and six at the second. That is a loss of five of eleven subjects, approximately 45 percent, by the final measurement. The Foundation has found no statement in the paper of why subjects were lost or of whether those remaining differed from those lost. The consequence is that the persistence of the effect, which is the feature of this study that most distinguishes it from earlier work and which this comment cites at Part V.B.6, rests at its final time point on six people who remained available for testing. That does not make the finding wrong. It means the finding is weaker than a reader would assume from a statement that the improvement was unchanged at the final follow-up, and the Foundation states it rather than leaving it to be discovered.

What it establishes. That the long-wavelength content absent from LED lighting is physiologically consequential and not merely invisible. A measurable deficit in a visual function is present in adults working under ordinary LED lighting; it is attributable to the spectral composition of the ambient light rather than to its quantity; and it is reversed by restoring the part of the spectrum that the transition from incandescent to light-emitting diode lighting removed. The concurrent control group discriminates the effect from the passage of time and from repeated testing. The persistence of the improvement after withdrawal tells against an expectancy effect, though on a sample reduced to six by the final measurement, and the Foundation does not press it further than that. The practical significance is that no existing regulatory instrument addresses what a lamp fails to emit.

What it does not establish. It does not establish harm to any clinical endpoint. The sample is small, eleven per arm, and the exposed arm fell to six by the final follow-up. Subjects were

not blinded to the intervention and the endpoint is psychophysical and requires subject cooperation. The control group was not randomized, worked in a separate space under slightly different LED lighting, and was measured only at baseline and at two weeks, so it provides no comparison at the follow-up time points at which persistence is claimed. The incandescent lamps added visible as well as infrared light. The systemic mechanism the authors propose, involving serum cytokine expression, was not measured in this study and is advanced by them as a possibility.

Considerations bearing on confidence. Against: small sample, loss of nearly half the exposed arm by the final follow-up, absence of blinding, non-randomized control, control measured at only two time points, single site. In favor: the exposure was measured rather than estimated, at nine mapped locations and with spectral profiles; the design is interventional rather than observational; the effect was present in every exposed subject at the end of the exposure; the control group was concurrent and showed no change; and the seasonal trend ran against the finding, since natural daylight was decreasing across the study period while measured performance improved. A confounder that would bias an observed effect toward the null strengthens rather than weakens the inference.

Bearing on the statutory question. The study concerns a property of LED emission that no federal requirement addresses and that the blue light hazard framework does not reach: the absence of long-wavelength content. It is evidence that the spectral composition of general illumination has measurable functional consequences for adults in ordinary working conditions. That is material to whether the Secretary should study and evaluate conditions of exposure to this radiation under § 360ii(a)(4). It is not offered as evidence that a performance standard under § 360kk is presently warranted. Parts V.A, V.B.6 and IX.H.3.

C.2 Dai and others (2026) — nighttime light exposure, cardiac structure and function, and incident cardiovascular disease

Citation. Dai J, Dai W, Heianza Y, Qi L. Nighttime light exposure and cardiac structure and function. European Heart Journal. 2026, advance article ehag563. doi:10.1093/eurheartj/ehag563. Published September 9, 2026.

Design. Prospective population-based cohort study using UK Biobank data, with objectively measured exposure, imaging outcomes, and incident clinical outcomes over eight to ten years of follow-up.

Population. Eleven thousand and seventy-one participants for the cardiac magnetic resonance analyses; between 71,077 and 73,286 for the incident cardiovascular disease outcomes.

Exposure, as measured. Light exposure was measured, not reported by participants. Each wore an Axivity AX3 triaxial accelerometer with an integrated light sensor on the dominant wrist for seven days between 2013 and 2015. Nighttime exposure above 3 lux and daytime exposure above 1000 lux were derived from calibrated measurements integrated with each individual's circadian phase, using the least active five-hour and most active ten-hour periods. The Foundation draws attention to the threshold: 3 lux is a low level, within the range produced by light entering a bedroom from outside.

Outcomes and measurement. Cardiac magnetic resonance imaging performed approximately three years after accelerometry, yielding left ventricular volumes, mass and wall thickness, ejection fraction, myocardial contraction fraction, circumferential, radial and longitudinal strain, and right ventricular and atrial parameters. Secondary outcomes were incident myocardial infarction, stroke, heart failure, atrial fibrillation and cardiovascular mortality.

Adjustment. Models adjusted for age, sex, ethnicity, deprivation, education, employment and urbanicity; physical activity, diet, smoking and alcohol; body mass index, hypertension, dyslipidemia, diabetes, kidney disease and vitamin D; air pollution, photoperiod and

season; and sleep duration. The adjustment set includes the confounders ordinarily raised against studies of artificial light at night, namely urbanicity, deprivation, air pollution and season.

Result — cardiac structure and function. For high versus no nighttime light exposure above 3 lux, after multivariable adjustment: 2.4 percent (95% CI 1.6, 3.1) greater left ventricular mass indexed to height; 1.5 percent (1.0, 2.0) greater mean wall thickness; 1.9 percent (1.1, 2.7) lower myocardial contraction fraction. Global left ventricular strain was impaired in all three directions: circumferential −2.7 percent (−3.7, −1.7), radial −2.9 percent (−3.9, −1.8), longitudinal −2.8 percent (−3.9, −1.7). Right ventricular end-diastolic volume was 0.9 percent (0.1, 1.8) and end-systolic volume 1.6 percent (0.5, 2.8) greater; left atrial maximum volume 2.3 percent (0.7, 3.9) greater and ejection fraction 1.1 percent (0.3, 1.9) lower.

Result — incident disease. Over eight to ten years of follow-up, participants with high versus no nighttime light exposure had a 29 percent (12, 49) higher risk of heart failure, 15 percent (4, 27) higher risk of atrial fibrillation, 24 percent (7, 44) higher risk of myocardial infarction, 33 percent (11, 59) higher risk of stroke, and 26 percent (5, 52) higher risk of cardiovascular mortality.

Dose-response and mediation. The authors report that all associations exhibited linear dose-response relationships, visualized with restricted cubic splines, and that most were partly mediated by shorter sleep duration, with 24 to 49 percent of the effect mediated on formal causal mediation analysis.

Conclusion, in the authors' words. "Greater nighttime light exposure was associated with adverse cardiac remodelling and subclinical functional decline across multiple chambers, statistically mediated by shorter sleep duration. These findings provide potential mechanistic insights into how nighttime light exposure may elevate CVD risk and highlight dark nights and adequate sleep for cardiovascular health."

What it establishes. That objectively measured exposure to light at night, at levels above 3 lux, is associated in a large cohort with adverse cardiac remodeling on imaging and with incident cardiovascular disease and cardiovascular mortality, with a linear dose-response relationship and a partially identified pathway through sleep duration.

What it does not establish. It is observational and cannot establish causation, as the authors state by describing associations. Residual confounding cannot be excluded. The exposure measured is ambient light at the wrist from any source; the study does not isolate light-emitting diode sources, does not characterize the spectral content of the light, and makes no claim about lighting technology. Light exposure was sampled over seven days and treated as representative of a longer period. The cohort is predominantly of one national population and is not representative of the United States.

Considerations bearing on confidence. Against: observational design; residual confounding; no spectral characterization; exposure sampled over one week. In favor: exposure was measured by instrument rather than reported, which removes recall bias; the sample is large; adjustment included urbanicity, deprivation, air pollution, photoperiod and season; a linear dose-response relationship was observed; imaging findings and clinical endpoints point the same way, which is internal coherence rather than a single result; the effect sizes on hard outcomes are substantial; and a mediating pathway was identified and quantified. Magnitude of effect and dose-response gradient are recognized grounds for increased confidence in observational evidence.

Bearing on the statutory question. The Foundation is careful here. This study is about light at night, not about light-emitting diodes, and it cannot be cited for a proposition about LED products as such. What it supports is narrower and still material: that ambient light at night at low levels is associated with serious cardiovascular outcomes, and therefore that

the conditions of exposure to artificial light at night are a proper subject of federal study. Light-emitting diode sources are now the dominant contributors to that exposure in the United States, for the reasons set out at Part IV.G.3, and nothing in the federal framework measures what any person actually receives. Parts II.F, V.F and IX.H.3.

C.3 Guo and others (2026) — global population exposure to outdoor artificial light at night

Citation. Guo W, Liu J, Kyba CCM, Zhao X, Cui X, Zhang Y, Lu D, Rienow A. Global trends in population exposure to outdoor artificial light at night and future projections. Environment International. 2026 Aug;214:110371. doi:10.1016/j.envint.2026.110371. PMID 42314476.

Design. Exposure assessment and projection study. Two satellite radiance datasets were merged into a single consistent time series and combined with gridded population data; future exposure was projected under Shared Socioeconomic Pathways scenarios.

Scope. Global, with the observed period running from 2000 to 2020 and projections to 2050.

Exposure measure. Outdoor artificial light at night, measured as upward radiance detected by satellite, classified into emission bands and intersected with population distribution to yield numbers of people exposed at each level.

Results. The population exposed to outdoor light emissions rose from 4.3 billion in 2000 to 6.3 billion in 2020. Eighty-eight percent of that growth occurred in areas of medium to high emission. In high-emission areas, predominantly urban, 73 percent of the increase was attributable to population growth and migration. In medium-emission areas, predominantly suburban, increased radiance accounted for the larger share at 63 percent. By 2050 nearly 70 percent of further growth is projected to occur in medium to high emission areas.

Conclusion, in the authors' words. "Exposure to artificial light at night (ALAN) is a form of environmental change, and is associated with disease in epidemiological studies… Preparation for potential increased disease burden and actions to reduce light growth are therefore advisable."

What it establishes. That exposure of the human population to outdoor artificial light at night has grown substantially and measurably over two decades, that the growth is quantifiable and has been quantified, that its drivers can be decomposed into population movement and increased emission, and that it is projected to continue.

What it does not establish. It is not a health study and reports no health outcome of its own. Satellite radiance measures light radiated upward and is a proxy for ground-level human exposure rather than a measurement of it. It describes outdoor light only and does not address interior exposure. It does not identify the technology producing the light and makes no statement about light-emitting diodes as such.

Considerations bearing on confidence. This is an exposure assessment rather than an effect estimate, and the appropriate question is accuracy rather than bias. Against: proxy measurement; the merging of two sensor records into one time series requires cross-calibration assumptions; projections depend on scenario choice. In favor: the data are instrumental and global rather than sampled or self-reported, the period is long, and the decomposition of growth into migration and radiance components is a check on the result rather than an assumption of it.

The construction of the series, and what rests on measurement. Real Visible Infrared Imaging Radiometer Suite day-night band composites are available from 2012. The values for 2000 to 2011 are not measurements. They are simulated day-night band data generated from Defense Meteorological Satellite Program Operational Linescan System imagery by a variational autoencoder, trained on a nighttime light enhancement index that combines that imagery with

the Moderate-resolution Imaging Spectroradiometer vegetation index to mitigate the saturation of the older sensor. The merged series accordingly inherits the spectral limitations of both instruments, and for more than half of the observed span it is a deep-learning reconstruction rather than an observation. The 2020 cross-section rests on instrument data; the two-decade trend does not, at its earlier end.

The authors' own statement that their figures are a floor. Among the limitations the authors record that both sensors have "limited sensitivity to short-wavelength (blue) light below 500 nm, which is the spectral range most strongly associated with non-visual physiological effects such as circadian disruption"; that blue-rich emission has increased substantially with the adoption of solid-state lighting; that satellite radiance therefore underestimates both the visual and the non-visual exposure burden, especially where the conversion to light-emitting diode lighting is rapid; and that "the ALAN exposure estimates presented in this study should be interpreted as conservative lower-bound estimates, and the actual environmental and biological light burden may be greater than indicated by satellite observations alone". This is the concession that matters most in the entry, and it is used at Part V.J.4. It means the exposure figures above are a floor rather than an estimate.

A second limitation the authors state, which cuts the other way. The conversion to light-emitting diode lighting is commonly accompanied by improved shielding and a changed angular distribution of emission, which reduces direct uplight. The authors state that this may weaken the relationship between ground-level illumination and satellite-observed upward radiance and introduces further uncertainty into long-term trend analysis. The consequence is that this record cannot establish the direction of the ground-level trend: better shielding at constant or rising ground illuminance would appear in these data as a reduction, and so would a real reduction. The comment states this at Part V.J.4 rather than leaving it to a reader.

Figures for the United States and other developed countries. The authors report that in the developed countries where the projected change is smallest, the United States among them, the present proportion of the population exposed is already very high, with 70 percent exposed to high light emissions and more than 90 percent exposed to at least low light emissions. Those are the figures of most direct relevance to this Department and they are given in the discussion of the projection figure rather than in a table of national results.

The classification, and a caution about it. The four exposure bands are the authors' own, constructed to "broadly match" the environmental lighting zones of the International Commission on Illumination. The thresholds were set empirically from the distribution of the authors' light emissions index within urbanization categories: the boundary between low and medium at the 75th percentile for rural areas and between medium and high at the 25th percentile for urban areas. The corresponding radiance ranges are given as zero for the combined E0 and E1 bands, 0 to 1.56 for E2, 1.56 to 5.89 for E3 and 5.89 to 100 nanowatts per square centimeter per steradian for E4, with values above 100 capped. The comment must not present those radiance figures as the Commission's own definitions of its zones, because they are not: they are this study's approximation to them. The zones themselves are the same scheme the billboard material at Part VI.J.6 encounters in another setting.

A table in the paper the comment does not use. The discussion reproduces a table of hazard ratios for sleep disorder, breast cancer, coronary heart disease and type 2 diabetes mellitus, compiled from four other studies. The Foundation does not rely on it, for three reasons. It is secondary, and the underlying studies are better cited directly, as this appendix does elsewhere. Several of the intervals include no effect. And the table's own footnote asserts that the higher the neighborhood emissions the greater the risk of disease, which the table does not show: the sleep disorder row rises to 1.43 at the third quintile and then falls to 1.31 and 1.25, so the series is not monotonic. The Foundation records the overstatement rather than repeating it.

Funding, interests and two defects of the published record. Funded by the National Natural Science Foundation of China, grants 42571426 and 52274169. The authors declare no

competing financial interests or personal relationships. Two defects should be noted because the comment relies on this paper. The data availability statement gives, for the simulated day-night band dataset on which the earlier half of the series rests, a Harvard Dataverse private URL carrying an access token rather than a published digital object identifier; a tokenized private link is not a public dataset and may not resolve. And the contribution statement for the third author is empty. Neither affects the findings; both affect what can be said about verifiability and should be checked against the final published version.

Bearing on the statutory question. Paragraph 360ii(a)(2) directs the Secretary to minimize the emissions of and the exposure of people to unnecessary electronic product radiation. This study is a measurement of that exposure and of its trend, performed by academic researchers and published in a peer-reviewed journal, with an express recommendation that action be taken to reduce it. No federal counterpart exists, and no federal baseline exists against which the minimization duty could be assessed. Parts II.D, V.J and IX.H.3.

C.4 Li and others (2026) — bedroom nighttime light and hepatic encephalopathy in hepatocellular carcinoma

Citation. Li S, Zhang S, Li S, Meng T, Feng H. Association between bedroom nighttime light pollution and risk of hepatic encephalopathy in hepatocellular carcinoma patients: a prospective cohort study. Scientific Reports. 2026;16:20417. doi:10.1038/s41598-026-51269-5. Published May 2, 2026. Department of Hepatobiliary and Pancreatic Surgery, First Affiliated Hospital of Xinxiang Medical University, Henan, China.

Design. Prospective cohort study with twelve months of follow-up.

Population. Four hundred and fifty-four patients with hepatocellular carcinoma and compensated cirrhosis, recruited from communities in one city in Henan Province between July 2021 and June 2024, from 477 enrolled. Inclusion required age 18 or over, no prior anti-tumor treatment, and stable nighttime sleep patterns. One hundred and ninety-three were assigned to the exposed group and 261 to the comparison group.

Exposure, as measured. Bedroom nighttime light intensity measured directly with a portable illuminometer between 23:00 and 04:30, at baseline, two months and four months. The three measurements were averaged, and a mean above 50 lux defined the exposed group. Sleep quality was assessed at the same three points using the Pittsburgh Sleep Quality Index.

Outcomes. Overt and minimal hepatic encephalopathy as primary outcomes; liver function markers, esophagogastric variceal rupture and disease-related mortality as secondary outcomes.

Adjustment. Age, body mass index, household income, baseline tumor characteristics including intrahepatic metastasis and capsule invasion, treatment received, dietary intake and exercise duration.

Results. Mean bedroom light above 50 lux was associated with an approximately one- to threefold increased risk of overt and minimal hepatic encephalopathy, and a 1.7- to twofold increased risk of liver function deterioration, variceal rupture and disease-related death. On Cox regression the authors report a 1.9- to 2.7-fold elevated risk of overt hepatic encephalopathy, variceal rupture and death. Reported p values include $p < 0.001$ for overt hepatic encephalopathy, $p = 0.003$ for new-onset minimal hepatic encephalopathy, $p = 0.027$ for variceal rupture and $p = 0.001$ for death. Interaction analyses indicated modification by age of 60 or over and by TNM stage.

What it establishes. Within this clinical population, an association between directly measured bedroom light at night above 50 lux and a set of adverse hepatic outcomes, with consistent direction across several endpoints. Separately and independently of its findings, it

establishes that repeated direct measurement of an individual's nighttime optical exposure is practicable and inexpensive.

What it does not establish. It does not establish causation and does not support extrapolation to the general population. The cohort consists of patients with hepatocellular carcinoma and cirrhosis, in whom hepatic encephalopathy is a complication of the underlying disease. The threshold of 50 lux is more than an order of magnitude above the 3 lux threshold at which the cohort study at Appendix C.2 found effects, so the two are not measuring the same exposure range.

Considerations bearing on confidence. Against, and substantially so. First and most seriously, reverse causation is plausible and is not addressed: hepatic encephalopathy produces sleep-wake inversion, confusion and nocturnal disturbance, so a patient in whom the condition is developing may acquire more bedroom light at night through nocturia, caregiver presence or disorientation, rather than the light producing the condition. The exposure measurements at baseline, two and four months give some temporal ordering but do not exclude subclinical disease preceding them. Second, the adjustment set omits variables ordinarily required in studies of light at night, including urbanicity, ambient noise, air pollution and socioeconomic position beyond household income. Third, the sample is small and drawn from a single city. Fourth, the principal effect estimates are reported as ranges rather than as point estimates with confidence intervals. Fifth, the authors acknowledge that no circadian markers such as melatonin or cortisol were measured and no mechanistic work was undertaken. In favor: the exposure was measured in each participant's own bedroom rather than modeled or reported, repeatedly; the design is prospective; the direction of association is consistent across several distinct endpoints; and the authors state their limitations candidly.

Bearing on the statutory question. The Foundation offers this study for two limited purposes and expressly not for a third. It is offered as one further observation, in a different population and on different endpoints, pointing in the same direction as the literature at Appendix C.2; and it is offered at Part V.J for the proposition that direct measurement of individual nighttime optical exposure is practicable, inexpensive and has been done. It is not offered as evidence that light at night causes disease in the general population, and it would not support that proposition.

C.5 Chen and others (2026) — outdoor artificial light at night and incident ulcerative colitis

Citation. Chen J, Li L, Ran Y, Sun Z, Lu S, Zhuang Y, Wang L, Sun Y, Dai F. Exposure to outdoor artificial light at night is associated with a higher risk of ulcerative colitis: a prospective cohort study from the UK Biobank. Frontiers in Public Health. 2026;14:1704450. doi:10.3389/fpubh.2026.1704450. Published January 30, 2026. Department of Gastroenterology, Second Affiliated Hospital of Xi'an Jiaotong University, and Shaanxi Province Key Laboratory of Gastrointestinal Motility Disorders, China.

Design. Prospective cohort study using the UK Biobank, original research article. Cox proportional hazards regression across four nested models, with restricted cubic splines for non-linearity, and subgroup and sensitivity analyses.

Population. Three hundred and forty-six thousand one hundred and sixty-three participants, mean age 56.15 years, 52.2 percent female, followed for a mean of 13.71 years. One thousand one hundred and six incident ulcerative colitis diagnoses and 508 incident Crohn's disease diagnoses.

Exposure, as assigned. Outdoor artificial light at night derived from satellite datasets in units of nanowatts per square centimeter per steradian, matched to each participant's residential coordinates within a 1,000-meter buffer.

Outcome ascertainment. Incident inflammatory bowel disease identified by diagnostic codes from hospital admission records, primary care records and self-report.

Adjustment. Age, sex, race, education, Townsend Deprivation Index, physical activity, diet, smoking, alcohol, sleep duration, body mass index, grip strength, waist-to-hip ratio, and history of psychiatric disorder, thyroid disease, hypertension and diabetes.

Results. Each standard deviation increment of outdoor exposure was associated with an 8 percent higher risk of incident ulcerative colitis (HR 1.084, 95% CI 1.023–1.149, $p < 0.001$). The highest exposure level carried a 31 percent higher risk than the lowest (HR 1.309, 95% CI 1.12–1.529, $p < 0.001$). The association was non-linear (p for non-linearity 0.0063) and was stronger in women than in men. No significant association was found with Crohn's disease (HR 1.044, 95% CI 0.83–1.308, $p = 0.71$).

What it establishes. An association, in a very large prospective cohort with long follow-up and record-based outcome ascertainment, between satellite-assessed outdoor light at night at the residence and incident ulcerative colitis, with a dose-response relationship.

What it does not establish. Causation. Nor anything about which wavelengths or which light sources are implicated: the authors state expressly that wavelength-specific effects could not be differentiated. The exposure is not a measurement of what any participant received.

Considerations bearing on confidence. Against: the exposure measure is ecological, describing light radiated upward from the neighborhood of residence rather than light reaching the person, and the authors acknowledge that indoor and device exposure is not captured; outdoor light at a residential address is strongly correlated with urbanicity, for which the Townsend index is an imperfect proxy; the effect sizes are modest, and modest hazard ratios are the ones most vulnerable to residual confounding; the cohort is a volunteer sample with known healthy-volunteer selection; several covariates were self-reported; and green space, blue space and noise were not fully accounted for. In favor: very large sample; long follow-up; prospective design with record-based outcomes rather than self-report; extensive adjustment; a demonstrated dose-response relationship; and an internal contrast that bears on confounding, in that ulcerative colitis and Crohn's disease share the urban and socioeconomic distribution but only ulcerative colitis showed the association. A confounder operating through urbanicity would be expected to move both. That contrast is evidence, though not proof, that the finding is not simply a map of where cities are.

Bearing on the statutory question. The Foundation offers this study as one of a set of large-cohort findings associating light at night with disease across unrelated organ systems, and chiefly for the limitation its authors identify. A study of this size and quality that cannot say which wavelengths are implicated demonstrates the measurement gap described at Part V.J.4. That gap is the reason the existing literature cannot by itself support a performance standard, and it is what 21 U.S.C. § 360ii(a)(4) directs the Secretary to close. Parts V.J.4 and IX.H.3.

C.6 Spitschan and others (2026) — expert consensus on research gaps and priorities for ocular light exposure

Citation. Spitschan M, Biller AM, Broszio K, Fischer E, Hegewald J, Rabstein S, Saathoff E, Smolders K, Thalji SM, Weigelt S, Weiskopf D, Zauner J. Ocular light and optical radiation exposure as a modifiable environmental determinant of health: expert consensus on research gaps and priorities. BMC Medicine. 2026;24(1):119. doi:10.1186/s12916-025-04608-8. Published January 29, 2026. PMID 41612386. PMCID PMC12924618. Open access under CC BY.

Article type. Consensus statement and review, not primary research. The Foundation cites it as evidence of the state of expert opinion and of the identified gaps, in accordance with the rule at Part V.A.2, and not as evidence of any health effect.

Method. A multi-disciplinary consensus workshop and expert consultation process with thirteen experts drawn from academia, public health, radiation protection and occupational health institutions, conducted as an in-person and hybrid meeting followed by iterative refinement, feedback and a stated agreement and consensus procedure.

Outputs. Nine identified research gaps, grouped under exposure measurement and estimation, health outcomes and mechanistic understanding, interventions and implementation, and infrastructure, data sharing and integration; eleven research priority areas; and four cross-cutting capacity-building priorities covering global research networks, cross-sector collaboration, communication and policy engagement.

The nine gaps, as stated. Lack of standardized measurement tools; inadequate exposure estimation infrastructure; lack of consistent exposure descriptors and metrics; absence of core outcome standards; limited dose-response evidence; limited evidence on intervention effectiveness; poor characterization of globally representative and vulnerable populations; fragmented data harmonization and sharing; and limited integration of non-visual effects of light into public health frameworks.

What it establishes. That a multi-disciplinary expert group, including radiation protection and occupational health specialists, considers ocular light exposure to be a modifiable environmental determinant of health; that the field in its assessment lacks coordinated research infrastructure, standardized methodology and translational pathways; and that nine specific gaps require a coordinated research program to close.

What it does not establish. Any health effect. It is a statement of expert opinion about research priorities, arrived at by deliberation rather than by experiment, and it reports no data of its own. A consensus process reflects the composition of the panel convened, and a different panel might order the priorities differently.

Considerations bearing on confidence. Against: a consensus statement is not primary evidence; the panel is small at thirteen and predominantly European; the process is described but its outputs remain judgments. In favor: the panel is multi-disciplinary and includes radiation protection and occupational health institutions rather than lighting researchers alone; the method, participants and agreement procedure are described in the paper; it is published in a peer-reviewed general medical journal and is openly available; and it is independent of this Foundation and of this proceeding.

Bearing on the statutory question. This is the most directly responsive document in this appendix to the question the request for information asks. An independent expert body has set out what research is needed on optical radiation exposure as a determinant of health, and the agenda it describes corresponds, gap by gap, to the duties that 21 U.S.C. § 360ii already imposes on the Secretary. The Foundation relies on it to show that the research it asks for is not idiosyncratic, is not the Foundation's invention, and is regarded by specialists in the field as necessary. Parts V.J.4, V.K, IX.H.3 and IX.H.6.

C.7 Quinn and others (2025) — wavelength-resolved outdoor light at night and breast cancer risk

Citation. Quinn EK, Parks J, Gagné T, McLeod CB, Peters CE, Shen-Tu G, Vena J, Aubé M, Bhatti P. Wavelength-resolved measures of outdoor artificial light at night and breast cancer risk. Environment International. 2025 Nov;205:109871. doi:10.1016/j.envint.2025.109871. PMID 41135428.

Design. Pooled analysis of two prospective cohort studies, baseline 2009 to 2016. Cox proportional hazards regression adjusted for breast cancer risk factors and built environment features.

Population. Twenty-four thousand seven hundred and ninety-three female participants, with 674 incident breast cancer cases.

Exposure, and why it is the point of this entry. Outdoor light at night at residential addresses was estimated from photographs taken from the International Space Station between 2011 and 2013, at approximately 30-meter spatial resolution. Because those images carry color information, three measures were derived rather than one: average visual radiance, that is brightness; an average melatonin suppression index, weighting the exposure by the extent to which its spectral composition suppresses melatonin; and the product of the two, termed average impact melatonin suppression index. This is the only study in this appendix in which the spectral composition of the exposure was retained rather than discarded.

Outcome. Incident breast cancer, with exploratory analyses by subtype, including invasive ductal, luminal A and postmenopausal disease, and among participants self-reporting light entering their rooms while sleeping.

Results. No statistically significant associations were observed in the overall study population. Among women reporting light entering their rooms, statistically significant associations of average impact melatonin suppression index with breast cancer risk were observed overall and across each subtype. Those in the highest versus lowest tertile of average impact had a 1.53-fold increased hazard of overall breast cancer (95% CI 1.18 to 1.98).

Conclusion, in the authors' words. "Our findings suggest that outdoor ALAN is associated with increased risk of breast cancer and that both intensity and wavelength of light should be considered when evaluating ALAN exposures."

What it establishes. Principally a methodological proposition, and the Foundation relies on it for that: that a spectrally weighted measure of outdoor light exposure can be derived from available imagery, that it has been derived, and that it did not return the same answer as the conventional brightness measure applied to the same population. Secondarily, a subgroup association between that measure and breast cancer among women reporting light in their sleeping rooms.

What it does not establish. That outdoor light at night causes breast cancer. The primary analysis was null. The association arises in a subgroup defined by self-report, in analyses the authors describe as exploratory.

Considerations bearing on confidence. Against, and the Foundation states these first. The overall result was null, and the positive finding is confined to a self-reported subgroup; subgroup findings among several exposure measures and several disease subtypes carry a substantial risk of false positive, and no adjustment for multiple comparison is apparent from the abstract. The subgroup is defined by self-report of light entering the room, which is not a measurement and may correlate with other exposures. Outdoor light at a residence remains a proxy for personal exposure. The imagery dates from 2011 to 2013 while cohort baselines run from 2009 to 2016, so exposure is assigned from a period that does not align with each participant's entry. In favor: the pooled sample is substantial; the design is prospective with incident cases; adjustment included built environment features as well as conventional risk factors; the exposure derivation is a methodological advance on the satellite products used elsewhere in this literature; and the internal contrast between the brightness measure and the spectrally weighted measure is a comparison within one population rather than across studies.

Bearing on the statutory question. This entry supports the argument at Part V.J.4 and at Part IV.G.4 that the measurand matters. Federal lighting policy selects on a photometric quantity; the epidemiology overwhelmingly measures exposure in photometric or broadband units; and the single study that weighted exposure by spectral composition found that the weighting changed the result. Whether the particular association replicates is unresolved, and resolving it is work that 21 U.S.C. § 360ii(a)(2) and (a)(4) assign to the Secretary. Parts V.F, V.J.4 and IX.H.3.

C.8 Windred and others (2025) — light exposure at night and cardiovascular disease incidence

Citation. Windred DP, Burns AC, Rutter MK, Lane JM, Saxena R, Scheer FAJL, Cain SW, Phillips AJK. Light Exposure at Night and Cardiovascular Disease Incidence. JAMA Network Open. 2025 Oct 1;8(10):e2539031. doi:10.1001/jamanetworkopen.2025.39031. PMID 41129148. PMCID PMC12550636. Open access. Supported in part by the National Institutes of Health. Previously posted as a preprint, Personal night light exposure predicts incidence of cardiovascular diseases in more than 88,000 individuals, medRxiv, June 20, 2025, doi:10.1101/2025.06.20.25329961. The preprint and the published article report the same cohort, the same exposure data and the same analysis, and are one study. The Foundation cites the published version and does not count the preprint separately. Part V.A.1.

Design. Prospective cohort study. Cox proportional hazards models at three levels of adjustment. Cardiovascular disease records across 9.5 years, June 2013 to November 2022.

Population. Eighty-eight thousand nine hundred and five individuals from the UK Biobank, mean age 62.4 years (SD 7.8), 56.9 percent female.

Exposure, as measured. Approximately 13 million hours of light exposure data recorded by wrist-worn light sensors over one week per participant in a naturalistic setting, categorized into the 0 to 50th, 51st to 70th, 71st to 90th, and 91st to 100th percentiles.

Outcomes. Incident coronary artery disease, myocardial infarction, heart failure, atrial fibrillation and stroke, derived from National Health Service records after the period of light tracking.

Adjustment. Established cardiovascular risk factors including physical activity, smoking, alcohol, diet, sleep duration and socioeconomic status, and additionally polygenic risk.

Results. Comparing the brightest nights (91st to 100th percentiles) with dark nights (0 to 50th): coronary artery disease adjusted HR 1.32 (95% CI 1.18–1.46); myocardial infarction 1.47 (1.26–1.71); heart failure 1.56 (1.34–1.81); atrial fibrillation 1.32 (1.18–1.46); stroke 1.28 (1.06–1.55). Larger associations in females for heart failure (p for interaction .006) and coronary artery disease (.02), and in younger participants for heart failure (.04) and atrial fibrillation (.02).

Conclusion, in the authors' words. "In this cohort study, night light exposure was a significant risk factor for developing cardiovascular diseases among adults older than 40 years. These findings suggest that, in addition to current preventive measures, avoiding light at night may be a useful strategy for reducing risks of cardiovascular diseases."

What it establishes. An association, in a large cohort with instrument-measured exposure and record-based outcome ascertainment over 9.5 years, between light exposure at night and the incidence of five distinct cardiovascular conditions, robust to adjustment for conventional risk factors and for polygenic risk, with larger associations in women and in younger participants.

What it does not establish. Causation. Nor anything about which wavelengths or which sources are implicated: the sensor records illuminance, and Part V.J.4 applies. Nor does it establish that the finding generalizes beyond the UK Biobank, for the reason given below.

Relationship to Appendix C.2. This entry and the entry at C.2 are not independent. Both analyze the UK Biobank and both derive exposure from the same wrist-worn light sensor data; the participants substantially overlap. They differ in outcome set, in sample, and in analytic approach, and C.2 adds cardiac magnetic resonance phenotypes that this study does not examine. The Foundation relies on the pair for coherence between subclinical

imaging findings and clinical event findings within one population, and expressly not as two independent replications. Part V.F.

Considerations bearing on confidence. Against: observational, so residual confounding cannot be excluded; exposure sampled over one week and treated as representative; no spectral characterization; the UK Biobank is a volunteer cohort with known healthy-volunteer selection and is not representative of the United States population; and the dependence of this literature on a single cohort limits what can be inferred about generalizability. In favor: large sample; long follow-up; exposure measured by instrument rather than reported or modeled, over approximately 13 million hours; outcomes from national health records rather than self-report; adjustment including polygenic risk, which addresses genetic confounding directly rather than by assumption; consistent direction and substantial magnitude across five distinct conditions; a graded exposure categorization; and an author group of established standing in circadian science.

Bearing on the statutory question. Paragraph 360ii(a)(2) directs the Secretary to minimize the exposure of people to unnecessary electronic product radiation. The authors of this study, on the largest instrument-measured dataset available, conclude that avoiding light at night may be a useful strategy for reducing cardiovascular risk. That is a statement that the exposure is modifiable and that modifying it may matter, which is the premise on which the minimization duty operates. What the study cannot supply, and what no study of this design can supply, is the specification of which emission to limit. Parts V.J.4 and IX.H.3.

C.9 Yang and others (2025) — outdoor light at night, DNA methylation, and lipid control

Citation. Yang L, Wang Q, Zheng H, Wang Y, Miao Z, Li H, Yang Y. Association between outdoor artificial light at night, circadian health, and LDL-C in intracranial artery atherosclerotic stenosis. Clinical Epigenetics. 2025;17(1):132. doi:10.1186/s13148-025-01938-5. Published July 28, 2025. PMID 40722184. PMCID PMC12302883. Open access.

Design. Two components. An observational analysis of patients with intracranial artery atherosclerotic stenosis, using generalized additive models, with residential outdoor light at night estimated from satellite imagery and sleep quality assessed by validated questionnaire. And an animal experiment using untargeted metabolomics and DNA methylation analysis.

Population, human arm. One thousand and ten patients with intracranial artery atherosclerotic stenosis, of whom 32 were classified as having poor low-density lipoprotein cholesterol control after three months of management.

Results, human arm. An association between outdoor light intensity and poorer lipid control, odds ratio 1.02 (95% CI 1.00 to 1.05) per unit increase in radiance. Sensitivity analyses were reported as supporting the stability of the association.

Results, animal arm. Dim light at night promoted global hypomethylation in mice. Melatonin treatment partially counteracted that effect, without reducing the stress response. Metabolic profiling indicated that light at night may regulate lipid metabolism through effects on ATP-binding cassette transporter proteins.

What it establishes. In the animal arm, that an exposure to dim light at night produces a measurable change in genomic methylation, and that administering melatonin partially reverses it. That is a mechanistic result of a different kind from the physiological results elsewhere in this appendix, and the Foundation relies on it as such.

What it does not establish. Nothing of weight in the human arm, and the Foundation declines to rely on that arm. Nothing about humans from the animal arm. The animal exposure is

described as dim light at night without a spectral or photometric characterization in the abstract, so the dose cannot be compared to any human exposure.

Considerations bearing on confidence. Against, as to the human arm, and decisively. The outcome occurred in 32 of 1,010 patients, which is a very small number of events on which to fit an adjusted model; the odds ratio is 1.02 per unit and its confidence interval extends to 1.00, so the result sits at the boundary of conventional significance; the exposure is satellite radiance at the residence and is a proxy for personal exposure; the population is narrow and under active clinical management; and lipid control is in part a function of medication adherence, which may itself vary with the urban and socioeconomic characteristics that covary with residential light. Against, as to the animal arm: species difference, and an exposure that is not characterized in terms that permit comparison. In favor, as to the animal arm: it is experimental rather than observational, the exposure was administered rather than observed, and the melatonin condition functions as a mechanistic test rather than a control alone, since partial reversal by the hormone whose secretion light suppresses is what the hypothesized pathway predicts.

Bearing on the statutory question. The Foundation offers this entry for one proposition only: that the biological effects of light at night under investigation extend to the epigenome, and that the pathway through melatonin is testable and has been tested in an animal model. Whether any comparable effect occurs in humans at the exposures they receive is unknown. Paragraph 360ii(a)(2) directs the Secretary to plan, conduct, coordinate and support research, and paragraph 360ii(a)(4) to study and evaluate conditions of exposure. An open mechanistic question of this kind is what those paragraphs are for. Parts V.F and V.K.

C.10 Ding and others (2025) — personal 24-hour light exposure and adiposity in school-aged children

Citation. Ding W, Li Q, Zhou Y, Xu Y, Wan Y, Tao F, Sun Y. Personal 24-hour light exposure pattern with obesity and adiposity-related parameters in school-aged children: A cross-sectional study based on compositional data analysis. Environmental Research. 2025 Jun;275:121422. doi:10.1016/j.envres.2025.121422. PMID 40118310.

Design. Cross-sectional study. Exposure and outcome measured contemporaneously. Analysis by compositional data analysis, which is the appropriate method for time-use data whose components sum to a fixed total.

Population. Eight hundred and thirty-one school-aged children recruited in Chuzhou, Anhui Province, China, mean age 8.53 years (SD 0.62).

Exposure, as measured. Personal 24-hour light exposure recorded over five days by wearable sensor, divided into four measures: light at daytime at or above 100 lux and below 100 lux, and light at night at or above 1 lux and below 1 lux. Measured exposure averaged 490.1 minutes (SD 92.7) per day at or above 100 lux in daytime, and 311.2 minutes (SD 98.5) per night at or above 1 lux.

Outcome. Adiposity-related parameters measured by body composition analyzer, with percentage body fat as the reported parameter.

Results. An increase of one percent in the proportion of time spent in daytime light at or above 100 lux, equivalent to 14.4 minutes per day, was associated with a 3.10 percent decline in percentage body fat. An additional 14.4 minutes per day at or above 1 lux at night was associated with a 3.49 percent increase. Both at p less than 0.01. The associations were reported as robust in boys after stratification by sex. The compositional analysis estimated that reducing time above 1 lux at night had more influence on the odds of childhood overweight and obesity than increasing daytime light.

What it establishes. Principally an exposure measurement, and the Foundation relies on it for that. The nocturnal light exposure of school-aged children was measured directly, by wearable instrument, over five days, and found to average more than five hours per night at or above 1 lux.

What it does not establish. Any causal relationship between light exposure and body composition. The design is cross-sectional and cannot establish temporal order.

Considerations bearing on confidence. Against, as to the associations. The cross-sectional design is the governing weakness: exposure and adiposity were measured at the same time, and reverse causation is at least as plausible as the hypothesized direction, since a heavier child may spend less time outdoors in daylight and more time indoors under artificial light in the evening. The sample is from a single city. Exposure was sampled over five days. The report that associations were robust in boys implies that they were not in girls, and a sex-stratified inconsistency of that kind requires explanation. The adjustment set is not stated in the abstract. In favor, as to the exposure measurement: the light data are personal and instrumental rather than ambient or modeled; the measurement period covers the full 24-hour cycle rather than night alone; and compositional data analysis is the methodologically correct treatment of time-use data, which many studies in this field do not use.

Bearing on the statutory question. Two matters. First, children are among the populations identified at Part VII and are repeatedly named in this field as a priority for research in which evidence is sparse. Part V.L. Second, and more directly, this study is a measurement of the conditions of exposure of a defined population to optical radiation, which is what 21 U.S.C. § 360ii(a)(4) directs the Secretary to study and evaluate. It was performed in China. The Foundation is aware of no equivalent measurement of the nocturnal optical exposure of children in the United States, and invites the Department to identify one if it exists. Parts V.J, V.K and IX.H.3.

C.11 Deziel and others (2025) — perinatal exposure to outdoor light at night and pediatric papillary thyroid cancer

Citation. Deziel NC, Wang R, Warren JL, Dinauer C, Ogilvie J, Clark CJ, Zhong C, Wiemels JL, Morimoto L, Metayer C, Ma X. Perinatal Exposures to Ambient Fine Particulate Matter and Outdoor Artificial Light at Night and Risk of Pediatric Papillary Thyroid Cancer. Environmental Health Perspectives. 2025;133(5):57026. doi:10.1289/EHP14849. PMID 40209106. PMCID PMC12121722. Open access. Environmental Health Perspectives is the journal of the National Institute of Environmental Health Sciences, National Institutes of Health, Department of Health and Human Services.

Design. Case-control study nested within a California birth cohort, with logistic regression adjusted for potential confounders and stratified by age and by race and ethnicity.

Population. Seven hundred and thirty-six cases of papillary thyroid cancer diagnosed between 0 and 19 years of age in children born between 1982 and 2011, and 36,800 controls frequency-matched on birth year.

Exposure, as assigned. Individual-level exposures assigned for residence at birth. Fine particulate matter from a validated ensemble-based prediction model. Outdoor artificial light at night from the New World Atlas of Artificial Night Sky Brightness.

Results. For outdoor light at night, significantly increased odds of papillary thyroid cancer in the higher exposure tertiles against the reference tertile: tertile 2, odds ratio 1.25 (95% CI 1.04 to 1.50); tertile 3, 1.23 (1.02 to 1.50); and modeled continuously, 1.07 per 1 mcd/m2. In age-stratified analysis the associations were significant in the 15 to 19 year group but not in the 0 to 14 year group. No significant differences by race or ethnicity. For fine particulate matter, odds ratio 1.07 per 10 micrograms per cubic meter (1.01 to 1.14) overall.

What it establishes. An association, in a large case-control study with individual-level exposure assignment, between outdoor artificial light at night at the residence of birth and pediatric papillary thyroid cancer.

What it does not establish. Causation, and the authors are explicit about the reason. They state that outdoor light at night may also serve as a proxy for other outdoor air pollutants or for urbanization, and conclude that further research and refinements to exposure metrics are needed to disentangle these factors. The Foundation reproduces that caution rather than omitting it.

On the phrase environmental carcinogen. The study's statement of objectives describes both exposures as considered environmental carcinogens. That is a characterization of how the exposures are regarded in the literature, offered as the rationale for the investigation. It is not a finding of this study and it is not a regulatory classification. The Foundation cites it as what it is, and Part II.E.6 sets out the use the Foundation makes of it.

Considerations bearing on confidence. Against: the exposure derives from a modeled atlas of night sky brightness rather than from measurement at the residence, and is assigned at birth for an outcome occurring up to nineteen years later; the authors themselves identify confounding by urbanization and co-pollutants as unresolved; the associations did not show a monotonic gradient across tertiles, since the second and third tertile estimates are close together; and the age-stratified result was confined to the older group. In favor: a large case-control sample with registry-ascertained cases; individual-level rather than group-level exposure assignment; a second exposure analyzed in parallel with an independent evidence base, which permits comparison; and candor from the authors about the proxy problem.

Bearing on the statutory question. The Foundation relies on this entry chiefly for the matter developed at Part II.E.6, which concerns the position of this research relative to the determination of May 24, 2024 and the fact that both originate within this Department. As evidence of risk it is one study with a confounding problem its authors name. As an indication that the question is live within the Department's own research establishment, it is difficult to set aside. Parts II.E.6, V.F and IX.H.3.

C.12 Stewart and Albrecht (2025) — light, the circadian clock, and mood-related behavior

Citation. Stewart D, Albrecht U. Beyond vision: effects of light on the circadian clock and mood-related behaviours. npj Biological Timing and Sleep. 2025;2:12. doi:10.1038/s44323-025-00029-1. Published March 13, 2025. PMID 40092590. PMCID PMC11906358. Open access under CC BY.

Article type. Review article. Not primary research and not a systematic review. The Foundation cites it as a synthesis of the state of the field, in accordance with the rule at Part V.A.1, and not as evidence of any particular effect.

Subject. The relationships between light exposure, the circadian clock, and mood-related behavior, together with the underlying mechanisms and their implications for health.

What it establishes. That the pathway from light exposure through circadian timing to mood is a recognized subject of scientific inquiry with identified mechanisms, sufficiently established to support a review in a journal of the Nature portfolio devoted to biological timing. The authors state that light affects the circadian clock, that the clock regulates daily rhythms of biochemical and physiological processes, and that these ultimately bear on mood and behavior, with jet lag and shift work as the familiar illustrations.

What it does not establish. Any quantitative relationship between a given exposure and a given affective outcome. Nothing about light-emitting diode products, which it does not address. Nothing about the exposures encountered in ordinary domestic or roadway

settings. A narrative review reflects the authors' selection of the literature and does not carry the weight of a systematic review with a registered protocol.

Considerations bearing on confidence. Against: secondary rather than primary; narrative rather than systematic; no stated search strategy or inclusion criteria; two authors. In favor: published in a peer-reviewed journal of the Nature portfolio dedicated to the subject matter; openly available in full under a Creative Commons license, so that the Department can read it and need not rely on the Foundation's characterization; and consistent with the mechanisms described independently at Parts V.F and V.C.

Bearing on the statutory question. The Foundation uses this entry for one purpose, set out at Part V.G.2. The first-hand reports at Part VII describe affective responses to light exposure and cannot establish causation. This literature supplies a recognized biologically plausible route by which such responses could arise. The conjunction of a plausible mechanism with an accumulation of reports is the circumstance in which 21 U.S.C. § 360ii(a)(4) directs study and evaluation, and it is not a circumstance in which anyone should reach a conclusion. Parts V.G, VII and IX.H.3.

C.13 Roddick and others (2024) — near-infrared radiation in ambient lighting, cognition, emotion and heart rate variability

Citation. Roddick CM, Wang Y, Chen FS, Durmus D, Royer MP, Veitch JA, Zhao J, Seo YS, Cao W, Whitehead LA. Effects of near-infrared radiation in ambient lighting on cognitive performance, emotion, and heart rate variability. Journal of Environmental Psychology. 2024 Dec;100:102484. doi:10.1016/j.jenvp.2024.102484. Open access under the Creative Commons Attribution license. Received November 29, 2023; accepted November 8, 2024; available online November 9, 2024. Corrigendum: Journal of Environmental Psychology. 2025 Mar;102:102536, doi:10.1016/j.jenvp.2025.102536, available online January 28, 2025, correcting an error in the conversion of irradiance to dose rate at subsection 2.3.1. The corrected figure is approximately 14 watts per square meter, corresponding to 50,400 joules per square meter per hour of exposure.

Design. Preregistered, double-blind, within-subjects laboratory experiment with counterbalanced order. Each participant experienced both lighting conditions in a single two-hour session, approximately forty-five minutes of exposure per condition, separated by a short break during which the lighting was changed while the participant was out of the enclosure. Preregistered on the Open Science Framework in early January 2022, before the first participant was enrolled. Approved by the research ethics boards of the University of British Columbia, the National Research Council of Canada, and Pacific Northwest National Laboratory.

Population. One hundred fifty-six undergraduate students at one university attended; five were excluded, leaving 151 for the cognitive analyses — 117 female, 34 male, mean age 20.25 years, standard deviation 2.62, range 16 to 44. Subsets of 150, 149 and 148 were analyzed for emotion, environmental satisfaction and heart rate variability respectively. Enrollment ran January to April 2022. Exclusion criteria included chronic medical conditions, cardioactive medication, smoking, and color-deficient vision or vision not correctable to normal.

Exposure, as characterized. Two stimuli, both nominally 3500 K white light-emitting diode lighting, at matched illuminance of 741 lux without near-infrared and 748 lux with it. Irradiance above 700 nm was 0.12 watts per square meter in the first condition, described by the authors as typical of modern office lighting, and 14.11 watts per square meter in the second, supplied by additional emitters peaking at 735 nm in the far red and at 875 and 960 nm in the near infrared. Correlated color temperature was 3316 K and 3213 K. The alpha-opic quantities were closely matched: melanopic irradiance 0.532 against 0.539 watts per square meter, rhodopic 0.662 against 0.669, S-cone-opic 0.258 against 0.265, M-cone-opic 0.904 against 0.917, L-cone-opic 1.215 against 1.246. Colorimetric and alpha-

opic analysis under ANSI/IES TM-30-20 and CIE S 026/E:2018 indicated no noticeable chromaticity change. An infrared-detecting photodiode verified within each session that the intended stimulus was present.

Outcomes and measurement. Attention by a visual search foraging task; perception by a visual comparison task; short-term and working memory by forward and backward digit span; executive function by a hundred-trial flanker task. All cognitive tasks were administered on paper rather than on a screen, to avoid additional light exposure. Emotional state by a modified Affect Grid yielding separate pleasure and alertness scores, taken on seven occasions. Environmental satisfaction by a preference question at the end of the session. High-frequency heart rate variability from continuous electrocardiography sampled at 1000 Hz, analyzed in sixty-second epochs across approximately 45 minutes of exposure per condition, at rest and during cognitive demand.

Result — cardiovascular. Resting high-frequency heart rate variability was higher under lighting containing near-infrared. In the initial linear mixed model the main effect of lighting condition was beta = 0.17, standard error 0.07, t = 2.41, p = .016, 95 percent confidence interval 0.03 to 0.31. In the final model retaining covariates for experimental order, rest period, sex, lighting preference and caffeine consumption, beta = 0.13, standard error 0.06, t = 2.25, p = .025, interval 0.02 to 0.24. The response to cognitive demand was larger under near-infrared for four of the five tasks, all p < .001, the exception being visual comparison, p = .607. A significant interaction with experimental order, beta = −0.34, t = −4.58, p < .001, indicates the effect was more pronounced among participants who encountered near-infrared in the second block.

Result — emotional. A main effect of lighting condition on pleasure, beta = −0.26, standard error 0.10, t = −2.46, p = .014, interval −0.46 to −0.05, qualified by an interaction with experimental order, beta = 0.30, standard error 0.11, t = 2.63, p = .009, interval 0.08 to 0.53. Participants who began without near-infrared declined in pleasure during that block, mean change −0.76, standard deviation 1.44, and rose during the subsequent near-infrared block, mean 0.12, standard deviation 1.64. Those who began with near-infrared declined less, mean −0.29, standard deviation 1.34. There was no main effect of lighting condition on alertness, beta = 0.02, p = .821, although an interaction with order was present.

Result — cognitive, and stated preference. Lighting condition predicted performance on one of the five cognitive tasks, visual search, and in the direction opposite to the hypothesis: performance was worse under near-infrared, F = 8.94, p = .003, Cohen’s d = 0.12. There was no significant effect of lighting condition on perception, short-term memory, working memory or executive function. Asked at the end of the session which half of their time they had preferred, a majority in both order groups chose the block without near-infrared — 59.1 percent of one group and 54.2 percent of the other — with only a weak association to order, Yule’s Q = 0.26. The Foundation reports these results because they ran against the authors’ hypotheses.

Blinding. Of 149 participants asked directly whether they had noticed a difference between the two blocks, 21, or 14.1 percent, reported one. None mentioned lighting when asked unprompted what they believed the study hypothesis to be. The authors note that the small number who did perceive a difference tended to describe the near-infrared block in more positive terms.

Funding and affiliations. The funding statement reads: “This work was supported by the U.S. Department of Energy’s Lighting R&D Program, part of the Building Technologies Office within the Office of Energy Efficiency and Renewable Energy (EERE).” The declaration of competing interest states none. Author affiliations are the University of British Columbia, Pennsylvania State University, Pacific Northwest National Laboratory, and the National Research Council of Canada.

Conclusion, in the authors' words. "This study provides preliminary evidence that ambient near-infrared (NIR) exposure in architectural lighting can influence both physiological and psychological states." And, on the implication: "the move away from the natural balance of visible and near-infrared radiation found outdoors—the condition under which humans evolved—may not be optimal for well-being, even if it is better for delivering more light output for less energy."

What it establishes. That the near-infrared content of ambient lighting is a variable with measurable physiological and affective effects in humans, at an exposure duration representative of part of an indoor working day, and that those effects are present when the visible content of the light is held constant. Because the two conditions were matched on illuminance, on correlated color temperature and on every alpha-opic quantity, the observed differences cannot be attributed to brightness, to color appearance or to melanopic stimulation. They are attributable to the presence or absence of radiation above 700 nanometers. It further establishes that a federal research program has treated the question as open and worth funding.

What it does not establish. That near-infrared content is beneficial on balance. The findings are mixed: a physiological effect in the predicted direction, an affective effect qualified by order of exposure, a cognitive effect in the opposite direction on one task of five, no effect on alertness, and a majority stated preference for the condition without near-infrared. It does not establish long-term effects, a dose-response relationship, an optimal exposure, a threshold, or a mechanism; the authors identify each of these as unresolved. The sample was young, predominantly female, and drawn from a single university. Exposure lasted about forty-five minutes per condition with a washout of only a few minutes. It establishes nothing about outdoor lighting, nothing about light at night, and nothing about any disease outcome.

Considerations bearing on confidence. In favor: preregistration on a public registry before the first participant was enrolled; within-subjects design with counterbalanced order; effective double-blinding, confirmed by direct questioning of participants; complete radiometric, colorimetric and alpha-opic characterization of both stimuli; independent verification of the stimulus within each session; retention of the main effect after adjustment for covariates; ethics approval from three institutions; and the publication of a corrigendum correcting the authors' own unit conversion, which is evidence of post-publication scrutiny rather than against the work. Against: a washout period of only a few minutes, which the authors acknowledge; short exposure; a narrow and young sample; self-reported covariates including sleep and caffeine; a small effect size on the single significant cognitive result; and no mechanism tested. The authors characterize the work as preliminary and the Foundation adopts that characterization.

Bearing on the statutory question. This entry is not offered to show that light-emitting diode products are unsafe, and it should not be read that way. It is offered for four propositions. First, that the absence of a band of wavelengths from a product's emission is a characteristic with measurable human effects, which is the premise of Part V.B.6. Second, that such effects are detectable only by an instrument that resolves the spectrum, since here every photometric and alpha-opic quantity was matched while the band above 700 nanometers differed by a factor exceeding one hundred — which demonstrates rather than asserts the measurement argument at Part V.J.4. Third, that the question is unresolved in the direction of requiring study rather than of being settled, which is the condition to which § 360ii(a)(4) speaks. Fourth, and independently of the science, that the research was funded by the Department of Energy program whose standards are described at Part IV.G, which bears on whether the subject matter could have been unknown to the federal government when § 360ii(a)(6) consultation did not occur. Parts IV.G.4, V.B.6, V.J.4 and IX.H.3.

C.14 Palomar-Cros and others (2024) — artificial light at night and cancer risk, systematic review and meta-analysis

Citation. Palomar-Cros A, Deprato A, Papantoniou K, Straif K, Lacy P, Maidstone R, Adan A, Haldar P, Moitra S, Navarro JF, Durrington H, Moitra S, Kogevinas M, Harding BN. Indoor and outdoor artificial light-at-night (ALAN) and cancer risk: A systematic review and meta-analysis of multiple cancer sites and with a critical appraisal of exposure assessment. Science of the Total Environment. 2024 Dec;955:177059. doi:10.1016/j.scitotenv.2024.177059. PMID 39437923. First published online October 20, 2024. Open access under the Creative Commons Attribution-NonCommercial license.

Article type. Systematic review and meta-analysis of observational studies, conducted with a formal critical appraisal of exposure assessment. This is the highest level of synthesis in the evidence hierarchy represented in this appendix, and the Foundation draws attention to that in connection with the characterization of this literature described at Part IV.C.

Search and selection. Six databases, two registries and Google Scholar were searched from inception to April 17, 2024. Nine thousand eight hundred thirty-five records were identified; 28 studies were included for qualitative synthesis, comprising 2,508,807 individuals in 15 cohort and 13 case-control studies. Eligible designs were observational studies of indoor or outdoor artificial light at night and cancer incidence, reporting relative risk, hazard ratio or odds ratio. Study quality was appraised using the Joanna Briggs Institute critical appraisal tools. Pooled estimates were obtained by random-effects meta-analysis.

Result — breast cancer. Twenty studies, 731,493 individuals. Higher outdoor artificial light at night was associated with breast cancer risk, pooled relative risk 1.12, 95 percent confidence interval 1.03 to 1.23, with substantial heterogeneity, I squared = 69 percent. For indoor light the association was positive but not statistically significant, 1.07, 0.95 to 1.21, I squared = 60 percent. No differences were observed by menopausal status.

Result — other sites. Two studies of prostate cancer, 53,254 individuals, gave a pooled estimate for higher outdoor light of 1.43, 0.75 to 2.72, not statistically significant, with I squared = 90 percent. In the qualitative synthesis the authors report positive associations with non-Hodgkin lymphoma and with colorectal, pancreatic and thyroid cancer. The Foundation has not obtained the individual estimates for those sites and does not state them.

The authors' own appraisal of exposure assessment. The authors report that most included studies relied on satellite images of very low resolution, one to five kilometers, from the Defense Meteorological Satellite Program, and without information on the color of light, and conclude that future studies with better exposure assessment should investigate other cancer sites. The critical appraisal of exposure assessment is announced in the title of the paper and is therefore a stated object of the work rather than an incidental limitation.

What it establishes. That a substantial body of observational evidence associates higher outdoor artificial light at night with breast cancer risk, and that the association survives formal systematic review and random-effects pooling across twenty studies. And, separately, that the investigators who assembled that body regard its exposure assessment as the limiting factor, for two stated reasons: spatial resolution of one to five kilometers, and the absence of any information about the color of the light measured.

What it does not establish. Causation. The included designs are observational and the authors report associations. It does not establish any proposition about light-emitting diode products as against the sources they replaced, and cannot, because the exposure instrument carries no spectral information and cannot distinguish sources by correlated color temperature or spectral power distribution. It does not establish an indoor

association, which was not statistically significant. It does not establish a prostate cancer association. The pooled estimates for the sites described qualitatively are not reported here. It says nothing about any non-cancer outcome and nothing about exposure during daylight hours.

Considerations bearing on confidence. In favor: prospectively structured systematic review with a stated search strategy, stated inclusion criteria, a published quality appraisal instrument, and random-effects pooling; very large aggregate population; a strong authorship in cancer and environmental epidemiology; and an express critical appraisal of exposure assessment, which is uncommon and which the Foundation treats as a mark of care. Against: substantial heterogeneity in every pooled estimate, I squared of 69, 60 and 90 percent; the principal estimate of 1.12 is modest and its lower bound close to unity; only two studies supported the prostate analysis; publication bias in a literature of this kind cannot be excluded on the information available to the Foundation; and the exposure defect the authors identify applies to the pooled estimate as much as to the individual studies.

Bearing on the statutory question. The Foundation uses this entry principally at Part V.J.4, and for a purpose that does not depend on the strength of the cancer association. The subsection argues that the epidemiology of artificial light measures exposure in units that discard spectral composition, and therefore cannot by itself specify an emission characteristic for a performance standard under § 360kk, however large the literature grows. This review states that proposition about its own field, in its own title and in its own conclusion. The Foundation also offers it at Part IV.C, on the characterization of this literature as low quality evidence: a systematic review of 9,835 screened records and 2.5 million individuals, appraised with a published instrument and published in a peer-reviewed journal, is not met by that characterization without reasons given. And it bears on the request at Part IX.F, because what the authors ask for — better exposure assessment, applied prospectively — is what § 360ii(a)(2) and (a)(4) direct the Secretary to provide and what no individual research group can supply.

C.15 Chang and others (2024) — hepatic injury following light-emitting diode light exposure in mice

Citation. Chang MC, Wang SR, Lin DPC, Chang HH. Hepatic inflammation, ballooning, and pyknosis caused by LED light exposure in a mouse model, with differential effects by age and gender. Ecotoxicology and Environmental Safety. 2024 Oct;284:116984. doi:10.1016/j.ecoenv.2024.116984. PMID 39265263. First published online September 11, 2024. Open access under the Creative Commons Attribution license.

Design. Controlled animal experiment. C57BL/6 mice were exposed to light-emitting diode light under one of two regimes: 1,000 lux for twelve hours per day for 45 days, or 4,500 lux for one hour per day for seven days. Animals were aged either 8 weeks or 36 weeks, and both sexes were studied. A twelve-hour light and dark cycle was maintained throughout and the diet was not altered. Liver tissue sections were examined by hematoxylin and eosin staining and by immunohistochemistry.

Exposure, as characterized. Stated in illuminance only — 1,000 lux and 4,500 lux at the stated durations. The authors describe light-emitting diode sources as delivering higher levels of blue light than other light sources, which is the rationale for the study, but the abstract reports no correlated color temperature, no spectral power distribution, and no irradiance in any wavelength band. The Foundation notes the irony and the relevance: a study whose premise is the spectral composition of the source reports its exposure in the photometric unit that discards spectral composition. Part V.J.4.

Outcomes and measurement. Histopathological examination of liver tissue for inflammation, hepatocellular ballooning and pyknosis, with immunohistochemical staining for the macrophage marker F4/80 and for tumor necrosis factor alpha.

Result. The animals exposed at 1,000 lux displayed liver injury described by the authors as severe, comprising inflammation, ballooning and pyknosis. The same changes were present to a lesser extent in the animals exposed at 4,500 lux. Older animals showed aggravated injury. Hepatocellular ballooning was more severe in males; females expressed the F4/80 and tumor necrosis factor alpha inflammatory markers more evidently. The abstract reports these results qualitatively and the Foundation has not obtained the quantitative scores.

A caution about the two exposure groups. The greater injury in the 1,000 lux group should not be read as showing that lower illuminance is more harmful. The two regimes differ in duration as well as in intensity, and the cumulative exposures are not comparable: roughly 540,000 lux-hours in the first group against roughly 31,500 in the second, a ratio of about seventeen to one. The comparison is therefore consistent with cumulative exposure driving the result, and it confounds intensity with duration. The Foundation states this because the abstract's phrasing could be read the other way, and because a comment that misreads a study it relies on forfeits the right to be read carefully itself.

What it establishes. That controlled exposure to light-emitting diode illumination, at the intensities and durations administered, produced histologically identifiable liver injury in a mouse model, and that the severity varied with age and differed by sex. The feature the Foundation relies on is the design: the light and dark cycle was maintained and the diet was unchanged, so the result is not attributable to circadian disruption, to sleep loss, or to light at night. The exposure variable was the emission itself during the light phase.

What it does not establish. Anything about human liver health. The subject is a nocturnal rodent whose retinal organization, light biology and hepatic physiology differ materially from a human's, and the Foundation states that indirectness here as Part V.A.2 requires. It does not establish a dose at which effects begin, a threshold, or a no-effect level, and the two regimes tested do not support a dose-response curve. It does not establish that the blue content of the source was the operative variable, since no comparison with a source of different spectral composition at matched illuminance is reported in the abstract. Histological change is not clinical disease. It establishes nothing about any product in commerce.

Considerations bearing on confidence. In favor: experimental rather than observational, so the exposure was assigned rather than observed and confounding by urbanization, socioeconomic position and the rest does not arise; a maintained light and dark cycle and unaltered diet, which exclude two major alternative explanations; age and sex examined as prespecified factors; peer-reviewed and published open access. Against: a single laboratory; no spectral characterization reported; illuminance at 1,000 lux for twelve hours daily is high relative to ordinary rodent husbandry and its human analogue is not obvious; outcomes reported qualitatively in the abstract; no comparison light source of differing spectrum; and the species difference. The Foundation also records an apparent tension within the abstract, which reports ballooning as more severe in males while identifying females among the vulnerable groups in its conclusion; the full text is needed to resolve how those two statements fit together.

Bearing on the statutory question. Two uses, both narrow. The first is at Part V.A.2: this is evidence about artificial light that does not depend on light at night, and it therefore answers the objection that the literature in this Part is really about sleep and circadian timing rather than about what a product emits. The second is at Part II.F. Paragraph 360ii(a)(4) directs the Secretary to study and evaluate emissions of, and conditions of exposure to, electronic product radiation, and paragraph 360ii(a)(5) directs the development, testing and evaluation of procedures for minimizing exposure. An experiment that varies an emission under controlled conditions and examines an endpoint unavailable in human subjects is the form of work those paragraphs contemplate. The Foundation offers this entry to show that such work is feasible and is being done

elsewhere, not to show that light-emitting diode products injure the human liver. It does not contend that they do. Parts II.F, V.A.2 and IX.H.3.

Related entry. Appendix C.4 reports an association in humans between bedroom nighttime light and hepatic encephalopathy in hepatocellular carcinoma. The Foundation notes the convergence of organ system without resting anything on it: the exposures, the species, the designs and the outcomes differ, and two studies concerning the liver are not a finding about the liver.

C.16 Voigt and others (2024) — outdoor nighttime light and Alzheimer's disease prevalence

Citation. Voigt RM, Ouyang B, Keshavarzian A. Outdoor nighttime light exposure (light pollution) is associated with Alzheimer's disease. Frontiers in Neuroscience. 2024;18:1378498. doi:10.3389/fnins.2024.1378498. Published September 6, 2024. Open access.

Design. Observational, cross-sectional, and ecological. The unit of analysis is the geographic area, not the person. Satellite-derived average outdoor nighttime light intensity for each area was compared with the prevalence of Alzheimer's disease recorded in Medicare data for the same area. The Foundation emphasizes this characteristic at the outset because it governs everything the study can and cannot support.

Population and units. Medicare beneficiaries, 2012 to 2018, analyzed at the level of 48 states and 46 counties. No individual was linked to that individual's own light exposure. The effective sample size for the correlations reported is the number of geographic units, not the number of beneficiaries.

Exposure, as measured. Radiance from the Visible Infrared Imaging Radiometer Suite day-night band aboard the Suomi National Polar-orbiting Partnership satellite, in nanowatts per square centimeter per steradian, averaged annually and grouped into quintiles by state and quartiles by county. This is a broadband upward-radiance measurement carrying no information about the spectral composition of the light. Part V.J.4.

Outcome and analysis. Alzheimer's disease prevalence from the Medicare Chronic Conditions data, compared across light-intensity categories by analysis of variance and by linear mixed models with age, sex and race as covariates, and with a set of comorbid conditions entered as additional factors.

Result. A positive correlation between light intensity and Alzheimer's disease prevalence, $r(46) = 0.557$, $p < 0.001$. Atrial fibrillation, diabetes, hyperlipidemia, hypertension and stroke were more strongly associated with prevalence than nighttime light was; alcohol abuse, chronic kidney disease, depression, heart failure and obesity were less strongly associated with it. In beneficiaries under the age of 65, nighttime light was more strongly associated with prevalence than any other factor examined, and remained significant after adjustment, coefficient 0.174, $p = 0.007$.

Conclusion, in the authors' words. "These data suggest light exposure at night may influence AD, but additional studies are needed."

What it establishes. That across United States states and counties, areas with brighter measured outdoor nighttime light have on average a higher recorded prevalence of Alzheimer's disease among Medicare fee-for-service beneficiaries, and that this relationship persists in the authors' models after adjustment for the covariates they entered. That is a statement about places. It is not a statement about people.

What it does not establish. Nothing about any individual. An association between area-level averages does not license an inference about the individuals within those areas; this is the ecological fallacy, and it applies to this study in full force. The design is cross-sectional and reports prevalence rather than incidence, so it cannot establish that exposure preceded

disease, and prevalence is affected by survival as well as by onset. Outdoor nighttime light is among the closest available proxies for urbanization, and therefore covaries with air pollution, population density, socioeconomic position, access to specialist care and the intensity of diagnostic coding — areas with more neurologists record more dementia diagnoses. It establishes nothing about light-emitting diode products, since the exposure instrument carries no spectral information. It establishes nothing about indoor light, which was not measured.

Considerations bearing on confidence. In favor: a national dataset; a prespecified comparison against a panel of established disease factors, which is a useful discipline and which placed light in the middle of that panel rather than at the top; open access publication; and an explicitly tentative conclusion. Against, and the Foundation sets these out at length because they are substantial: the ecological design; cross-sectional prevalence data; an effective sample of 48 and 46 units; confounding by urbanization that no area-level adjustment can resolve; Medicare fee-for-service coverage only, excluding a large share of beneficiaries enrolled in Medicare Advantage; and reliance on administrative diagnostic coding. The Foundation adds one caution the abstract does not state. Medicare beneficiaries under the age of 65 qualify through disability, so the under-65 group is a strongly selected population and is not the general population under 65. The striking finding in that group should be treated as hypothesis-generating and nothing more.

Rating within this appendix. The Foundation records that this is the weakest entry in Appendix C by study design, and says so rather than leaving the Department to discover it. It is included because the Foundation undertook at Part V.A.1 to describe the literature it relies on without selection for strength, and because the entry is used for a purpose that does not depend on the finding.

Bearing on the statutory question. The Foundation offers this entry for two propositions, neither of which requires the association to be real. The first is at Part II.E.6: the study was funded by the National Institutes of Health, under grants R01AG056653 and R24AA026801. The Secretary of Health and Human Services is therefore already supporting research into the health effects of artificial light at night, which is one of the four verbs of § 360ii(a)(2), while the planning, conducting and coordinating that the same paragraph directs are absent as to light-emitting diode products. The second is at Part V.J.4: here again the exposure is satellite radiance, broadband and blind to spectrum, and here again the result cannot say which light. Parts II.E.6, V.J.4 and IX.H.3.

C.17 Wu and others (2024) — outdoor light at night, air pollution, and cerebrovascular disease

Citation. Wu Y, Shen P, Yang Z, Yu L, Xu L, Zhu Z, Li T, Luo D, Lin H, Shui L, Tang M, Jin M, Chen K, Wang J. Outdoor light at night, air pollution, and risk of cerebrovascular disease: a cohort study in China. Stroke. 2024 Apr;55(4):990–998. doi:10.1161/STROKEAHA.123.044904. PMID 38527152. Published online March 25, 2024.

Design. Prospective population-based cohort study with incident clinical outcomes and time-to-event analysis by Cox proportional hazards models. Participants were enrolled in Ningbo, China between 2015 and 2018.

Population. Twenty-eight thousand three hundred and two participants, followed through 127,877 person-years.

Exposure, as measured. Outdoor light at night estimated from satellite-derived imagery. Air pollution — particulate matter of aerodynamic diameter 2.5 micrometers or less, particulate matter of 10 micrometers or less, and nitrogen dioxide — estimated separately by land-use regression models. The light exposure is a broadband upward-radiance product and carries no information about spectral composition. Part V.J.4.

Outcomes and measurement. Incident cerebrovascular disease confirmed by medical records and death certificates, subdivided into ischemic and hemorrhagic stroke. One thousand two hundred and seventy-eight cerebrovascular disease cases were identified, including 777 ischemic and 133 hemorrhagic strokes.

Result — single-exposure models. Per interquartile-range increase: outdoor light at night, hazard ratio 1.17, 95 percent confidence interval 1.06 to 1.29; fine particulate matter, 1.25, 1.12 to 1.39; coarse particulate matter, 1.14, 1.06 to 1.22; nitrogen dioxide, 1.21, 1.06 to 1.38. Results were similar for ischemic stroke. No association was observed for hemorrhagic stroke.

Result — multiple-exposure models. The associations of outdoor light at night and of particulate matter with cerebrovascular disease persisted when both were entered together, but did not persist for ischemic stroke specifically. No interaction between outdoor light at night and air pollution was observed.

Conclusion, in the authors' words. That levels of exposure to outdoor light at night and air pollution were positively associated with the risk of cerebrovascular disease, and that the detrimental effects of the two might be mutually independent.

What it establishes. That in a cohort of this size, followed prospectively with outcomes verified against medical records and death certificates, outdoor light at night was associated with incident cerebrovascular disease, and that the association persisted after air pollution was measured by an independent method and adjusted for in the same model. This is the entry in Appendix C that speaks most directly to the confounding objection described at Part V.A.2, because it tested the most commonly named confounder rather than listing it as a limitation.

What it does not establish. Causation; the design is observational. It does not establish an association with hemorrhagic stroke, and in the multiple-exposure models it does not establish one with ischemic stroke specifically — only with cerebrovascular disease overall, and the Foundation does not state the result more broadly than that. It does not exclude residual confounding by urban factors other than air pollution, such as noise, traffic, density or socioeconomic position. It establishes nothing about which light, because the exposure instrument carries no spectral information, and therefore nothing about light-emitting diode products as against the sources they replaced. The cohort is drawn from one Chinese city, whose lighting stock, spectrum mix and installation practice are not those of the United States, and the Foundation does not assume transferability.

Considerations bearing on confidence. In favor: prospective design; substantial size and person-time; incident rather than prevalent outcomes; outcome ascertainment against medical records and death certificates rather than self-report; independent measurement of the principal suspected confounder by land-use regression; multiple-exposure modeling; publication in a leading specialty journal. Against: observational; a single city; residual confounding; no spectral characterization of the exposure; the attenuation of the ischemic stroke result in the multiple-exposure models; and a modest hazard ratio with a lower bound near unity.

Bearing on the statutory question. The Foundation offers this entry for three purposes. First, at Part V.A.2, as the answer to the confounding objection: the alternative explanation most often offered for associations of this kind was measured and adjusted for, and the association survived. Second, at Part V.J.4, as a further instance of the measurement problem, since even this study — the methodologically strongest of its kind in this appendix — cannot say which light, for the same reason as all the others. Third, for the comparison set out at Part V.A.2: the hazard ratio reported here for light at night is of the same order as that reported in the same cohort for fine particulate matter, an exposure that is the subject of a national standard and a national monitoring network, while light at night is federally unmeasured. Parts V.A.2, V.J.4 and IX.H.3.

C.18 Salceda (2024) — light pollution, oxidative stress, and the retina

Citation. Salceda R. Light pollution and oxidative stress: effects on retina and human health. Antioxidants. 2024;13(3):362. doi:10.3390/antiox13030362. PMID 38539895. Published March 18, 2024. Open access.

Article type. Narrative review by a single author. Not primary research, not a systematic review, and no search strategy or inclusion criteria are stated. The Foundation cites it as evidence of the state of expert opinion, in the category described at Part V.A.2, and not as primary evidence of any effect. Every quantitative figure reported below is taken by the review from another source and has not been verified by the Foundation against that source.

Subject. The mechanisms by which artificial light, and short-wavelength light in particular, is reported to produce oxidative stress in ocular tissue, together with the downstream consequences discussed in the literature: reactive oxygen species production, photoreceptor apoptosis, injury to the retinal pigment epithelium, effects on intrinsically photosensitive retinal ganglion cells and melanopsin, melatonin suppression, circadian disruption, and mitochondrial dysfunction.

Figures the Foundation relies on, and their status. The review reports that more than 65 percent of blue light at 460 nanometers is transmitted to the retinas of children under nine years of age, and that intrinsically photosensitive retinal ganglion cells constitute approximately one percent of the human retinal ganglion cell population. The first of those figures has since been traced one step further. The 2012 Opinion of the European predecessor committee, at Appendix D.1, states the same figure within a full age-resolved table, and Part V.C.2.g now cites that Opinion rather than this review. The Opinion is itself a secondary source and does not identify the underlying measurement, so the trace is not complete, but this entry is no longer the authority for the figure anywhere in the comment. The second figure is relied on for context only. The review also reports a number of further figures the Foundation does not rely on, among them that blue light constitutes approximately 25 percent of solar radiation, that electronic devices emit approximately 30 percent of their radiation in the blue, and that indoor lighting emits between 6 and 40 percent; the last of those would be useful at Part V.B.3 if it could be traced to a measurement, and it should not be used before it is.

The authors' own limitation, which the Foundation emphasizes. The review states that there is currently insufficient evidence to conclusively determine the direct effects of light-emitting diode light sources when used normally at domestic intensity levels or as backlights in screen devices, and that more epidemiological, clinical and fundamental research is required to assess their risk factors in age-related macular degeneration, aging and overall health, especially for vulnerable groups such as children and adolescents.

What it establishes. That a mechanism by which short-wavelength light produces oxidative stress in retinal tissue is described and discussed in the peer-reviewed literature, and is treated by reviewers in the field as biologically established at the exposures used in laboratory study. And, separately and with equal importance for this comment, that a reviewer surveying that literature in 2024 concluded that the effects of light-emitting diode sources at domestic intensities are not determined and that further research is required.

What it does not establish. That light-emitting diode products in ordinary domestic or occupational use injure the human retina. The review expressly declines to draw that conclusion, and the Foundation does not draw it either. Many of the exposures underlying the mechanistic literature it surveys are laboratory exposures far above domestic levels — the review refers to intensities such as 8,000 lux for eight hours — and several are in nocturnal animals, whose retinal organization differs from a human's. Nothing in it establishes a dose-response relationship in humans, a threshold, or a safe level. The Foundation does not carry forward the review's closing observations about skin aging and

cancer development, which are outside its subject matter and beyond what a narrative review of this kind can support.

Considerations bearing on confidence. In favor: peer-reviewed, open access, indexed in PubMed, written by a researcher in the field, and notably candid about the limits of the evidence it surveys, which the Foundation treats as a mark of care. Against: narrative rather than systematic; a single author; no stated search strategy, inclusion criteria or quality appraisal; secondary throughout, so every figure is reported at one remove; and a conclusion that ranges beyond the retina into skin and cancer on a thinner basis than the ocular material. The Foundation gives it the weight appropriate to a narrative review and no more.

Bearing on the statutory question. Two uses. The first is at Part V.C.2.g, for the proposition that ocular transmission of short-wavelength light varies with age, so that an identical emission produces an unequal retinal dose across the exposed population. That is a fact about conditions of exposure, which is the second of the two objects § 360ii(a)(4) names. The second use is at Part V.A.2 and Part I.C.7. The review concludes that the evidence is insufficient to determine the effects of light-emitting diode sources at domestic levels. The Center for Devices and Radiological Health has stated that such products have a long history of safety with respect to the visible wavelengths they emit. Those two statements are not the same statement, and the difference between them is the whole of this comment. Insufficient evidence to determine an effect is the occasion for the research § 360ii(a)(2) and (a)(4) direct; it is not a finding of safety. Parts I.C.7, V.A.2, V.C.2.g, IX.L and IX.H.3.

C.19 Powner and Jeffery (2024) — 670-nanometer light and circulating blood glucose in humans

Citation. Powner MB, Jeffery G. Light stimulation of mitochondria reduces blood glucose levels. Journal of Biophotonics. 2024;17(5):e202300521. doi:10.1002/jbio.202300521. PMID 38378043. Received December 8, 2023; accepted January 21, 2024. Open access under the Creative Commons Attribution license. Affiliations: Centre for Applied Vision Research, City, University of London; UCL Institute of Ophthalmology.

Design. Randomized, sham-controlled, participant-blinded parallel group trial with an additional paired within-participant analysis. Each participant attended twice: a control oral glucose tolerance test at visit one, and within seven days a second test preceded by the allocated intervention. A crossover design was deliberately not used, the authors explaining that a single 670-nanometer exposure is reported to have effects persisting five to seven days and that individual glucose tolerance responses vary over time. Ethics approval ETH2122-1596, City, University of London; conducted in accordance with the Declaration of Helsinki with informed consent.

Population. Thirty healthy adults, randomized at recruitment: 15 to 670-nanometer exposure, mean age 41.1 years, standard deviation 13.1; 15 to sham, mean age 38.3, standard deviation 13.7. No known metabolic conditions and no medication.

Exposure, as characterized. Light-emitting diode array with a peak wavelength of 670 nanometers and a half-power bandwidth of approximately 10 nanometers, positioned 400 millimeters from the participant and shielded against leakage, delivering 40 milliwatts per square centimeter for 15 minutes to an 800 square centimeter area of upper back — a total of 28,800 joules, over roughly four percent of body surface area. Exposure began 45 minutes before glucose consumption. Sham participants were positioned identically for 15 minutes with the array switched off, and were blinded to allocation.

Outcomes and measurement. Standard oral glucose tolerance test: 75 grams of glucose in 150 milliliters of water after a fast of at least ten hours, with capillary blood glucose by finger-prick at 0, 15, 30, 45, 60, 75, 90, 105 and 120 minutes. End-tidal carbon dioxide partial pressure and breath rate were measured at the same intervals by side-stream

capnometry. Analysis by repeated-measures multivariate analysis of variance with post hoc Mann-Whitney U tests, and Wilcoxon signed rank tests for paired data; two-tailed throughout.

Result — between groups. Comparing the two interventions, each baselined against its own group's control test: total circulating glucose by area under the curve was reduced 7.3 percent, p = 0.0061; the post-consumption rise in glucose was reduced 27.7 percent, p = 0.0002; and peak glucose concentration fell 12.1 percent, from 10.8 to 9.5 millimoles per liter, p = 0.0102. Repeated-measures analysis gave p = 0.035 for absolute concentration and p = 0.049 for the baselined data, with post hoc differences significant at 45, 60, 75 and 90 minutes after loading.

Result — within participants. In the exposed group, comparing each participant's intervention visit against that participant's own control visit: absolute glucose by area under the curve reduced 7.9 percent, p = 0.0012; the baselined rise reduced 26.3 percent, p = 0.0008; peak concentration reduced 7.5 percent, from 10.3 to 9.5 millimoles per liter, p = 0.0054. The equivalent paired comparison in the sham group showed no significant difference on any measure.

Result — respiratory. No significant difference in end-tidal carbon dioxide between the two interventions, p = 0.21. Within the exposed group against its own control visit, a significant increase was observed, p = 0.03, with post hoc significance at 60 minutes. No difference in breath rate in any comparison. The authors offer this as weakly consistent with increased glucose oxidation rather than storage, and the Foundation records that the between-group comparison, which is the stronger test, was null.

What it establishes. That a single short exposure to light at 670 nanometers, delivered to the skin of the back and not to the eye, produces a measurable and statistically significant change in the handling of an oral glucose load in healthy adults. The effect is systemic, since the irradiated tissue was not the tissue measured. The sham-controlled design and the null result in the sham group's paired analysis together exclude an order or habituation effect arising from the fixed visit sequence, which is the principal design risk given that every participant received the control test first.

What it does not establish. Nothing about ambient lighting. This was a therapeutic-intensity exposure of 40 milliwatts per square centimeter to four percent of the body surface, which bears no resemblance to the irradiance of room lighting, and the study therefore does not show that lighting lacking long wavelengths impairs glucose regulation in anyone. It does not establish any effect in diabetes; the subjects were healthy and the authors state that their results cast no light on that question. It does not establish a dose-response relationship, a minimum effective exposure, or duration of benefit. Body mass index was not recorded, so adiposity — which the authors note influences glucose metabolism — could not be accounted for.

Considerations bearing on confidence. In favor: randomized; sham-controlled with participants blinded to allocation; an objective instrument-measured endpoint rather than a reported one; a prespecified three-way analysis including within-participant comparison; a null result in the sham arm; effects significant at several consecutive time points rather than at one; data deposited publicly on FigShare; funded by a charity, Sight Research UK; and a declaration of no conflicts of interest, which the Foundation checked and records because this field attracts commercial devices. Against: fifteen participants per arm; a single site; no crossover, for reasons the authors state; body mass index not collected; no statement that outcome assessors were blinded, though the endpoint is instrument-read; and an effect on peak glucose that differs between the two analyses, 12.1 percent between groups and 7.5 percent within participants, which the Foundation reports as both rather than choosing the larger.

Independence from other entries. Glen Jeffery is an author of this study and of the study at Appendix C.1. The two are therefore not independent confirmations of one another, and the Foundation does not present them as such. They are products of a single research program, which is a strength as to coherence and a limitation as to replication. Independent replication of this line of work is among the things the Foundation asks the Department to support under § 360ii(a)(2).

Bearing on the statutory question. The Foundation uses this entry at Part V.B.6, for the premise that the long-wavelength content of light is biologically active in humans at the systemic level, and therefore that the spectral composition of ambient light is a physiological variable rather than an aesthetic one. It does not use it to show harm. The Foundation also directs the Department's attention to the authors' own closing judgment, quoted at Part V.B.6, that lengthy exposure to light-emitting diode lighting in the absence of sunlight may have significant long-term consequences for human health and is likely to be a public health issue not yet appreciated. That is a statement about potential, and § 360ii(a)(3) directs the Secretary to receive information on present and future potential electronic product radiation. Parts V.B.6, II.E and IX.H.3.

C.20 Deprato and others (2024) — light at night and allergic disease, systematic review and meta-analysis

Citation. Deprato A, Maidstone R, Palomar-Cros A, Adan A, Haldar P, Harding BN, Lacy P, Melenka L, Moitra S, Navarro JF, Kogevinas M, Durrington HJ, Moitra S. Influence of light at night on allergic diseases: a systematic review and meta-analysis. BMC Medicine. 2024;22:67. doi:10.1186/s12916-024-03291-5. PMID 38355588. PMCID PMC10865638. Published February 14, 2024. Open access under the Creative Commons Attribution license.

Article type. Systematic review and meta-analysis of observational studies. Six databases, two registries and Google Scholar were searched from inception to December 15, 2023; 3,368 records were identified and 12 publications were included. Risk of bias was assessed with the ROBINS-E tool and the quality of evidence with the GRADE framework, each independently by two reviewers. Pooling was by inverse-variance random-effects meta-analysis. Publication bias was examined by funnel plot with Egger's and Begg's tests.

Exposures, and an important qualification. Three exposures were treated together under the heading of light at night: artificial light at night, high versus low; evening versus morning chronotype; and night versus day shift work. The Foundation stresses that only the first concerns what a product emits. Chronotype is a trait and shift work is an employment schedule. The authors say so themselves, recording that chronotype and night shift work were used as proxies for artificial light at night and might not be properly classified as such, and that shift work carries additional occupational exposures — shift duration and rotation, work environment, job stress, workload — that may themselves bear on the outcomes.

Outcomes. Asthma, allergic rhinitis, and skin allergies.

Result — by exposure. Artificial light at night, odds ratio 1.88, 95 percent confidence interval 1.04 to 3.39. Evening chronotype, 1.35, 0.98 to 1.87, which does not reach statistical significance. Night shift work, 1.33, 1.06 to 1.67.

Result — by disease and by age. Asthma, 1.62, 1.19 to 2.20. Allergic rhinitis, 1.89, 1.60 to 2.24. Skin allergies, reported as 1.11, 1.09 to 1.91; see the next field. By age, the association was larger in youth, 1.63, 1.07 to 2.48, than in adults, 1.30, 1.03 to 1.63. Significant geographical variation was observed.

A reported estimate the Foundation does not rely on. The skin allergy figure is given in both the abstract and the body of the paper as an odds ratio of 1.11 with a confidence interval of 1.09 to 1.91. Those three numbers are not mutually consistent: a point estimate

of 1.11 cannot sit almost at the lower bound of an interval extending to 1.91 under the random-effects pooling the authors describe. One of the three figures appears to be mistyped in the publication. The Foundation reports the estimate as published, does not rely on it, and does not speculate as to which figure is wrong.

What it establishes. That a systematic review of this literature has been conducted to a recognized methodological standard, and that across the studies it was able to locate, measures of light at night were associated with higher odds of asthma, allergic rhinitis and skin allergy, with a larger association in young people than in adults. It establishes that respiratory and allergic disease is a domain in which this question is being asked, which no other entry in this appendix covers.

What it does not establish. Causation. The authors record that every included study was cross-sectional, which excludes any inference about temporal order. More importantly for this comment, the artificial light at night estimate of 1.88 does not rest on a body of studies. The authors state that only one study on outdoor artificial light at night was eligible for inclusion, that it had no unexposed reference group so that only a high-versus-low comparison was possible, and that its exposure was assessed from satellite imagery at 750-meter resolution with consequent potential for exposure misclassification. A pooled estimate drawn from a single cross-sectional study is not a meta-analytic finding about that exposure, and the Foundation does not present it as one. Nothing here establishes anything about light-emitting diode products as against the sources they replaced, for the reason that recurs throughout this appendix: the exposure instrument carries no spectral information.

Considerations bearing on confidence. In favor: a prespecified systematic method with a stated search, two published appraisal instruments applied independently by two reviewers, formal testing for publication bias, stratification by exposure, disease, age and geography, and unusually candid reporting of the review's own weaknesses. Against: twelve included publications, which is a thin base; all cross-sectional; one eligible study for the exposure of most interest; two of the three exposures are proxies the authors themselves describe as possibly misclassified; wide intervals, the principal estimate running from 1.04 to 3.39; an internally inconsistent estimate for one outcome; and selected study populations in most of the included work.

Independence from other entries. This review and the cancer review at Appendix C.14 share most of their authors, including Deprato, Palomar-Cros, Maidstone, Adan, Haldar, Harding, Lacy, Navarro, Kogevinas, Durrington and both authors named Moitra. They are products of one research group and are not independent syntheses of the field. The Foundation records this for the same reason it records the common authorship at Appendix C.19.

A statement in the review worth the Department's attention. The authors write in their introduction that for several decades sodium vapor, metal halide and fluorescent lamps were predominantly used for outdoor lighting, that white light-emitting diode lamp use has since increased exponentially because of lower production and maintenance costs, and that this has consequently driven an increase in the blue light spectrum emitted by light pollution. They add that indoor exposure continues to increase through lighting and personal devices which primarily emit blue-white light, and that such exposure is of particular concern because of its greater ability to suppress melatonin compared with other wavelengths. That is a characterization in a statement of background rather than a finding of the review, and the Foundation presents it as such. It is nonetheless the proposition at the center of Parts II.D and V.B, stated as settled background by a peer-reviewed review in a general medical journal.

Bearing on the statutory question. The Foundation offers this entry for three narrow purposes. First, it extends the range of outcomes under investigation to respiratory and

allergic disease, which bears on the breadth of the question § 360ii(a)(4) directs the Secretary to study. Second, the larger association reported in youth than in adults bears on the request at Part IX.L that sensitive populations be addressed expressly, though the Foundation notes that a difference between two overlapping intervals is weak evidence of a difference in effect. Third, and most reliably, the review demonstrates the state of the evidence rather than the state of the world: a systematic search of six databases produced twelve cross-sectional studies and one eligible study of outdoor exposure. That is what a question looks like when it has not been studied, and it is the condition § 360ii(a)(2) and (a)(4) address. Parts II.F, V.J.4, IX.C and IX.L.

C.21 Menculini and others (2024) — light pollution and affective disorders, narrative review

Citation. Menculini G, Cirimbilli F, Raspa V, Scopetta F, Cinesi G, Chieppa AG, Cuzzucoli L, Moretti P, Balducci PM, Attademo L, Bernardini F, Erfurth A, Sachs G, Tortorella A. Insights into the effect of light pollution on mental health: focus on affective disorders, a narrative review. Brain Sciences. 2024;14(8):802. doi:10.3390/brainsci14080802. PMID 39199494. PMCID PMC11352354. Received July 17, 2024; revised August 4, 2024; accepted August 8, 2024; published August 10, 2024. Open access under the Creative Commons Attribution license.

Article type. Narrative review. The authors searched PubMed, Scopus and Web of Science to May 31, 2024 and included eighteen papers on human samples: nine on sleep, six on mood disorders and related behavior, and three on risk perception. Animal studies and studies without clinical measures were excluded. No systematic appraisal instrument, no risk-of-bias assessment and no pooling were applied. The Foundation cites it in the category described at Part V.A.2 as evidence of the state of expert opinion, not as primary evidence of any effect.

Why the Foundation includes it. Because the psychological domain is one of the four this comment identifies at Part V, and because this is the only entry in the appendix that addresses it as its subject. The title also uses the term light pollution, which bears on Part II.D.3: the expression is in use in the peer-reviewed medical literature and is not a lay coinage.

Reported findings, as reported. The review tabulates results from its included studies. Among them: bedroom light at or above 3 lux was associated with sleep disturbance at an odds ratio of 1.25 and with depressive symptoms at 1.30, and at or above 10 lux with 1.29 and 1.33 (Obayashi and others, 2,947 adults aged 40 and over). Each median absolute deviation increase in outdoor artificial light at night was associated with mood disorders at an odds ratio of 1.07 and anxiety disorders at 1.10 (Paksarian and others, 10,123 adolescents). In adults with bipolar disorder, bedroom light at or above 3 lux was associated with hypomanic states cross-sectionally, adjusted odds ratio 2.15, and longitudinally with manic or hypomanic relapse, adjusted hazard ratio 2.17, with no significant association with depressive relapse (Esaki and others). A light-reduction intervention in 30 university students was followed by a fall in Pittsburgh Sleep Quality Index score from 6.83 to 3.93 (Randjelovic and others). These are the findings of the underlying studies, not of this review, and the Foundation has not assessed any of them directly.

What it establishes. That the relationship between artificial light at night and affective symptoms is a subject of published clinical inquiry, that the inquiry extends to clinical populations as well as general ones, and that reviewers in psychiatry regard the question as open and worth pursuing. It establishes the existence and shape of a literature. It does not establish the truth of what is in it.

What it does not establish, stated emphatically. That artificial light causes depression, bipolar disorder, anxiety, or any other psychiatric condition. The Foundation does not

assert that proposition anywhere in this comment and asks that nothing in this entry be read as asserting it. The included studies are predominantly cross-sectional and observational; the review performs no pooling and applies no quality instrument; and the authors record that most outcomes were self-reported, that individual sleep habits and sleep hygiene were not assessed in most of the included work, that it is therefore not always possible to distinguish changes in sleep habits from effects of light, that other urban pollutants and social stressors confound the setting, and that studies conducted at different latitudes are not readily comparable because daylight duration and light quality differ. The Esaki findings concern people already diagnosed with bipolar disorder and cannot be generalized to anyone else. Nothing in the review concerns light-emitting diode products as against the sources they replaced.

A gap between the abstract and the conclusion. The abstract states that the results clearly indicate a link between light pollution and the development of affective symptoms. The body of the paper is more measured: the conclusion speaks of evidence of a role in the development of circadian disruptions and mood symptoms, says the relationship is complex, and states that future studies are expected to further clarify and characterize it. The Foundation relies on the conclusion rather than the abstract. A narrative review of eighteen largely cross-sectional papers does not support the word clearly, and the Foundation does not adopt it.

Considerations bearing on confidence. In favor: open access; declared no conflicts of interest and no external funding; a candid and detailed limitations section which the Foundation has drawn on above; and authors working in clinical psychiatry. Against: narrative rather than systematic; eighteen papers; no appraisal instrument, no risk-of-bias assessment, no pooling; an abstract that overstates the body; and findings reported at one remove, so that every figure above is unverified against its source. The Foundation also records, as a fact bearing on the weight a reader may give the review, that it was received on July 17, 2024 and accepted on August 8, 2024, twenty-two days later, and that Brain Sciences is published by MDPI, as is the entry at Appendix C.18.

An observation about three lux. Three separate lines of work referred to in this appendix use thresholds of about 3 and 10 lux of bedroom light at night as the exposures of interest: Obayashi and Esaki as reported here, and the cardiac study at Appendix C.2. The origin of those cut points is now established. Appendix C.32 records that they were predefined from the experimental melatonin-suppression literature, citing Cajochen and others and Zeitzer and others, both 2000, rather than being derived from the epidemiological data they were then applied to. That is a better provenance than convention: a threshold drawn from laboratory dose-response work and afterwards tested in a population is doing real work rather than being copied forward. The Foundation still does not propose 3 lux as a federal criterion, because whether it marks anything in an American population is exactly the question a program under § 360ii(a)(4) would resolve. Parts IX.J.3 and V.J.4.

Bearing on the statutory question. Narrow, and narrower than the subject matter might suggest. The Foundation offers this entry to show that the affective domain is under active clinical investigation and that the question is unresolved, which is the condition § 360ii(a)(4) addresses, and to show that exposures at the scale of a few lux in a bedroom — the scale produced by a streetlight through a window — are what the literature is examining. It is not offered to show that any product injures anyone mentally, and the Foundation asks the Department not to read it that way. Parts V.G, V.J.4 and IX.C.

C.22 Kim and others (2024) — outdoor artificial light at night and incident exudative age-related macular degeneration

Citation. Kim SH, Kim YK, Shin YI, Kang G, Kim SP, Lee H, Hong IH, Chang IB, Hong SB, Yoon HJ, Ha A. Nighttime outdoor artificial light and risk of age-related macular degeneration. JAMA Network Open. 2024;7(1):e2351650. doi:10.1001/jamanetworkopen.2023.51650.

PMID 38227312. PMCID PMC10792474. Published January 2, 2024. Open access under the Creative Commons Attribution license.

Design. Nationwide population-based case-control study. All individuals aged 50 or over with newly diagnosed exudative age-related macular degeneration between January 1, 2010 and December 31, 2011 were identified from the Korean National Health Insurance Service registration program for rare and intractable diseases. Controls matched on birth year and sex at a ratio of 1 to 30, with no such diagnosis through 2020. Data acquired in 2021 and analyzed in 2022.

Population. One hundred twenty-six thousand four hundred eighteen participants: 4,078 incident cases and 122,340 matched controls. Mean age 66.0 years, standard deviation 7.9; 61.9 percent men.

Exposure, as measured. Mean outdoor artificial light at night at the participant's residential address during 2008 and 2009, estimated from time-varying satellite data for persistent nighttime illumination at a scale of approximately one square kilometer. Broadband upward radiance; no spectral information. Part V.J.4.

Outcome and adjustment. Incident exudative age-related macular degeneration, ascertained from a national registry rather than by self-report. Estimates adjusted for sociodemographic characteristics, comorbidities, and two area-level environmental factors that the Foundation notes in particular: nighttime traffic noise, and particulate matter of aerodynamic diameter 10 micrometers or less, in each participant's administrative district.

Result. In fully adjusted models, an interquartile-range increase in exposure, 55.8 nanowatts per square centimeter per steradian, was associated with a hazard ratio of 1.67 for incident exudative age-related macular degeneration, 95 percent confidence interval 1.56 to 1.78. The exposure-response curve was nonlinear and concave upward, becoming more pronounced above approximately 110 nanowatts per square centimeter per steradian. In subgroup analysis the association was present in urban areas, 1.46, 1.33 to 1.61, and absent in rural areas, 1.01, 0.84 to 1.22.

Conclusion, in the authors' words. That higher levels of residential outdoor artificial light at night were associated with an increased risk of incident exudative age-related macular degeneration, and that future studies with more detailed information on exposure, individual adaptive behaviors, and potential mediators are warranted.

Why this entry matters more than most in this appendix. The outcome is ocular. Almost every other association reported in this appendix concerns an organ system remote from the eye, and each invites the response that the connection to an optical emission is indirect. Macular degeneration does not. The eye is the organ that receives the radiation; 21 C.F.R. part 1040 is titled Performance Standards for Light-Emitting Products; and the photobiological hazard framework described at Part V.C.2 is built around retinal injury. An association between ambient optical radiation and a retinal disease is within the subject matter of this program as the Department itself has defined it.

What it establishes. That in a nationwide registry-based study of over 126,000 people, residential outdoor artificial light at night was associated with incident exudative age-related macular degeneration, with a large and precisely estimated effect, a nonlinear exposure-response relationship, and adjustment for two of the confounders most often urged against findings of this kind. The cases were identified from a disease registry rather than reported by participants, which removes a source of error present in much of the rest of this appendix.

What it does not establish. Causation; the design is observational. It establishes nothing about light-emitting diode products, for the reason that recurs throughout this appendix and for a second reason specific to this study, set out in the next field. The exposure is areal, at roughly one square kilometer, and carries no spectral information; it is not a

measurement of the light reaching any individual eye. No indoor light, individual behavior, time spent outdoors, or ocular history was measured. The population is Korean, and neither its lighting stock nor its urban density is that of the United States.

Two further limitations the Foundation raises on its own account. First, latency. Exposure was measured in 2008 and 2009 and cases were diagnosed in 2010 and 2011. Macular degeneration is a degenerative condition developing over decades, and a two-year exposure window immediately preceding diagnosis is a weak proxy for the exposure that would matter. Residential exposure is likely correlated over time, which mitigates this, but the study does not establish that. Second, and bearing directly on this comment: the exposure period of 2008 to 2009 substantially predates the conversion of outdoor lighting to light-emitting diode sources. The radiance measured was emitted predominantly by the technologies that preceded them. The Foundation draws no conclusion from that and cannot: it means the study says nothing about light-emitting diode emission, and it leaves entirely open what the same analysis would show for a spectrum shifted toward shorter wavelengths. That open question is one the research directed by § 360ii(a)(2) and (a)(4) would answer.

The urban and rural subgroups, read both ways. The association was present in urban areas and absent in rural ones. Two readings are available and the Foundation does not choose between them. On one, the finding is internally consistent: the exposure-response curve is concave upward and steepens above roughly 110 nanowatts per square centimeter per steradian, so a rural population sitting mostly below that region would be expected to show little association. On the other, a result confined to urban areas is also the pattern that residual confounding by urbanicity produces, and the adjustment for noise and particulate matter, though more than most studies attempt, does not exhaust what differs between a city and the countryside. The Foundation reports both because the choice between them is an empirical question and not an argumentative one.

Considerations bearing on confidence. In favor: nationwide coverage; a very large matched sample; registry-ascertained incident cases; matching on birth year and sex at 1 to 30; adjustment for nighttime traffic noise and particulate matter, which addresses the confounding objection by measurement rather than by acknowledgment, as at Appendix C.17; a nonlinear exposure-response relationship rather than an assumed linear one; a narrow confidence interval; and publication in a major general medical journal under an open license. Against: observational; areal exposure at one square kilometer with no spectral content; a short exposure window relative to the natural history of the disease; no individual-level exposure or behavior; the rural null; and a single national setting. The Foundation also notes that hazard ratios are reported from what is described as a case-control design, which is unconventional terminology, and that the estimation method should be checked against the paper before the figures are relied on in any filing.

Bearing on the statutory question. This entry does more work than most. Paragraph 360ii(a)(4) directs the Secretary to study and evaluate emissions of, and conditions of exposure to, electronic product radiation. Here is a disease of the organ that receives optical radiation, associated in a large national study with the ambient level of that radiation, with a dose-response shape, after adjustment for the two competing urban exposures most often raised. The Foundation does not contend that this establishes harm from any product. It contends that a federal program directed to study the conditions of exposure to electronic product radiation, which has prescribed performance standards for light-emitting products since 1979 and whose hazard framework is built around the retina, cannot treat a finding of this kind as outside its subject matter. Parts II.F, V.C, V.J.4, IX.C and IX.L.

C.23 Li and others (2024) — light at night, amygdala BDNF signaling, and stress-evoked behavior in rats

Citation. Li Z, Lee CS, Chen S, He B, Chen X, Peng HY, Lin TB, Hsieh MC, Lai CY, Chou D. Blue light at night produces stress-evoked heightened aggression by enhancing brain-derived neurotrophic factor in the basolateral amygdala. Neurobiology of Stress. 2024;28:100600. doi:10.1016/j.ynstr.2023.100600. PMID 38187456. PMCID PMC10767493. Published online December 15, 2023. Open access under the Creative Commons Attribution license.

Design. Controlled animal experiment combining behavioral testing, extracellular electrophysiology and immunoassay, with bidirectional pharmacological manipulation of the proposed mechanism. Adult male Sprague-Dawley rats, eight weeks of age, group housed four to a cage. Conducted in accordance with the ARRIVE guidelines and approved by the Institutional Animal Use Protocol Committee at MacKay Medical College, Taiwan, protocol A111003.

Exposure, as characterized — and why it matters. Animals were maintained on a twelve-hour light and dark cycle, lights on 06:00 to 18:00, at approximately 200 lux of white light-emitting diode illumination at cage level. Four conditions were compared over five days. Light control: the standard cycle with no light at night. Blue light at night: approximately 400 lux at cage level, 465 to 475 nanometers, from 19:00 to 22:00. White light at night: approximately 400 lux, 380 to 780 nanometers, over the same hours. Blue light at day: the same blue source and intensity delivered from 07:00 to 10:00. Testing was conducted the day after the exposure ended, and again seven days after.

The dose is environmentally plausible, which is unusual. The Foundation draws attention to the intensity, because a standing criticism of mechanistic light research — which the Foundation itself makes at Appendix C.18 — is that exposures are set far above anything encountered in ordinary life. That criticism does not apply here. The authors state that a full moon provides under 1 lux, that streets in industrialized countries are lit to approximately 5 to 15 lux, and that nighttime light in modern living rooms runs approximately 100 to 300 lux, and they chose approximately 400 lux as close to the living-room figure. This is an experiment conducted at something near a domestic exposure level.

Result — behavior. Light at night amplified aggression provoked by a mild stressor, measured by the resident-intruder test. For blue light at night: stress effect $F(1,36) = 23.75$, $p < 0.0001$; light effect $F(1,36) = 7.797$, $p = 0.0083$; interaction $F(1,36) = 5.006$, $p = 0.0315$. For biting: light effect $F(1,36) = 7.744$, $p = 0.0085$; interaction $F(1,36) = 12.42$, $p = 0.0012$. Anxiety-like behavior was also increased.

Three features of that result the Foundation emphasizes. First, there was no effect on baseline aggression. The light did not make the animals aggressive; it amplified a response to a stressor. Second, the effect was reversible: it was absent after a seven-day recovery period, stress effect $p = 0.2527$, light effect $p = 0.1209$. Third, and most important for how this entry may be used, white light at night produced the same effect as blue light at night, while blue light delivered during the day did not produce it at all.

What the white-light arm means. The title of the paper names blue light, but the study's own comparison arms show that the operative variable here is the timing of the exposure rather than its spectral composition. Blue at night and white at night both produced the effect; blue at the same intensity during the day did not. The Foundation states this plainly because the contrary reading would be convenient and is not supported. This entry is not evidence that short-wavelength content is specifically responsible for anything. It is evidence that light during the dark phase is.

Result — mechanism. Light at night potentiated both long-term potentiation and long-term depression in the basolateral amygdala, and produced stress-induced elevation of brain-derived neurotrophic factor, mature brain-derived neurotrophic factor, and phosphorylated tyrosine receptor kinase B in that structure. The mechanism was then tested in both directions. Microinfusion into the basolateral amygdala of BDNF RNA interference, a BDNF neutralizing antibody, K252a, or rapamycin each blocked the

heightened behavior in exposed animals; and microinfusion of BDNF or of the TrkB agonist 7,8-DHF produced the heightened behavior in animals not exposed to light at night.

What it establishes. That light during the dark phase, at an intensity comparable to a lit living room and over five days, produces measurable changes in synaptic plasticity and neurotrophin signaling in a limbic structure of the rat brain, and that those changes are necessary and sufficient for the behavioral effect observed, within this model. Demonstration of necessity and sufficiency by bidirectional manipulation is stronger evidence of mechanism than correlation of a marker with an outcome, and the Foundation records it as such. In the categories at Part V.A.2 this is a mechanistic study: it establishes that a pathway exists and is biologically plausible.

What it does not establish, stated emphatically. Nothing about human behavior. The Foundation does not contend, and asks that nothing in this comment be read as contending, that artificial light makes people aggressive or violent. The subject is a rat; the endpoint is a laboratory assay of territorial behavior toward an intruder, which is not a model of human conduct; the effect appeared only in combination with an applied stressor and not at baseline; and it resolved within seven days. The animals were male only. Rats are nocturnal, so light during their dark phase falls in their active period rather than their rest period, and the translation of that timing to a diurnal species is not straightforward. The study establishes nothing about light-emitting diode products as against other sources, and nothing about short-wavelength content, for the reason given above.

Considerations bearing on confidence. In favor: a controlled experiment with assigned exposure; four comparison conditions including a same-spectrum different-timing control, which is the design feature that makes the result interpretable; an environmentally plausible intensity; convergent behavioral, electrophysiological and biochemical measures; bidirectional pharmacological manipulation of the proposed mechanism; ARRIVE compliance and institutional approval; open access publication with test statistics reported. Against: a single laboratory; male animals only; a species difference that bears directly on the variable under study; a five-day exposure; and group sizes that should be confirmed from the figures rather than inferred from the degrees of freedom.

Bearing on the statutory question. Two uses, and the first is the more valuable. Paragraph 360ii(a)(2) directs the minimization of emissions and of exposure. This study isolates the temporal dimension of exposure: the same radiation at the same intensity produced an effect at one hour of the day and no effect at another. That is direct support for the proposition at Part II.D.2.d that when a product emits is part of what makes an emission necessary or unnecessary, and for the recommendation at Part IX.J.2 that outdoor luminaires be capable of dimming and scheduling. Second, it supplies a mechanism by which light at night could bear on the affective outcomes reported in humans at Appendix C.21, which is relevant to biological plausibility and to nothing more. Parts II.D.2.d, V.A.2, V.G and IX.J.

C.24 Burns and others (2023) — day and night light exposure and psychiatric disorders

Citation. Burns AC, Windred DP, Rutter MK, Olivier P, Vetter C, Saxena R, Lane JM, Phillips AJK, Cain SW. Day and night light exposure are associated with psychiatric disorders: an objective light study in >85,000 people. Nature Mental Health. 2023;1:853–862. doi:10.1038/s44220-023-00135-8. Published October 9, 2023.

Design and population. Cross-sectional analysis of UK Biobank data under application 6818. Eighty-six thousand seven hundred seventy-two adults, mean age 62.4 years with a standard deviation of 7.4, of whom 57 percent were women. Light exposure was measured objectively by wrist-worn Axivity AX3 device rather than reported by participants; the

analysis code is published. Day and night exposure were examined as independent predictors.

Outcomes. Major depressive disorder, generalized anxiety disorder, post-traumatic stress disorder, psychosis, bipolar disorder, and self-harm behavior.

Result, in the authors' own words. "Greater night-time light exposure was associated with increased risk for major depressive disorder, generalized anxiety disorder, PTSD, psychosis, bipolar disorder, and self-harm behavior. Independent of night-time light exposure, greater daytime light exposure was associated with reduced risk for major depressive disorder, PTSD, psychosis, and self-harm behavior. These findings were robust to adjustment for sociodemographics, photoperiod, physical activity, sleep quality, and cardiometabolic health."

Effect estimates. Not stated here. The odds ratios and intervals are presented in the published figures and the Foundation has not been able to obtain them: the article is behind a subscription and the accepted manuscript in the author's institutional repository is not served. This entry is therefore incomplete as to magnitude, and the Foundation relies on it for direction and robustness only.

Why this entry matters out of proportion to its design. Every other entry in this appendix concerns light at night. This one measures day and night exposure separately and finds them to act in opposite directions, independently of each other. That changes the shape of the proposition this comment advances. The Foundation does not contend that artificial light is harmful. It contends that the pattern of exposure matters — that the human light environment has been inverted, with too little during the day and too much at night — and that no federal body has evaluated the pattern that American products now produce. A finding that daytime light is associated with reduced risk is as much a part of that proposition as a finding that nighttime light is associated with increased risk, and the Foundation presents both. It is also consistent with the long-wavelength findings at Appendices C.1, C.13 and C.19, which concern what daytime light contains rather than when it falls.

What it establishes. That in a very large cohort with objectively measured rather than self-reported exposure, nighttime and daytime light were independently associated with psychiatric outcomes in opposite directions, and that these associations survived adjustment for photoperiod, physical activity, sleep quality and cardiometabolic health. Adjustment for sleep quality is worth noting: it addresses the most obvious alternative explanation, that light acts only by disturbing sleep.

What it does not establish. Causation, and the design makes this more than a formality. The analysis is cross-sectional, so exposure and outcome were measured at the same time and nothing establishes which came first. Reverse causation is a live possibility here in a way it is not for many outcomes in this appendix: a person experiencing depression may spend less time outdoors and keep different hours, which would produce exactly this pattern of day and night exposure without the light having caused anything. The Foundation does not resolve that and neither does the study. It establishes nothing about light-emitting diode products specifically, and nothing about spectral composition, since a wrist-worn sensor records illuminance and not spectrum. Part V.J.4.

Competing interests, which the Foundation records in full. The declaration states that A.J.K. Phillips and S.W. Cain have received research funding from Delos and Versalux and co-founded and co-direct Circadian Health Innovations PTY LTD; that S.W. Cain has also received research funding from Beacon Lighting and has consulted for Dyson; that P. Olivier co-founded Axivity Ltd, the manufacturer of the device used to measure exposure, and was a director until 2015; and that C. Vetter is a board member of the Working Time Society and a research committee member for DiME. All other authors reported none. Funding was from the Australian Government Research Training Program and the

National Health and Medical Research Council, grant GNT1183472, with a statement that the funders had no role in the work.

What the Foundation makes of that, and what it does not. It makes nothing of it by way of accusation. The interests were disclosed, which is what disclosure is for, and several of the authors are among the most productive researchers in this field. The Foundation records them for two reasons. The first is consistency: it has named the weaknesses of every other entry in this appendix and will not make an exception for an entry whose findings suit it. The second is that the interests run in a particular direction. Two senior authors hold commercial positions in circadian lighting, and the finding is that the timing of light matters. That is a reason to want independent replication, not a reason to discount the work, and independent replication of this line of research is among the things § 360ii(a)(2) directs the Secretary to support.

Independence from other entries. Windred, Phillips and Cain are also authors of the cardiovascular study at Appendix C.8. The two are products of the same group working on the same UK Biobank accelerometry resource and are not independent. The Foundation records this as it has at Appendices C.19 and C.20.

Bearing on the statutory question. The Foundation offers this entry for the proposition that the temporal distribution of light exposure is a variable with measurable associations in a very large population, and that it is a variable no federal instrument currently describes. Paragraph 360ii(a)(4) directs the Secretary to study and evaluate conditions of exposure, and when a person is exposed is a condition of exposure. The entry also supports the recommendations at Part IX.J.2 concerning dimming and scheduling capability, and it bears on Part V.G. It is not offered to show that any product causes psychiatric illness, and for the reasons stated above it could not be. Parts II.D.2.d, V.G, V.J.4 and IX.J.

C.25 Moore-Ede and others (2023) — scientific consensus survey on circadian light

Citation. Moore-Ede M, Blask DE, Cain SW, Heitmann A, Nelson RJ. Lights should support circadian rhythms: evidence-based scientific consensus. Frontiers in Photonics. 2023;4:1272934. doi:10.3389/fphot.2023.1272934. Received August 4, 2023; accepted September 20, 2023; published October 4, 2023. Open access.

Article type and method. A brief research report presenting a single-round online opinion survey, described by the authors as the Scientific Consensus Survey on Circadian Light. A PubMed search for circadian and light identified 10,002 articles by 29,455 authors between 2008 and 2022. The 2,142 authors with four or more such articles were invited. One thousand one hundred fifty-six opened an invitation and 248 completed the survey. Respondents rated thirty factual statements and five practical statements on an evidence scale, and five expert policy statements on an agreement scale. Consensus was defined as two-thirds support with don't-know responses excluded. Twenty-five of forty statements reached that threshold. Respondents could not revise answers after feedback.

Items relevant to this comment. Among the consensus results: that light used in the evening, during the three hours before bedtime, should have as little blue content as practically possible, 82.5 percent; that the risk of circadian disruption in those three hours can be reduced by dimming indoor lighting or reducing its blue content, 72.0 percent; and, in the factual group, that blue-enriched light between 460 and 495 nanometers in those three hours disrupts sleep, 70.3 percent, phase delays the circadian system, 75.5 percent, and disrupts circadian rhythms more than blue-depleted light at the same intensity, 70.1 percent. In the expert-opinion group: that light-emitting diode lamps with high 460 to 495 nanometer blue content should carry the warning label maybe harmful if used at night, 79.1 percent.

What it is, stated plainly. An opinion poll of researchers. It is not a study of light, it generates no data about any product or any person, and it measures what a self-selected group of

respondents believes. The Foundation uses it only in the category described at Part V.A.2 as evidence of the state of expert opinion. The warning-label item in particular was presented in the survey as a policy opinion, not as a statement of evidence, and the Foundation does not present it as more than that.

Considerations bearing on confidence, which are substantial. First, participation. Of 2,142 researchers invited, 248 responded, about 11.6 percent, and 248 of the 1,156 who opened an invitation. A survey about whether light at night is harmful, answered by one in nine of those asked, is exposed to self-selection in the direction of the result. Second, composition: 103 of the 248 respondents had conducted human research and 145 had not. Third, method: a single round with no opportunity to revise after feedback is weaker than the iterative procedures by which formal consensus is usually established, and the word consensus should be read accordingly. Fourth, three of the five authors — Cain, Blask and Nelson — took part in the survey they report.

Funding and competing interests, recorded in full. The survey platform fees and part of the cost of compiling the invitation list were funded by Korrus, Inc., a lighting company, with a statement that the funder had no role in the work. The declaration states that Moore-Ede and Heitmann are inventors on patents covering circadian-optimized spectrally engineered light sources; that Moore-Ede was chief executive of Circadian ZirClight Inc. until April 2022, when its intellectual property was acquired by Korrus, that he has received compensation from Korrus, and that he holds equity in CIRCADIAN companies which hold a stake of under one percent in Korrus; that Cain is an inventor on a provisional patent for a circadian lighting system and is co-founder and co-director of Circadian Health Innovations; and that Cain was a Frontiers editorial board member at submission, which the authors state had no effect on review.

What the Foundation makes of that. It makes no allegation of bad faith and none is warranted; the interests were disclosed in detail, which is to the authors' credit. But the Foundation will not rest an argument on this entry, and says why. The recommendation that lamps with high short-wavelength content carry a warning label would, if adopted, advantage manufacturers of low-blue circadian-optimized lighting. The survey was funded by a company in that business, and its first author holds patents in that product category, was chief executive of a company whose intellectual property that funder acquired, and receives compensation from the funder. A reader encountering this entry for the first time in a reply to this comment would find all of that, and the Foundation would rather state it first. An opinion poll so situated cannot carry weight as evidence of a hazard.

What it is nevertheless good for. One proposition, which does not depend on the survey being well conducted or disinterestedly funded: that whether products emitting substantial short-wavelength content should be labeled is a question people working in this field are actively asking, in print. Paragraph 360ii(a)(3) directs the Secretary to maintain liaison with and receive information from professional organizations on present and future potential electronic product radiation. A published survey of two hundred forty-eight researchers in the field is information of that kind, whatever its weight. Parts II.E.4 and IX.J.5.

Independence from other entries. Sean W. Cain is also an author of Appendices C.8 and C.24, and the competing interests declared here overlap with those declared there. The Foundation records this as it has elsewhere in this appendix.

C.26 Hiramoto and others (2023) — long-term blue light irradiation and skin cancer in hairless mice

Citation. Hiramoto K, Kubo S, Tsuji K, Sugiyama D, Hamano H. Induction of skin cancer by long-term blue light irradiation. Biomedicines. 2023;11(8):2321. doi:10.3390/biomedicines11082321. PMID 37626816. PMCID PMC10452187. Published August 21, 2023. Open access under the Creative Commons Attribution license.

Design. Controlled animal experiment with four spectral exposure conditions and an unirradiated comparison. Specific-pathogen-free male hairless mice, strain Hos:HR-1, eight weeks of age at the start, housed individually on a twelve-hour light and dark cycle and randomized by body weight into groups of five. Approved by the Suzuka University of Medical Science Animal Experiment Ethics Committee, approval number 34.

Exposure, as characterized — the figures the Foundation relies on. Whole-body irradiation for ten minutes per day, every day, for one year. Blue: 380 to 500 nanometers, peak emission 479, at 40 kilojoules per square meter per session. Green: 500 to 560 nanometers, peak 538, at 40 kilojoules per square meter. Red: 600 to 700 nanometers, peak 629, at 40 kilojoules per square meter. White: 12 kilojoules per square meter. The control group received the fluorescent lamp ordinarily used for breeding. Energy content was measured with a light analyzer. Expressed otherwise, the three matched conditions delivered 4 joules per square centimeter per session at an irradiance of approximately 6.7 milliwatts per square centimeter, and approximately 1,460 joules per square centimeter over the year.

Result. Skin cancer was induced in the blue-light group and in no other group. Long-term blue irradiation increased migration of neutrophils and macrophages into the skin. In neutrophils, citrullinated histone H3 and peptidylarginine deiminase 4 expression increased, which the authors suggest indicates NETosis. In macrophages, inflammatory type 1 macrophages increased and anti-inflammatory type 2 macrophages decreased. Analysis was by one-way analysis of variance with Tukey post hoc testing.

Which comparison carries the spectral claim, and which does not. The green and red conditions each received the same 40 kilojoules per square meter as the blue condition and produced no cancer. That is the comparison that supports a conclusion about wavelength, because the delivered energy was matched and only the spectrum differed. The white condition received 12 kilojoules per square meter, under a third of the blue dose, so the absence of cancer in the white group is confounded by dose and cannot be read as showing that white light is safer at equal energy. The Foundation sets this out because the paper's summary statement, that cancer appeared only in the blue group, is true of four comparison groups of which only two are dose-matched.

What it establishes. That in this strain of hairless mouse, a year of daily ten-minute whole-body exposure to 4 joules per square centimeter of 380 to 500 nanometer light produced skin tumors, where the same energy delivered at longer wavelengths did not, together with an inflammatory cellular picture in the skin. Within the model, the dose-matched green and red arms make this a statement about wavelength rather than about energy.

What it does not establish. Anything about human skin. Hos:HR-1 hairless mice are a strain selected for use in photocarcinogenesis research and are not a model of ordinary human exposure. Five animals per group is a very small sample for a cancer endpoint. The exposure is not representative of exposure to screens or to indoor lighting: at approximately 6.7 milliwatts per square centimeter it is orders of magnitude above room illumination, and the Foundation notes that the paper's framing refers to blue light from personal computers and smartphones while the exposure administered does not model either. No dose-response series was run, so the study identifies no threshold and no safe level; it tested one dose. It establishes nothing about any product in commerce and nothing about the retina.

Considerations bearing on confidence. In favor: a controlled experiment with assigned exposure; three spectral conditions matched on delivered energy, which is the design feature that makes the result interpretable at all; a full year of exposure, which is rare and which addresses the chronic-exposure gap this comment describes; radiometric rather than photometric reporting of the exposure, which is also rare and which the Foundation commends; institutional ethics approval; open access. Against: five animals per group; a

single laboratory; one dose only; a highly susceptible strain; a dose-confounded white arm; male animals only; and the gap between the exposure administered and the exposures invoked in the paper's framing.

Affiliations and declaration. The corresponding author is at the Department of Pharmaceutical Sciences, Suzuka University of Medical Science. The remaining four authors give their affiliation as the Research Department of Daiichi Sankyo Healthcare Co., Ltd. The paper's declaration states that the authors declare no conflict of interest. The Foundation records both facts as they appear on the paper and draws no inference from them.

Bearing on the statutory question. The Foundation offers this entry principally at Part V.C.2.d, and for the question of quantity rather than the question of harm. The study states its exposure in radiometric units, and from those the delivered dose per session, the irradiance, and the cumulative dose over a year can all be computed. That is what an evaluation under § 360ii(a)(4) would look like, performed by a university laboratory in Japan for five mice. No federal instrument states, for any product emitting visible light, what dose in what waveband over what period is acceptable for a person. The existing blue-light hazard framework stops at ten thousand seconds and addresses the retina; this experiment ran for a year and concerned the skin. The Foundation does not contend that any product causes skin cancer and this entry is not offered for that. It is offered to show that the question is askable in numbers, and that nobody in the federal government has asked it. Parts V.C.2.d, IX.C and IX.J.

C.27 Mazzoleni and others (2023) — outdoor artificial light at night and dementia, Modena

Citation. Mazzoleni E, Vinceti M, Costanzini S, Garuti C, Adani G, Vinceti G, Zamboni G, Tondelli M, Galli C, Salemme S, Teggi S, Chiari A, Filippini T. Outdoor artificial light at night and risk of early-onset dementia: a case-control study in the Modena population, Northern Italy. Heliyon. 2023;9(7):e17837. doi:10.1016/j.heliyon.2023.e17837. PMID 37455959. PMCID PMC10339013. Open access under a Creative Commons Attribution-NonCommercial-NoDerivatives license.

Design and population. Case-control study in the province of Modena. Dementia newly diagnosed between 2017 and 2019; 58 early-onset cases, 34 late-onset cases, and 54 controls drawn from the caregivers of the patients. Residential address at recruitment was geo-referenced, with a requirement of five years of residential stability. Exposure was assigned from 2015 Visible Infrared Imaging Radiometer Suite nighttime luminance imagery, categorized as under 10, 10 to under 40, and 40 or more nanowatts per square centimeter per steradian. Logistic regression adjusted for age, sex and education, with a spline model for non-linearity.

Result. For early-onset dementia, odds ratio 1.36 in the intermediate exposure category, 95 percent confidence interval 0.54 to 3.39, and 1.04 in the high category, 0.32 to 3.34. For late-onset dementia, 2.58, 0.26 to 25.97, and 3.50, 0.32 to 38.87. The spline analysis showed what the authors describe as a substantial lack of association for early-onset dementia and an almost linear though highly imprecise association for late-onset dementia.

The weight of this entry, stated first. No result in this study reached statistical significance. Every confidence interval includes unity, and two of them span more than two orders of magnitude: an odds ratio reported as 3.50 with an interval running from 0.32 to 38.87 is consistent with a substantial protective effect and with a very large harmful one. There are 54 controls. The Foundation states plainly that this entry carries essentially no evidentiary weight on the question whether light at night causes dementia, and it is not offered for that question. The title names early-onset dementia, and that is the outcome for which the authors report substantially no association.

A further design feature. The controls were the caregivers of the cases. Caregivers of people with dementia frequently live with or near them, so case and control exposures are liable to be correlated. The authors identify this as possible overmatching and argue that it would bias the estimates toward the null and therefore strengthen rather than weaken what they found. That is their inference and it is a reasonable one, but it is an argument rather than a demonstration, and the Foundation records it as such.

What the authors could not adjust for, in their own account. They state that they could not take air pollution into account, which they describe as a likely risk factor for dementia that tends to be associated with light pollution; nor residential green space; nor noise. Compare Appendix C.17, where air pollution was measured and adjusted for, and Appendix C.22, where noise and particulate matter were. The contrast between those studies and this one is instructive about what adjustment requires, which is resources.

The limitation the Foundation relies on. The authors write that they took light intensity into account but were unable also to consider its wavelength, while noting that they used the highest spatial resolution available. That is the measurement gap described at Part V.J.4, stated once again by the investigators themselves and against their own result. It is now the fourth independent group in this appendix to say so, with Appendices C.5, C.14 and C.22.

Funding and competing interests. Supported by the Italian Ministry of Education, University and Research under the Dipartimenti di Eccellenza 2018–2022 program awarded to the University of Modena and Reggio Emilia Department of Biomedical, Metabolic and Neural Sciences, and by university and Fondazione di Modena grants. The authors declare no competing financial interests or personal relationships. The Foundation notes the absence of industry involvement, which distinguishes this entry from Appendices C.24 and C.25.

Bearing on the statutory question. The Foundation offers this entry for two purposes, neither of which is the strength of its findings. The first is the wavelength limitation stated above. The second is the condition of the literature itself. Here is a university group in Italy, without industry funding, asking whether ambient light at night bears on dementia, and able to assemble 92 cases and 54 controls, unable to adjust for air pollution or noise, and reporting intervals so wide that they exclude almost nothing. That is not a criticism of the investigators. It is what a question looks like when no one with resources is asking it. Paragraph 360ii(a)(2) directs the Secretary to plan, conduct, coordinate and support research, and § 360ii(b)(2) authorizes grants for precisely that purpose. Part II.B. Read alongside Appendix C.16, which addresses the same disease by an ecological design and is weak in a different way, this entry shows a question being approached repeatedly and answered by nobody. Parts II.B, II.F, V.J.4 and IX.C.

C.28 Karthikeyan, Davies and Gunhaga (2023) — non-visual opsins and photoreception outside the eye

Citation. Karthikeyan R, Davies WIL, Gunhaga L. Non-image-forming functional roles of OPN3, OPN4 and OPN5 photopigments. Journal of Photochemistry and Photobiology. 2023;15:100177. doi:10.1016/j.jpap.2023.100177. Available online April 2, 2023. Open access under the Creative Commons Attribution-NonCommercial-NoDerivatives license. Affiliations: Umeå Centre for Molecular Medicine, Umeå University, Sweden; School of Life Sciences, La Trobe University, Melbourne.

Article type. Review. Not primary research and not a systematic review. Every quantitative figure the Foundation takes from it is reported at one remove from a primary source. The Foundation cites it in the category described at Part V.A.2 as a synthesis of the state of the field, and for mechanism rather than for effect.

Subject. The three non-visual opsin photopigments OPN3 (encephalopsin or panopsin), OPN4 (melanopsin) and OPN5 (neuropsin): their spectral properties, their expression across tissues in vertebrates including humans, and the non-image-forming functions attributed to them, which the review groups as photoentrainment of biological rhythms, melanogenesis in dermal tissue, thermoregulation in adipose tissue, embryonic eye development, smooth muscle relaxation, and the development of certain cancers.

Spectral sensitivities reported. Peak dark absorbance of approximately 463 nanometers for OPN3, which the review notes can extend to 470 depending on species; 480 nanometers for OPN4; and 380 nanometers for OPN5. The review states that light at 480 nanometers activates OPN3 to 90 percent and OPN4 to 100 percent but does not activate OPN5, and that light at 400 nanometers activates OPN3 to 39 percent, OPN4 to 28 percent and OPN5 to 78 percent.

Expression outside the eye. Table 1 of the review lists tissue and cell expression. For OPN3 these include blood vessels; numerous brain regions including cerebellum, cerebral cortex, hippocampus, hypothalamus, limbic system and thalamus; the gastrointestinal tract including colon, esophagus, ileum, liver, pancreas and stomach; immune cells including human B-cells and T-cells; the reproductive system; skin including fibroblasts, hair follicles, keratinocytes and melanocytes; and adipocytes, adrenal glands, cochlea, heart, kidney, lung, smooth and skeletal muscle, spinal cord, spleen and thymus. OPN4 is listed in blood vessels, brain, eye, skin, reproductive tissue, adipose-derived stem cells, liver, smooth muscle and developing thyroid. OPN5 is listed in brain regions, eye, reproductive tissue, and skin keratinocytes and melanocytes.

Penetration of tissue. The review states that the penetration of specific wavelengths through skin, the skull and other bones, skeletal muscle, underlying soft tissues and through abdominal structures to reach the developing fetus has been firmly established, that longer wavelengths penetrate further than blue, and that biologically relevant shorter wavelengths also pass into deeper tissues.

What it establishes. That light detection in mammals is not confined to the rods and cones, that a family of photopigments with defined spectral sensitivities is expressed across a wide range of tissues including skin, fat, blood vessels, smooth muscle, immune cells and brain, and that functional responses to light have been demonstrated through those receptors in laboratory systems. It also establishes that the peak sensitivities of two of the three lie in the short-wavelength region in which phosphor-converted white light-emitting diodes emit most strongly.

What it does not establish. That any product in commerce produces any effect through any of these pathways in any person. Most of the underlying work is in cell culture, in isolated tissue and in animal models, much of it with gene knockouts and exogenous chromophore, and the review does not present exposure levels encountered in ordinary life. It identifies no threshold, no dose and no exposure limit. It is a review and performs no appraisal of the studies it summarizes. The Foundation uses it for the existence and location of a mechanism and for nothing else.

Considerations bearing on confidence. In favor: published in a photochemistry and photobiology journal by authors in the field; extensively referenced; explicit about uncertainty, including that determining a reliable peak absorbance value for OPN4 has proved difficult and inconsistent, and that functional roles of several opsins remain unknown or unclear. Against: a narrative review with no stated search strategy or appraisal instrument; a literature drawn from many species with differing opsin complements; and reliance throughout on knockout and ex vivo preparations whose relation to intact human exposure is not established.

Bearing on the statutory question. This is the mechanistic entry the rest of the appendix needed. Paragraph 360ii(a)(4) directs the Secretary to study and evaluate emissions of,

and conditions of exposure to, electronic product radiation. The photobiological safety framework the Department and the consensus bodies rely on assesses exposure to the eye. This review describes receptors for visible light distributed through the skin and viscera, with peak sensitivities near 463 and 480 nanometers, and functional responses in adipose tissue, vasculature, smooth muscle and immune cells. If those pathways operate at the exposures people actually receive — which is unresolved, and which the Foundation does not assert — then the quantity the existing framework measures is not the quantity that matters, and no instrument in federal use would detect the difference. That is a question for study, and it is the study § 360ii(a)(2) and (a)(4) direct. Parts V.B.1, V.C.2.h, V.J.4 and IX.C.

Entries this one bears on. Appendix C.15, hepatic injury in mice from whole-body exposure, where OPN3 is reported in liver; C.19, systemic glucose effects from light delivered to the back, though that study attributes its mechanism to cytochrome c oxidase rather than to an opsin and the two should not be merged; C.20, allergic and respiratory disease, where OPN3 is reported in bronchial epithelium and immune cells; C.23, limbic signaling in rats, where OPN3 is reported in hippocampus and limbic structures; and C.26, skin cancer in mice, where OPN3, OPN4 and OPN5 are all reported in keratinocytes and melanocytes. The Foundation does not assert that any of those findings is explained by any of these receptors. It observes that a plausible route exists and has not been investigated federally.

C.29 Cao, Xu and Yin (2023) — health threats of light pollution and the state of regulation

Citation. Cao M, Xu T, Yin D. Understanding light pollution: recent advances on its health threats and regulations. Journal of Environmental Sciences. 2023;127:589–602. doi:10.1016/j.jes.2022.06.020. PMID 36522088.

Status of this entry. Incomplete, and the Foundation says so at the outset. The article is not open access and no author manuscript or repository copy could be located. Everything below is taken from the published abstract. The entry is retained because of one sentence in that abstract, quoted at Part II.D.5, and because the subject matter of the review is the regulatory question this comment raises.

Article type and scope. Review, covering literature from 2018 to 2022, epidemiological and experimental. The authors state that they summarize associations of light pollution with obesity, mental disorders and cancer among others, and that they address the toxicological mechanism of light pollution through circadian disruption, reviewing alterations of clock genes and disturbance of melatonin homeostasis.

The sentence the Foundation relies on. "Although there are regulations and standards concerning light pollution, few of them are based on the potential contribution of improper lighting to diseases." The authors add that a better understanding of the health threats induced by light pollution may promote risk assessment and better regulation of artificial lights, and that they aim to provide perspectives for future research and guidance for relevant regulations and standards.

What it establishes. That researchers surveying this field describe the existing body of regulation and standards for light pollution as largely not disease-based, and regard better regulation as a purpose their review is meant to serve. That is a statement about the state of regulation internationally, made in a peer-reviewed journal, and it corroborates from outside what Part II.D.5 establishes from the United States record: that what governs this subject here is voluntary, non-federal, and not addressed to health outcomes.

What it does not establish. Anything about any product, any exposure or any person. It is a review, the Foundation has read only its abstract, and it makes no claim about United States law in particular so far as the abstract discloses. The Foundation does not rely on

any of its substantive findings about obesity, mental disorders, cancer, clock genes or melatonin, because it has not read them.

Considerations bearing on confidence. Unassessed. The Foundation has not seen the method, the search strategy, the funding statement, the competing interest declaration or any of the content beyond the abstract, and will not pretend otherwise. A review published in an indexed peer-reviewed journal carries the ordinary presumptions of that status and nothing further until read.

Bearing on the statutory question. One use, at Part II.D.5. The Final Response of May 24, 2024 rested in part on the effectiveness of existing mitigations in addressing unnecessary radiation. Part II.D.2. The Foundation asks the Department to identify those mitigations and to state which of them it administers, and offers this review for the narrow proposition that researchers surveying the international picture describe the regulatory instruments in this field as largely not grounded in disease. If that is so of the instruments generally, the Department should be able to say which of them, as applied to light-emitting diode products in the United States, is grounded in disease and who administers it. Parts II.D.2, II.D.5 and IX.H.2.

C.30 Campbell, Sharifpour and Vandewalle (2023) — light as a modulator of non-image-forming brain functions

Citation. Campbell I, Sharifpour R, Vandewalle G. Light as a modulator of non-image-forming brain functions — positive and negative impacts of increasing light availability. Clocks & Sleep. 2023;5(1):116–140. doi:10.3390/clockssleep5010012. PMID 36975552. PMCID PMC10047820. Published March 17, 2023. Open access under the Creative Commons Attribution license.

Article type. Narrative review. The authors describe it as such and state that they include what they consider important and relevant papers rather than applying a systematic search. The Foundation cites it in the category described at Part V.A.2, as evidence of the state of expert opinion and for the framework it supplies, not as primary evidence of effect. The authors declare no conflict of interest.

Subject. The image-forming and non-image-forming visual pathways; the impact of light on human cognition, sleep, alertness and mood; and the consequences of the adoption of light-emitting diode lighting and screens. Non-image-forming responses are mediated by intrinsically photosensitive retinal ganglion cells expressing melanopsin, which the authors state is maximally sensitive to blue-wavelength light around 480 nanometers, and which mediate melatonin suppression, pupillary constriction, stimulation of alertness and cognitive performance, circadian entrainment and influences on mood.

The passage the Foundation relies on. At its section headed Health and Lighting, the review distinguishes the blue light hazard from the non-image-forming response: the hazard concerns photochemical damage to retinal tissue, is particularly prominent for prolonged or intense exposure below approximately 440 nanometers and especially from relatively focal sources, and is therefore distinct from the non-image-forming impacts of diffused light, which peak around 460 to 480 nanometers. The quotation is set out at Part V.C.2.i.

What else it establishes, in the authors' own framing. That light use is rising steeply, mainly because of the advent of light-emitting diode devices; that many commonly used white light-emitting diodes are relatively rich in blue-wavelength light; and that the timing of such device use is widespread, leading, in the authors' phrase, to novel light exposure patterns on the non-image-forming system. The Foundation draws the Department's attention to that phrase. A novel exposure pattern is a condition of exposure, and § 360ii(a)(4) directs the Secretary to study and evaluate conditions of exposure to electronic product radiation.

The balance the review strikes, which the Foundation adopts. The authors frame the adoption of light-emitting diode lighting and screens as offering new opportunities to improve well-being while also raising concerns about increasing light exposure that may be detrimental to health, particularly in the evening. That is the same two-sided position the Foundation takes at Appendix C.24 and at Part I.A: the objection is not to artificial light but to an exposure pattern that has changed without evaluation. The Foundation cites the review as it is written and does not quote only its negative half.

What it does not establish. No primary data; a narrative review with no stated search strategy, no inclusion criteria and no appraisal instrument. It establishes nothing about any particular product, sets no threshold, and identifies no exposure limit. Its statements about melanopsin sensitivity and about the blue light hazard are summaries of other work and should be traced to that work where the comment relies on them heavily.

Considerations bearing on confidence. In favor: authors active in this specific field; open access; no declared conflict of interest; and a notably balanced presentation that treats light as beneficial as well as potentially harmful, which the Foundation regards as a mark of care. Against: narrative rather than systematic; published in an MDPI title, as are Appendices C.18, C.21 and C.26, and the same question about whether to note the publisher applies here; and everything in it is reported at one remove.

Bearing on the statutory question. This entry supplies the distinction on which Part V.C.2.i rests, and that distinction bears directly on the Final Response of May 24, 2024. The agency has stated that light-emitting diode products have a long history of safety with respect to the visible wavelengths they emit. Safety assessed how, and against what? The framework available for assessing optical radiation safety addresses photochemical retinal injury below roughly 440 nanometers from focal sources. The pathway by which light reaches the brain peaks near 480 nanometers and responds to diffuse illumination. A record of conformity with the first is not a history of safety with respect to the second, and the Foundation has found no assessment of the second for any product. Parts I.C.7, V.B.1, V.C.2.i, V.G and IX.C.

C.31 Lu and others (2023) — light at night and cause-specific mortality in Mainland China

Citation. Lu Y, Yin P, Wang J, Yang Y, Li F, Yuan H, Li S, Long Z, Zhou M. Light at night and cause-specific mortality risk in Mainland China: a nationwide observational study. BMC Medicine. 2023;21:95. doi:10.1186/s12916-023-02822-w. PMID 36927443. PMCID PMC10022237. Published March 16, 2023. Open access under the Creative Commons Attribution license.

Design, and why it differs from every other entry here. Time-stratified case-crossover study with conditional Poisson regression within each county, followed by random-effects meta-analysis across counties. In a case-crossover design each decedent serves as his or her own control: exposure on the day of death is compared with exposure on control days drawn from the same month and year and matched by day of week. The consequence is that every characteristic of a person that does not change from day to day — age, sex, smoking, genetics, income, occupation, neighborhood, the whole of the urbanicity problem that burdens the other observational entries in this appendix — is removed by the design rather than adjusted for in a model. Season and day-of-week effects are removed by the matching. No other entry in Appendix C has that property.

Population and exposure. Five hundred seventy-nine counties, 2015 to 2019. Daily light at night from the Suomi National Polar-orbiting Partnership Visible Infrared Imaging Radiometer Suite. Average daily light at night across counties was 4.39 nanowatts per square centimeter per steradian, with a range of 1.02 to 35.46. Daily mortality from the Disease Surveillance Point System.

Adjustment. Daily temperature, daily humidity and daily fine particulate matter were adjusted for, the last derived from the China High Air Pollutants dataset at one-kilometer resolution and the meteorological variables from the ERA5-Land reanalysis. The Foundation notes this because daily satellite radiance and daily weather are not independent, and an analysis of day-to-day variation that did not address temperature and air pollution would be of little use. This one does.

Result. Per 100 nanowatts per square centimeter per steradian increase in daily light at night: all-cause mortality relative risk 1.08, 95 percent confidence interval 1.05 to 1.11; natural-cause mortality 1.08, 1.05 to 1.11. Positive associations were observed for all natural cause-specific categories, the strongest being mortality from nervous system disease, 1.32, 1.14 to 1.52. Results were reported as robust in younger and older people and in both sexes, with a more pronounced effect in regions of median exposure, and the exposure-response relationship was non-linear.

A presentational point the Foundation raises on its own account. The relative risks are scaled to an increase of 100 nanowatts per square centimeter per steradian. The reported range of county average daily exposure is 1.02 to 35.46, a span of about 34 units, and the day-to-day variation within a county, which is what the case-crossover design actually uses, is not stated in the abstract and will be smaller still. A risk expressed per 100 units in data whose observed spread is a third of that, and whose operative contrast is smaller again, overstates to the eye what the study observed. Taken at face value and assuming log-linearity, a relative risk of 1.08 per 100 units corresponds to roughly 1.03 across the entire between-county range. The Foundation reports the figures as published and flags the scaling, because a reply that noticed it first would be entitled to make something of it.

What it establishes. That across 579 Chinese counties over five years, days of higher satellite-measured nighttime radiance were associated with higher mortality, after adjustment for temperature, humidity and fine particulate matter, with the association removed by design from confounding by any characteristic that does not vary day to day. This is the only entry in Appendix C with mortality as its endpoint and the only one using a within-person comparison.

What it does not establish. Causation; the study is observational, and association on a given day does not establish that the light contributed to the death. The design addresses short-term variation and says nothing about chronic exposure causing disease over years, which is the mechanism most of this appendix concerns; the two questions should not be run together. Exposure is assigned at county level and is not a measurement of what reached any individual, which the authors identify as a source of misclassification. The instrument is broadband and carries no spectral information, so this establishes nothing about light-emitting diode products or about which light. Part V.J.4. The authors further state that they could not adjust for indoor light, for the use of eye masks, or for sleep patterns, and that noise and other unrecognized environmental factors cannot be ruled out.

The question the Foundation cannot resolve from what it has read. Satellite-measured nighttime radiance on any given night varies not only with how much light is emitted but with cloud cover, lunar illumination, snow, aerosol load and viewing geometry. Standard products from this instrument are ordinarily screened for cloud and moonlight, and the comment at Part II.D.3.d describes how strongly cloud amplifies measured radiance. Whether and how the authors handled cloud and lunar illumination is the single most important methodological question for a study built on day-to-day variation, and the Foundation has not located the answer. Until it does, it treats the daily exposure variable as potentially carrying an atmospheric component that temperature, humidity and particulate adjustment would not fully remove.

Considerations bearing on confidence. In favor: a mortality endpoint, which is the least subject to ascertainment error of any outcome in this appendix; a national surveillance

system rather than a cohort; 579 counties; a design that eliminates time-invariant confounding structurally; adjustment for the three time-varying environmental confounders that matter most; a two-stage approach with county-specific estimates meta-analyzed rather than pooled naively; a non-linear exposure-response examined rather than assumed; consistency across age and sex; and open access publication in a general medical journal. Against: observational; county-level exposure; no spectral information; the scaling point above; the unresolved cloud and moonlight question; a modest effect size; and a single national setting whose lighting and reporting systems are not those of the United States.

Bearing on the statutory question. The Foundation offers this entry for two propositions and no more. First, that the outcomes under investigation in this literature now extend to death, which bears on the seriousness of the question § 360ii(a)(4) directs the Secretary to study rather than on whether any answer has been reached. Second, that a study design exists which removes the confounding objection structurally rather than by adjustment, and that it has been applied to this exposure once, in another country, using a satellite instrument that cannot see the spectrum. A federal research program could apply the same design to United States data with spectrally resolved exposure. Nothing prevents it except that no one has been asked to. Parts II.F, V.J.4 and IX.C.

C.32 Obayashi and others (2022) — directly measured bedroom light and health outcomes, HEIJO-KYO cohort

Citation. Obayashi K, Tai Y, Yamagami Y, Saeki K. Associations between indoor light pollution and unhealthy outcomes in 2,947 adults: cross-sectional analysis in the HEIJO-KYO cohort. Environmental Research. 2022;215:114350. doi:10.1016/j.envres.2022.114350. PMID 36150438. Received May 19, 2022; accepted September 12, 2022; available online September 21, 2022. Open access under the Creative Commons Attribution license. Department of Epidemiology, Nara Medical University School of Medicine, Japan.

Why this entry matters. It is the only study in Appendix C in which the exposure was measured directly, with a light meter, in the room where the participant sleeps, at a scale sufficient to describe the distribution across a population. Every other exposure in this appendix is satellite radiance over an area, a wrist-worn sensor, or a report by the participant. This is the measurement that corresponds most closely to the quantity a recommendation about bedroom light would have to specify. It is also the primary source for the Obayashi figures reported at second hand at Appendix C.21.

Design and population. Cross-sectional analysis within the Housing Environments and Health Investigation among Japanese Older People in Nara, Kansai Region, a prospective community-based cohort known as HEIJO-KYO. Enrollment between September 2010 and April 2019 of 3,012 adults aged over 40. Sixty-five were excluded for missing or improperly placed meters, leaving 2,947, or 97.8 percent. Mean age 69.3 years, standard deviation 7.8; 60.6 percent female. Written informed consent; approved by the Nara Medical University ethics committee.

Exposure, as measured — set out in full because the method is the point. Bedroom light intensity was measured from bedtime to rising time at intervals of less than two minutes on two consecutive weekday nights, using portable light meters placed at the head of the bed, 60 centimeters above the floor, facing the ceiling. Instrument sensitivity 0 to 100,000 and 0 to 130,000 lux with stated accuracy of 4 and 5 percent of reading. Participants were instructed to lead a normal life during the survey, and correct placement was confirmed from digital photographs the participants took themselves. The average of the two nights was used. Median intensity 1.0 lux, interquartile range 0.2 to 4.0. Quartile medians were 0.03, 0.5, 1.9 and 9.9 lux. The authors report that in the group at or above 3 lux the mean intensity was about 100 lux at bedtime and at rising time, and still around 10 lux at 120 minutes after bedtime and before rising.

The origin of the 3 and 10 lux thresholds. The authors state that these cutoffs were predefined on the basis of biological impact shown in previous studies, citing Cajochen and others and Zeitzer and others, both 2000. The thresholds therefore come from the experimental melatonin-suppression literature and were applied to these data, rather than being derived from them. The Foundation corrects its own earlier characterization at Appendix C.21 accordingly.

Result — metabolic and inflammatory, adjusted. Highest against lowest quartile: body weight greater by 1.1 kilograms, 95 percent confidence interval 0.3 to 2.0; body mass index by 0.4, 0.1 to 0.7; abdominal circumference by 1.6 centimeters, 0.7 to 2.5; low-density lipoprotein cholesterol by 3.8 milligrams per deciliter, 0.7 to 6.9. At or above 3 lux against below: body weight greater by 1.0, 0.4 to 1.7; body mass index by 0.4, 0.1 to 0.6; abdominal circumference by 1.2, 0.5 to 1.9; triglyceride by 6.7, 1.8 to 11.6; low-density lipoprotein by 3.6, 1.3 to 6.0; and high-density lipoprotein lower by 2.3, −3.5 to −1.1. At or above 10 lux: white blood cell count higher by 0.2 times ten to the ninth per liter, 0.01 to 0.3. Plasma glucose, glycated hemoglobin and platelet count showed no significant association.

Result — sleep and mood, adjusted. Sleep disturbance, by quartile against the lowest: 1.21, 0.96 to 1.51; 1.33, 1.06 to 1.67; and 1.43, 1.14 to 1.79. Against thresholds: 1.25, 1.05 to 1.48 at or above 3 lux; 1.29, 1.02 to 1.64 at or above 10 lux. Depressive symptoms by quartile reached no significance, the highest quartile giving 1.30, 0.98 to 1.73, p = 0.07; against thresholds the estimates were 1.30, 1.05 to 1.61 at or above 3 lux and 1.33, 1.003 to 1.77 at or above 10 lux. The Foundation draws attention to the depressive-symptom result, which is significant on the threshold analysis and not on the quartile analysis, and whose lower bound at 10 lux is 1.003. That finding is fragile and the Foundation does not rely on it.

Adjustment. Age, gender, smoking, drinking, income, education, physical activity, bedtime, duration in bed and day length throughout; lipid-lowering drugs for the lipid outcomes, antidiabetic drugs for glucose and glycated hemoglobin, hematocrit for the inflammatory parameters, and sleeping pills and antidepressants for the psychiatric outcomes. A sensitivity analysis excluding 178 participants with a history of shift work is reported as consistent.

What it establishes. That bedroom light at night can be measured directly at population scale by a reproducible method; what its distribution is in one large older cohort; and that higher measured bedroom light was associated with modest but consistent differences in body weight, body mass index, abdominal circumference and blood lipids, with white cell count at the higher threshold, and with sleep disturbance, after adjustment for a substantial covariate set. The magnitudes should be kept in view: about one kilogram of body weight and 0.4 units of body mass index between the extreme quartiles.

What it does not establish. Causation. The authors state that the cross-sectional design precluded causality assessment, and reverse causation is a live possibility: a person with disturbed sleep or depressive symptoms may be more likely to sleep with a light on. The sample is non-random and the authors cannot exclude selection bias. Light was measured on only two nights. Although the cohort was aged over 40, only 241 participants, 8.2 percent, were aged 40 to 59, so generalizability to younger people is undetermined. And the exposure is photopic illuminance: the authors state expressly that they did not measure light spectrum in all participants and that it therefore remains unclear whether intensity or spectrum has the larger effect on health outcomes.

A limitation of direct relevance to this comment. The authors write that it remains unknown which light sources have the largest impact on health outcomes, instancing bedside lights, street lighting, light from other rooms, televisions, smartphones and morning sunlight. That is the product-identification problem stated by investigators who measured the exposure as carefully as anyone has. A performance standard governs a product. A study that measures the light in a bedroom without identifying which product

emitted it cannot, by itself, tell a regulator which product to address. Parts II.D.2.d and V.J.4.

Funding and competing interests, recorded in full. The declaration states that Drs. Obayashi and Saeki report financial support provided by YKK AP Inc., Ushio Inc., Tokyo Electric Power Company, EnviroLife Research Institute Co., Ltd., Sekisui Chemical Co., Ltd., LIXIL Corp., KYOCERA Corp., ENDO Lighting Corp., and KANEKA Corp. Research funding is also acknowledged from the Japan Society for the Promotion of Science and numerous Japanese foundations and from Nara Medical University, with a statement that the funders had no role in study design, data collection and analysis, the decision to publish, or preparation of the manuscript. The Foundation records that several of the named commercial supporters are lighting manufacturers, that others make windows and building products, and that one is an electric utility. It makes no allegation and draws no inference; it records the disclosure on the same terms as at Appendices C.24 and C.25, and notes that the direction of any interest is not obvious here.

Bearing on the statutory question. Used at Part IX.J.3. The Foundation asks the Department to issue recommendations where the record supports them and to state what further evidence is needed where it does not. For bedroom light this entry shows what the needed evidence looks like and that it is obtainable: a light meter at the head of the bed, sampling every two minutes for two nights, across several thousand people, with the distribution published. Paragraph 360ii(a)(4) directs the study and evaluation of conditions of exposure; § 360ii(b)(2) authorizes grants for that purpose and § 360ii(b)(4) the procurement of electronic products for research and testing. Part II.B. The work has been done once, in Japan, by a university department. It has not been done in the United States. Parts II.B, II.F, V.J.4, IX.C and IX.J.3.

C.33 Chen and others (2022) — outdoor light at night and mild cognitive impairment in Chinese veterans

Citation. Chen Y, Tan J, Liu Y, Dong GH, Yang BY, Li N, Wang L, Chen G, Li S, Guo Y. Long-term exposure to outdoor light at night and mild cognitive impairment: a nationwide study in Chinese veterans. Science of the Total Environment. 2022;847:157441. doi:10.1016/j.scitotenv.2022.157441. PMID 35863567.

Provenance of this entry. The Foundation came to this study through a university news item announcing it. The news item is not the source and is not cited anywhere in this comment; the peer-reviewed article is. The Foundation records the point because the standard it undertook at Part V.A.1 is to rely on the published literature rather than on reporting about it.

Design and population. Cross-sectional study of 5,496 participants drawn by multi-stage random sampling from veteran communities in 18 cities across China and investigated during 2009 to 2011. Cognitive function was assessed first by the Mini Mental State Examination and the Chinese version of the Montreal Cognitive Assessment, then confirmed by clinical examination. Analysis by mixed-effects logistic regression.

Exposure, as measured. Outdoor light at night estimated from the Global Radiance Calibrated Nighttime Lights Product at a spatial resolution of approximately one kilometer, for the three years preceding the investigation. This is a product of the Defense Meteorological Satellite Program instrument, which is broadband and carries no information about the color of the light. Part V.J.4.

Result. After adjustment, the odds ratio for mild cognitive impairment per interquartile-range increase in exposure, the interquartile range being 21.17 nanowatts per square centimeter per steradian, was 1.44, 95 percent confidence interval 1.36 to 1.52. Analyzed by quartile, the highest odds ratio was in the highest quartile against the lowest, with a monotonically

increasing trend, p for trend below 0.001. Higher odds ratios were observed in women, in those with less educational attainment, and in those without regular social activities.

A caution about the precision, which the Foundation raises itself. An odds ratio of 1.44 with an interval of 1.36 to 1.52, from 5,496 participants, is a narrower interval than this design would ordinarily yield. For comparison, the study at Appendix C.22 reported a comparable effect size from 126,418 participants with an interval of similar width. Exposure here is assigned at an areal resolution of about one kilometer, so participants living near one another share an exposure value and the effective number of independent exposure observations is far smaller than the number of people. If that clustering is not fully accounted for, confidence intervals will be too narrow. The authors used a mixed-effects model, which addresses clustering at whatever level the random effects were specified, and the Foundation has not been able to determine what that specification was. Until it does, it treats the stated interval as probably optimistic and relies on the direction and the monotonic trend rather than on the precision.

What it establishes. That in a large nationally distributed Chinese sample, higher modeled outdoor light at night at the place of residence was associated with a higher prevalence of mild cognitive impairment, with a dose-response trend across quartiles, and that the association was larger in several subgroups the authors identify. Cognitive status was ascertained by instrument and confirmed clinically rather than self-reported, which is a strength relative to several entries in this appendix.

What it does not establish. Causation. Despite the word long-term in the title, the design is cross-sectional: prevalent cognitive impairment was measured once, with exposure assigned for the three preceding years. Nothing establishes that exposure preceded the onset of impairment, and cognitive impairment may itself alter where and how a person lives. The sample is of veterans in Chinese veteran communities and is not a general population. Exposure is areal and spectrally blind, so the study says nothing about light-emitting diode products or about which light; and the exposure window of roughly 2006 to 2011 substantially predates the conversion of Chinese outdoor lighting to light-emitting diode sources, so the radiance measured was emitted largely by the technologies that preceded them. The same observation is made at Appendix C.22. Residual confounding by urbanicity is not excluded by anything in the abstract.

Considerations bearing on confidence. In favor: a nationally distributed multi-stage random sample across 18 cities; outcome ascertained by two validated instruments and confirmed by clinical examination; a monotonic exposure-response across quartiles; and subgroup findings that are at least coherent, in that less educated and less socially active people are plausibly more exposed to their immediate residential environment. Against: cross-sectional; a selected population; areal exposure at one kilometer with no spectral content; an exposure period predating light-emitting diode conversion; the precision concern set out above; and an adjustment set the Foundation has not seen.

Position among the cognitive entries. This is the third entry in Appendix C addressing cognition or dementia, with Appendix C.16, an ecological analysis of Alzheimer disease prevalence in the United States, and Appendix C.27, a case-control study of dementia in Modena with 54 controls and no significant result. The three differ in design, country, population and quality, and all three point the same way. The Foundation does not present that as corroboration, because three weak-to-moderate studies pointing one way can also reflect a shared confounder, and urbanization is the obvious candidate in all three. What the Foundation presents it as is a question asked three times in three countries and answered definitively nowhere.

Bearing on the statutory question. Offered for the proposition that cognitive decline is among the outcomes under investigation in relation to ambient light at night, and that the investigation has not reached a conclusion. That is the condition § 360ii(a)(4) addresses.

The entry also illustrates, for the third time in this appendix, a study that cannot speak to the question this comment asks because its instrument cannot see the spectrum. Parts II.F, V.J.4 and IX.C.

C.34 Argilès and others (2022) — brain functional connectivity under three monochromatic wavelengths

Citation. Argilès M, Sunyer-Grau B, Arteche-Fernandez S, Peña-Gómez C. Functional connectivity of brain networks with three monochromatic wavelengths: a pilot study using resting-state functional magnetic resonance imaging. Scientific Reports. 2022;12:16197. doi:10.1038/s41598-022-20668-9. PMID 36171254. PMCID PMC9519584. Published September 28, 2022. Open access under the Creative Commons Attribution license.

The weight of this entry, stated first. Seven participants. The authors describe it as a pilot study and the Foundation adopts that description without qualification. Resting-state functional magnetic resonance connectivity is a measure with known reproducibility difficulties at small sample sizes, and seven subjects across several brain networks and three exposure conditions cannot support a conclusion about anything. The Foundation does not rely on any finding reported in this study and asks the Department not to read it as evidence of an effect.

Design. Pilot study, N = 7. Resting-state functional magnetic resonance imaging before and after one minute of exposure to blue, green or red monochromatic light, examining functional connectivity across visual and non-visual brain networks.

Reported findings. The authors report that one minute of exposure modified functional connectivity across a broad range of visual and non-visual regions, and describe three patterns: a global decrease in connectivity after blue light in all networks except the salience network; a global increase after green light, particularly in the left hemisphere; and after red light a decrease in attentional networks coupled with an increase in the default mode network. They suggest each pattern may suit performance on different cognitive domains.

Why the Foundation includes it notwithstanding. Not for the findings but for the method and for what the method shows about the state of the field. The question this comment asks the Department to study is which wavelengths produce which effects and in what proportion. Answering that question requires exposing people to one wavelength at a time and measuring the response, which is what this study does. Part V.C.2.j explains why that artificial design is the necessary method for deriving an action spectrum, and why action spectra are what a spectrally resolved performance standard would require. This entry is offered as an instance of that work, and as a measure of how early it is: a pilot study of seven people with three broad color bands and a one-minute exposure.

What it establishes. That the experiment is being attempted, and that investigators regard wavelength-resolved brain imaging as a tractable approach. Nothing about any effect of any wavelength on any person.

What it does not establish. Anything else. Seven participants; a one-minute exposure; three broad conditions described as blue, green and red rather than as narrow bands with stated peak wavelengths and irradiances so far as the Foundation has read; multiple networks examined; and an imaging modality whose small-sample reliability is contested. It establishes nothing about light-emitting diode products, nothing about ordinary exposure, and nothing about health.

Bearing on the statutory question. Used at Part V.C.2.j, for the proposition that the derivation of action spectra for non-visual responses is in its infancy. Paragraph 360ii(a)(2) directs the Secretary to plan, conduct, coordinate and support research, and § 360ii(b)(2) authorizes grants for that purpose. Part II.B. The Foundation submits that deriving the action spectra for the responses described in Part V is a specific and bounded research

program, that it is the program whose output a performance standard under § 360kk would require, and that at present it is being attempted by small university groups on samples of seven. Parts V.C.2.j, V.J.4, IX.C.4 and IX.J.3.

C.35 Tancredi and others (2022) — artificial light at night and mental disorders, systematic review

Citation. Tancredi S, Urbano T, Vinceti M, Filippini T. Artificial light at night and risk of mental disorders: a systematic review. Science of the Total Environment. 2022;833:155185. doi:10.1016/j.scitotenv.2022.155185. PMID 35417728.

Status of this entry. Drawn from the published abstract. The article is not open access and the Foundation has not read the full text. The fields below report what the abstract states and nothing more.

Article type and search. Systematic review of observational studies, without meta-analysis so far as the abstract discloses. PubMed, Embase and Web of Science were searched to April 1, 2022. Studies were eligible if they assessed the link between indoor or outdoor artificial light at night and one or more mental disorders in human populations, with exposure assessed either by satellite photometry or by measurement of bedroom brightness.

Result. Nine eligible studies were identified: six cross-sectional, two longitudinal with a median follow-up of 24 months, and one case-cohort. The authors report moderate evidence of a positive association between exposure and depressive symptoms, and to a lesser extent other mental disorders, while noting that the number of studies was limited and that residual confounding by socioeconomic factors, noise or air pollution may have influenced the results. Their conclusion is that although more robust evidence is needed, the evidence produced so far seems to support an association between light at night and risk of depressive disorders.

What it establishes. That as of April 2022 a systematic search of three major databases returned nine studies on this question, that two thirds of them were cross-sectional, and that reviewers applying a systematic method graded the resulting evidence as moderate for depressive symptoms and weaker for other mental disorders. It establishes the size and shape of the literature at that date.

What it does not establish. Causation, which the authors do not claim. It is a qualitative synthesis of nine mostly cross-sectional studies, and the authors identify by name the three confounders this comment repeatedly flags: socioeconomic position, noise and air pollution. It establishes nothing about light-emitting diode products, and nothing about spectral composition; the exposures it reviews are satellite photometry and bedroom brightness, both spectrally blind. Part V.J.4.

An important limitation of date. The search closed on April 1, 2022. The field has moved since. Appendix C alone contains work published after that date bearing on the same question, including the entries at C.21, C.23, C.24 and C.32, and the largest of them, with 86,772 participants and objectively measured exposure, appeared in October 2023. This review therefore describes the state of the evidence as it stood four years before this comment, and should be cited for that and not as a current assessment.

Independence from other entries. Marco Vinceti and Tommaso Filippini are also authors of the dementia case-control study at Appendix C.27. The two are products of the same group at Modena. The Foundation records the overlap as it has at Appendices C.19, C.20 and C.24. It notes separately that this review is cited in the reference list of the study at Appendix C.24, which is a point in its favor as to standing in the field.

Bearing on the statutory question. Two uses. First, it is a systematically conducted assessment of the affective literature and therefore sits above the narrative review at Appendix C.21 in the hierarchy described at Part V.A.2; where the two differ, this one

should be preferred. Second, and more usefully, nine studies. A systematic search of three databases for all human research connecting a near-universal environmental exposure to mental disorder returned nine papers, six of them cross-sectional. That is the condition § 360ii(a)(2) and (a)(4) address, and it is the same picture the Foundation records at Appendices C.20 and C.27: a question approached by small groups without coordination and answered by nobody. Parts II.F, V.A.2, V.G and IX.C.

C.36 Chun and others (2022) — circadian disruption and colorectal cancer in mice and intestinal organoids

Citation. Chun SK, Fortin BM, Fellows RC, Habowski AN, Verlande A, Song WA, Mahieu AL, Lefebvre AEYT, Sterrenberg JN, Velez LM, Digman MA, Edwards RA, Pannunzio NR, Seldin MM, Waterman ML, Masri S. Disruption of the circadian clock drives Apc loss of heterozygosity to accelerate colorectal cancer. Science Advances. 2022;8(32):eabo2389. doi:10.1126/sciadv.abo2389. PMID 35947664. PMCID PMC9365282. Open access; full text read.

What the light exposure was. This must be stated before anything else, because the paper is easily miscited. Mice were housed on a standard twelve hours light and twelve hours dark schedule. The experimental manipulation, which the authors call shift disruption, was to advance the light phase by eight hours every other day for ten weeks. The twelve-and-twelve ratio was maintained throughout. The clock time of the light and dark blocks was what moved. The authors describe the paradigm as a model of night shift work three to four times per week. No illuminance value, no spectral power distribution, no correlated color temperature and no lamp type is reported anywhere in the paper.

What this entry is not offered for. It is not evidence about light at night in the sense that governs most of this comment. A streetlight entering a bedroom window adds light to the dark phase; a phase advance moves the whole cycle and leaves the dark phase intact. Those are different exposures, and there is no basis in this paper for treating a finding about one as a finding about the other. It is also not evidence about any electronic product, about any emission characteristic, or about any spectral region. The Foundation does not cite it for any of those propositions and the FDA should not understand it to support them.

What the study did. Two lines of work. First, a genetically engineered mouse model: intestine-specific deletion of the clock gene Bmal1 was combined with heterozygous loss of the tumor suppressor Apc, and polyp formation and survival were compared across genotypes. Second, the environmental arm: Apc heterozygous mice were assigned either to the stable twelve-and-twelve schedule or to the shift disruption schedule, six animals per arm, and small intestinal polyp count and individual polyp size were compared. Intestinal organoids derived from the mice were then used to trace the mechanism, and the authors report that clock disruption promotes transformation by driving loss of heterozygosity at Apc, which hyperactivates Wnt signaling, upregulates c-Myc and drives heightened glycolytic metabolism. Patient-derived organoids were used to show that circadian rhythms are lost in human tumors, and transcriptomic data from 512 colorectal cancer patients in The Cancer Genome Atlas were analyzed for the relationship between clock gene and Wnt pathway variation and overall survival.

What it establishes. That in a mammal, experimentally imposed disruption of the light schedule accelerated tumor burden in a cancer-predisposed strain, and that a molecular pathway running from clock disruption to the disease process can be traced and is conserved in human tissue. The exposure was assigned by the investigators rather than observed, so the comparison does not depend on controlling confounders in a human population. That is the particular value of the entry: it answers, within its own domain, the objection that the circadian literature is entirely observational and therefore cannot support a causal claim. The circadian clock is shown to be causally upstream of a disease outcome, not merely correlated with one.

What it does not establish. Any effect in humans. The in vivo finding is in mice already carrying a tumor suppressor mutation, and the environmental arm is six animals against six. The human components of the paper are organoid and transcriptomic analyses bearing on mechanism and prognosis, not exposure studies. It establishes nothing about dose, nothing about duration thresholds and nothing about which part of a light exposure matters, because the variable manipulated was timing alone.

Independence and conflicts. The authors declare no competing interests. The work is from the University of California, Irvine, and the Foundation has identified no author shared with any other entry in this appendix.

Funding, and why it matters here. The paper was supported by eleven grants from three institutes of the National Institutes of Health — the National Cancer Institute, the National Institute of Diabetes and Digestive and Kidney Diseases, and the National Heart, Lung, and Blood Institute — together with a National Cancer Institute center grant to the Chao Family Comprehensive Cancer Center. Every one of those funders is a component of the Department of Health and Human Services. The Secretary's own department paid for this research into how disturbing the timing of light exposure accelerates a cancer process, and has done so repeatedly and at scale. Part II.H and Part IV.G.12 of this comment describe the Department of Energy funding lighting research that the Food and Drug Administration does not collect. This entry is the same failure inside a single department, which is harder to explain. The Secretary is the funder and the Secretary is the official on whom § 360ii(b)(1)(A) confers the power to collect and make available the results of research concerning the hazards of electronic product radiation. The Center for Devices and Radiological Health has not collected it.

A limit on that point, stated plainly. Whether research of this kind falls within § 360ii(b)(1)(A) depends on how broadly the phrase research and studies relating to the nature and extent of the hazards of electronic product radiation is read. These authors were not studying an electronic product and would not, so far as the Foundation can tell, describe their work that way. What they studied is the mechanism by which mistimed light exposure produces harm; electronic products are the means by which most people now receive mistimed light exposure. The Foundation submits that research into the mechanism of a hazard relates to that hazard within the ordinary meaning of the word, and that a program which collected only research naming a device would collect almost nothing. But the Foundation states the step rather than assuming it, and invites the Department to say whether it reads the provision the same way. Part IX.B.

Bearing on the statutory question. Three points. First, it belongs to the mechanistic tier described at Part V.A.2 and should be cited there and nowhere else. Second, it bears on the § 360ii(a)(4) duty to study and evaluate emissions and the effects of exposure, because it shows what a funded, coordinated program produces: an assigned exposure, a traced pathway, and a test of human relevance. That is what is absent from the visible light literature this appendix catalogs, and the contrast is the argument. Third, and most directly, it is an item of research the Secretary funded and the Secretary has not collected or made available. Parts II.F, II.H, V.A.2, IX.B and IX.C.

C.37 Lin and others (2022) — outdoor light at night and overweight and obesity in school-aged children

Citation. Lin LZ, Zeng XW, Deb B, Tabet M, Xu SL, Wu QZ, Zhou Y, Ma HM, Chen DH, Chen GB, Yu HY, Yang BY, Hu Q, Yu YJ, Dong GH, Hu LW. Outdoor light at night, overweight, and obesity in school-aged children and adolescents. Environmental Pollution. 2022;305:119306. doi:10.1016/j.envpol.2022.119306. PMID 35430310.

Status of this entry. Drawn from the published abstract. The article is not open access, is not in Europe PMC, and the Foundation has not read the full text. The figures below are those the abstract reports.

Design and population. Cross-sectional analysis of data from the Seven Northeastern Cities study, comprising 47,990 school-aged children and adolescents aged 6 to 18 years in China. Analysis by generalized linear mixed model, with outdoor light at night entered in quartiles. This is the largest sample of children in Appendix C.

Exposure, as measured. Outdoor light at night levels from satellite imaging data. The abstract does not name the instrument or the data product, and the Foundation therefore cannot state the spectral response of the measurement. The point is not formal: as recorded at Appendix C.33 and Part V.J.4, the satellite products used in this literature are broadband or near-infrared weighted and carry no information about the color of the light, and they measure upward radiance over an area rather than the illuminance reaching a child. Outdoor exposure was the only exposure assessed. The authors state in their own conclusion that future studies considering both outdoor and indoor exposure are needed.

Outcome. Height and weight were used to compute age- and sex-specific body mass index Z-scores against World Health Organization growth standards. Overweight and obesity were defined using the Chinese standard. The entry notes that the continuous and categorical outcomes therefore rest on two different reference populations.

Results. Against the lowest quartile of outdoor light at night, children at higher levels had larger body mass index Z-scores and higher odds of overweight including obesity, and of obesity. The largest estimates were: body mass index Z-score, beta = 0.26, 95 percent confidence interval 0.18 to 0.33; overweight including obesity, odds ratio 1.40, 1.25 to 1.56; obesity, odds ratio 1.46, 1.29 to 1.65. A sex interaction for the Z-score outcome was significant at p less than 0.001, with the association stronger in males. The authors report that results remained robust across multiple sensitivity analyses and after adjustment for sleep-related characteristics, obesogenic factors and other environmental exposures.

The exposure-response is not monotonic, and the Foundation says so first. Every estimate quoted above is from the third quartile, not the fourth. The abstract states that the largest estimates were in the third quartile, which means the most exposed children showed a smaller association than the next most exposed. A monotonic gradient is one of the ordinary grounds for inferring causation from an observational association, and this study does not supply one. Appendix C.33 does supply one and the contrast is instructive. The Foundation reports the quartile from which its figures come rather than presenting them as the top-quartile result, and it does not offer this study in support of any dose-response proposition.

What it establishes. An association, in a very large sample of children, between modeled outdoor light at night at the place of residence and higher body mass index and higher odds of overweight and obesity, which survived adjustment for sleep characteristics. The adjustment for sleep matters: it indicates the association is not wholly accounted for by reported sleep duration or quality, which is the mediating pathway most often assumed.

What it does not establish. Causation. The design is cross-sectional; exposure and body mass index were ascertained at the same time, and the direction of any effect is not fixed by the data. The exposure-response is non-monotonic. Most importantly, outdoor light at night at a residence is among the best available proxies for urban density, and childhood obesity in China tracks urbanization through diet, screen time, school environment and the decline of active transport. Adjustment for socioeconomic status by questionnaire does not dispose of that. The authors of the study at Appendix C.11 state the same objection about the same exposure variable in their own words, and the Foundation adopts it here rather than restating it. The study establishes nothing about spectral composition, nothing about illuminance at the child, and nothing about any electronic product.

Position among the entries on body composition. Three entries now address adiposity or metabolic parameters, and they are usefully read together because their exposure measurements differ in exactly the way that matters. This entry assigns outdoor satellite

radiance to 47,990 children. Appendix C.10 measured the personal 24-hour light exposure of 831 Chinese school-aged children by wearable sensor over five days, and found more nocturnal time at or above 1 lux associated with higher percentage body fat. Appendix C.32 measured bedroom illuminance directly with a meter at the head of the bed in 2,947 Japanese adults, and found higher measured light associated with greater body weight, body mass index and abdominal circumference. All three are cross-sectional and none establishes causation. Their value as a set is that the direction is consistent across three populations and three methods of exposure assessment, while only the latter two use a measurement from which an exposure limit could be written. Both this entry and Appendix C.10 also report the association as stronger in boys, by independent methods, which the Foundation records as a convergence worth investigating and not as a finding.

Position among the entries concerning children. With Appendix C.10 and Appendix C.11 this is the third entry whose subjects are children. The Foundation draws attention to the population for a reason that is legal and not rhetorical. A child does not choose the streetlight outside the bedroom window, the fixture in the hallway or the lighting in the classroom, and cannot change any of them. Part II.D.2 of this comment asks what portion of a lighting installation is necessary within the meaning of § 360ii(a)(2). For the exposures that reach children, the share of the emission that serves no purpose for the exposed person approaches the whole of it. Parts V.K, VI and VII.

Independence from other entries. Dong Guang-Hui and Yang Bo-Yi are authors of this study and of the study at Appendix C.33, and the Chen G of that entry may be the Chen Gong-Bo of this one. The two entries are therefore not independent. The Foundation records a second consequence. Appendix C.33 carries a caution, raised by the Foundation itself, that the confidence interval reported there is narrower than its design would ordinarily yield. The intervals in this study do not present that problem: for a quartile contrast within 47,990 children the reported widths are, if anything, wider than an unclustered calculation would give, which is what a mixed model with clustering should produce. The concern at Appendix C.33 does not transfer, and the Foundation says so rather than leaving an unexplained shadow over an overlapping group.

Bearing on the statutory question. Two propositions and no more. First, that the health of children is among the outcomes under investigation in this literature, at a sample size that makes the question unignorable, and that the investigation has not resolved it. That is the condition § 360ii(a)(4) directs the Secretary to address by studying and evaluating emissions and the effects of exposure. Second, that this study cannot yield a number and that two others in this appendix show what kind of measurement could. A quartile of satellite radiance is not a quantity any manufacturer, city or parent can act on. One lux at the wrist and three lux at the head of the bed are. The Foundation asks the Department, under § 360ii(b)(1)(B), to say what nighttime light level in a child's sleeping environment it considers acceptable, and if the present record will not support a figure, to say what evidence would and then obtain it under § 360ii(a)(2) and (b)(2). Parts II.D.2, V.F, IX.C and IX.J.

C.38 Kim and others (2023) — measured light at night and obesity, diabetes and hypertension in older adults, Chicago Healthy Aging Study

Citation. Kim M, Vu TH, Maas MB, Braun RI, Wolf MS, Roenneberg T, Daviglus ML, Reid KJ, Zee PC. Light at night in older age is associated with obesity, diabetes, and hypertension. SLEEP. 2023;46(3):zsac130. doi:10.1093/sleep/zsac130. PMID 35729737. PMCID PMC9995772. Free to read at the publisher; full text read.

Why this entry matters, stated first. It is the strongest of the metabolic entries in this appendix on three counts at once. The population is American. The exposure was measured at the person by instrument over seven days rather than modeled from satellite radiance or reported by the participant. And the outcomes were ascertained clinically, by

fasting blood draw and measured blood pressure, not by self-report. It also contains a specificity result, described below, that no other entry in this appendix supplies.

Cohort and population. Five hundred and fifty-two community-dwelling adults aged 63 to 84 years. The sample is drawn from the Chicago Healthy Aging Study, itself a subset of the Chicago Heart Association Detection Project in Industry, a workplace screening program conducted between 1967 and 1973. Participants were survivors of that original cohort who were free of major electrocardiogram abnormality or myocardial infarction at the baseline examination, which makes this a comparatively healthy surviving population and limits generalization accordingly. Derivation of the analytic sample: actigraphy was offered to all study participants and accepted by 1,310; 1,199 returned the device; of those, 634 had been issued the one model equipped with a light sensor, assigned on the basis of availability rather than by any characteristic of the participant; and 552 of those had at least five valid twenty-four-hour recording periods.

Exposure, as measured. Wrist actigraphy for seven consecutive days, recording in thirty-second epochs, with participants instructed to keep the light sensor uncovered by sleeves or bedding. The exposure variable is light during the least active five-hour period, which the authors chose over light during the scored sleep interval or a fixed clock window because it is less sensitive to season, to sleep timing and duration, and to scoring bias. The distribution of those values was zero-inflated, and the authors therefore dichotomized it: participants with zero recorded light during the five-hour nadir were classified as No-LAN, and those with any recorded light as LAN. The sensor's lower detection limit is 0.1 lux. The contrast is therefore between no light detectable at the wrist during the darkest five hours of the night and any light at all above a tenth of a lux. Two hundred and fifty-five participants fell in the first group and 297 in the second.

The spectral response of the instrument, which the Foundation draws to the Department's attention. The authors describe their sensor fully, and the description is the point. It is a miniature photodiode with a wavelength range of 330 to 720 nanometers and a peak spectral sensitivity at 580 nanometers, which the authors correctly characterize as approximating the sensitivity of the human eye. That is the photopic luminous efficiency function: the curve that describes how bright light looks. The non-visual pathway hypothesized to mediate the effects reported here peaks near 480 nanometers, as set out at Part V.C.2. The exposure in this study was therefore measured with an instrument weighted to a peak roughly one hundred nanometers away from the peak of the mechanism under investigation. This is not a criticism of these investigators, who disclosed the sensor's response precisely and used the instrument that exists. It is an illustration of the measurement problem this comment describes at Part IV.C and Part V.J: the available instruments report what the eye sees because that is the convention the governing standards are written in, and a research literature built on those instruments cannot resolve the spectral question no matter how carefully it is conducted. Parts V.C.2.j and IX.D.

Outcome definitions. Obesity, body mass index of 30 kilograms per square meter or above. Diabetes, fasting glucose above 126 milligrams per deciliter or use of antihyperglycemic medication. Hypertension, systolic pressure of 140 millimeters of mercury or above, diastolic of 90 or above, or antihypertensive treatment; blood pressure taken as the average of the second and third measurements. Hypercholesterolemia, total cholesterol of 240 milligrams per deciliter or above or lipid-lowering treatment. Cholesterol and glucose from twelve-hour fasting samples.

Results. Prevalence in the No-LAN and LAN groups respectively, then the adjusted odds ratio with 95 percent confidence interval. Obesity: 68 of 255, or 26.7 percent, against 121 of 297, or 40.7 percent; 1.82, 1.26 to 2.65, p = 0.002. Diabetes: 25, or 9.8 percent, against 53, or 17.8 percent; 2.00, 1.19 to 3.43, p = 0.010. Hypertension: 151, or 59.2 percent, against 216, or 73.0 percent; 1.74, 1.21 to 2.52, p = 0.003. Hypercholesterolemia showed no association

and was not carried into the multivariable models. Unadjusted and adjusted estimates are close throughout, which indicates the covariates carried in the main model are doing little work.

The specificity result, which is the most useful thing in this study. The authors tested every other light variable they had derived and found nothing. No significant association was found between any of the four risk factors and twenty-four-hour mean light intensity, twenty-four-hour median light intensity, peak daytime light intensity, relative amplitude, interdaily stability, intradaily variability, or the timing of either the least or most illuminated period. The two groups also did not differ in twenty-four-hour mean light exposure, which was a median of 342 lux in both. The association is therefore specific to light during the nocturnal nadir and does not attach to how much light a person receives overall. That bears directly on the confounding objection the Foundation concedes elsewhere in this appendix. A variable standing in for urban density, indoor living or sedentary behavior would be expected to track total daily light exposure. This one does not. Appendix C.37 and Appendix C.11 both rest on exposure variables that cannot be separated from urbanicity in this way; this entry can be, and the Foundation relies on it for that.

What was adjusted for, stated precisely. The published abstract states that the models were adjusted for age, sex, race, season of recording and sleep variables. The table reporting the odds ratios above states that its multivariable model was adjusted for age, sex, race and season of actigraphy recording. Sleep and activity entered as a sensitivity analysis reported in supplementary material, where the authors state that after adjustment for sleep, mean activity count during the nadir period, and other activity variables, the associations with obesity, diabetes and hypertension remained statistically significant. The Foundation records the distinction because the figures above are not themselves sleep-adjusted and should not be described as if they were. The sleep-adjusted estimates are not reported in the main text.

Reverse causation, and how the authors addressed it. This is the governing threat to the finding and it is more acute here than in the satellite studies, because an exposure measured at the person captures behavior that disease itself produces. Nocturia in diabetes and nocturnal awakening in hypertension both lead to switching on a light. The authors identify precisely this objection, name nocturia and sleep disorders as frequent comorbidities of both conditions, and report that the associations were independent of nocturnal awakening and of activity level during the period of light measurement, which they describe as a marker for bathroom visits. The Foundation regards that as a serious and adequate response to a serious objection, and credits it. It does not dispose of the problem, and the authors do not say it does: they state that the cross-sectional design leaves them unable to exclude the possibility that the exposure is a consequence of the conditions rather than a cause.

What it establishes. That among 552 older American adults, those with any instrument-detected light at the wrist during the darkest five hours of the night had substantially higher prevalence of clinically ascertained obesity, diabetes and hypertension than those with none; that the association was specific to the nocturnal measure and absent for every other light variable derived from the same recordings; and that it survived adjustment for nocturnal awakening and activity. It also establishes a prevalence: more than half of this community-dwelling older population, 297 of 552, had detectable light at the wrist during their own sleep period.

What it does not establish. Causation. The design is cross-sectional and the authors say so. It does not establish that the exposure is habitual: seven days of recording cannot show that, and the authors state in their limitations that they cannot determine whether light at night in older age represents chronic habitual exposure, notwithstanding the word habitual in the abstract's conclusion. It establishes nothing about spectral composition, for the reason

given above; nothing about any light source, since a wrist sensor does not identify what emitted the light; and nothing about dose beyond the presence or absence of detectable light. The outcomes that entered the multivariable models were selected by their significance in bivariate analysis, which the Foundation notes as a minor methodological qualification affecting which outcomes were modeled rather than the estimates themselves.

Position among the entries on body composition, and the question of a threshold. Four entries now address adiposity or metabolic parameters, and their exposure thresholds form a sequence the Department should see together. This entry: any light above 0.1 lux at the wrist during the nocturnal nadir, in 552 older American adults, with clinically ascertained outcomes. Appendix C.10: time at or above 1 lux at night by wearable sensor, in 831 Chinese children. Appendix C.32: 3 lux and 10 lux at the head of the bed, in 2,947 Japanese adults. Appendix C.37: quartiles of satellite radiance, in 47,990 Chinese children. Four populations on three continents, four methods of exposure assessment, and the direction is the same in all four. The Foundation does not present that as proof of causation; all four are cross-sectional. It presents it because the question the Department will have to answer is a numerical one, and the numbers in this literature are small. The 3 lux threshold at Appendix C.32 was imported from the experimental melatonin-suppression work of Cajochen and Zeitzer; the epidemiological signals here and at Appendix C.10 appear at and below 1 lux. Whether an effect threshold for these outcomes lies below the threshold established for melatonin suppression is not a question this appendix can answer, and it is precisely the question the Foundation asks the Department to resolve.

Independence and conflicts. All authors report no conflict of interest, and both financial and nonfinancial disclosures are stated as none. The Foundation has identified no author shared with any other entry in this appendix. The authors cite, as their own second reference, the 2013 HEIJO-KYO analysis of light at night and obesity by Obayashi and colleagues, whose later work is at Appendix C.32; the two research programs are independent of each other and reach concordant results by different instruments in different countries.

Funding. National Institutes of Health grants from the National Heart, Lung, and Blood Institute, the National Center for Advancing Translational Sciences and the National Institute on Aging, together with departmental funds at Northwestern University. The Foundation notes the point made at Appendix C.36 and submits that this entry is the better instance of it: here the Secretary's own institutes funded a study that measured the light exposure of American adults in their own bedrooms and related it to disease. Paragraph 360ii(b)(1)(A) authorizes the Secretary to collect and make available the results of research concerning the hazards of electronic product radiation. The Foundation is aware of no step the Center for Devices and Radiological Health has taken to collect this one.

Bearing on the statutory question. This entry does more work than most. First, on § 360ii(a)(4), which directs the Secretary to study and evaluate emissions and the conditions of exposure: the prevalence finding is itself such an evaluation, performed by others, and it reports that most older Americans sleep in detectable light. Second, on the confounding objection the Department may raise against this whole literature, the specificity result is the Foundation's answer, and it is an answer from data rather than from argument. Third, on § 360ii(b)(1)(B): the Department is asked to make recommendations, and an exposure contrast of any detectable light against none, at a 0.1 lux floor, is the kind of quantity a recommendation can be written around. Fourth, on the spectral question, this entry demonstrates why the recommendation cannot stop at an illuminance figure. The best-instrumented study of its kind measured the exposure with a photopic sensor peaking at 580 nanometers. Until a measurement convention exists that reports what the non-visual

system receives, no amount of further epidemiology will answer the question this comment puts. Parts II.D.2, IV.C, V.C.2, V.F, IX.C, IX.D and IX.J.

C.39 Himmelberg, Winawer and Carrasco (2022) — individual differences in primary visual cortex and contrast sensitivity

Citation. Himmelberg MM, Winawer J, Carrasco M. Linking individual differences in human primary visual cortex to contrast sensitivity around the visual field. Nature Communications. 2022;13:3309. doi:10.1038/s41467-022-31041-9. PMID 35697680. PMCID PMC9192713. Open access under the Creative Commons Attribution license; full text read.

What kind of entry this is. Not a study of light exposure and not a study of health. It is vision science: functional magnetic resonance imaging and psychophysics performed on the same observers to ask whether differences in the anatomy of primary visual cortex predict differences in measured visual performance. It is included because the Foundation relies on it for a single proposition about the population to which any exposure standard must apply, and for no proposition about any exposure or any outcome. The Foundation states the limits of the entry below at greater length than usual, because the temptation to read more into it is real.

Design and sample. Twenty-nine observers. Retinotopic mapping by functional magnetic resonance imaging was used to delineate primary visual cortex and to measure its surface area, both overall and locally within fifteen-degree wedges centered on the four polar angle meridians of the visual field. Contrast sensitivity was measured psychophysically in the same observers at the same four locations. Correlations were assessed by Spearman's rho, one-tailed for the principal tests.

The finding the Foundation relies on. The surface area of primary visual cortex varied approximately twofold across these healthy adults. The authors give the figure precisely: a range of 110 percent, the largest primary visual cortex measuring 1,776 square millimeters and the smallest 832. They then supply the comparison that makes the number meaningful. Total cortical surface area in the same observers varied by 50 percent. The visual cortex is therefore more than twice as variable between individuals as the cortex as a whole. This is not a novel claim of this paper; the authors cite six prior reports for it and describe their own data as consistent with them. The Foundation cites this paper as a recent, open-access and carefully quantified instance of an established fact.

The link to perception, reported at its actual strength. Average contrast sensitivity across the four locations correlated positively with the overall size of primary visual cortex: rho = 0.47, p = 0.005, one-tailed, n = 29. Observers with a larger primary visual cortex tended to detect lower contrasts. The correlation survived normalization of visual cortex area by total cortical area, at rho = 0.33, p = 0.038, and contrast sensitivity did not correlate with total cortical surface area at all, p = 0.106, which indicates the relationship is specific to visual cortex rather than to brain size. A second analysis correlating local contrast sensitivity with local cortical surface area returned rho = 0.60, but the authors themselves decompose that figure and the Foundation reports the decomposition rather than the headline. Removing between-observer variation leaves the effect of visual field location at rho = 0.78, which the authors call robust. Removing within-observer variation leaves the effect of individual differences at rho = 0.27, which the authors call modest. The strong correlation is therefore driven mostly by where in the visual field a person is tested, not by who the person is.

What it establishes. That the neural substrate of human vision varies by roughly a factor of two among healthy adults, that this variation substantially exceeds the variation in brain size generally, and that it bears some relationship to measured visual performance. The anatomical variation is the robust part. The link to perception is real, specific to visual cortex, and modest.

What it does not establish, stated at length because it matters. It says nothing about discomfort, glare, photophobia, pain, or aversion to any light source. Contrast sensitivity is the ability to detect a faint pattern; it is not a measure of susceptibility to harm, and a person with high contrast sensitivity is not thereby shown to be more or less troubled by a bright light. It says nothing about spectral sensitivity, nothing about the non-visual pathways described at Part V.C.2, and nothing about any electronic product. The sample is twenty-nine observers, which is adequate for the anatomical measurement and thin for correlational claims about individual differences; a rho of 0.47 from twenty-nine observers carries wide uncertainty, and the principal tests are one-tailed. The Foundation does not cite this study for any proposition about who is harmed by artificial light or by how much.

Why the Foundation cites it at all: the standard observer. Every photometric quantity in every lighting standard — the lumen, the lux, the candela, luminance — is defined by the photopic luminous efficiency function, a single curve describing the sensitivity of a notional standard observer, derived in the early twentieth century from a small number of real ones. The Department of Energy requirement of 45 lumens per watt discussed at Part IV.G is expressed in that unit. The wrist photometer in the study at Appendix C.38 was built to approximate that curve, peaking at 580 nanometers. The hazard functions discussed at Part V.C.2 are population-average weighting functions of the same kind. The standard observer is a convention, and a necessary one; the question this entry raises is what follows from the fact that the population it stands for is not uniform. If the cortical tissue that does the seeing differs by 110 percent between healthy adults, then a quantity expressed in units built on an average observer does not describe a constant experience across the people exposed to it. The Foundation submits that a performance standard or recommendation set at a population central tendency, without an express determination about the distribution it is drawn from, has not been shown to protect the population it governs. Parts IV.C, V.C.2.j and IX.D.

The consequence for how a standard must be set. This is the use to which the Foundation puts the entry, and it is a modest one. Variation of this magnitude among healthy adults, measured before disease, age-related change or any diagnosed visual condition is brought into account, means that people whose response lies well away from the average are not anomalies to be set aside but a predictable and substantial fraction of the exposed population. Section 360kk directs that performance standards be reasonable. Paragraph 360ii(b)(1)(B) authorizes recommendations the Secretary considers appropriate. Neither can be satisfied by a figure chosen for the average person without the Secretary saying what proportion of the population that figure leaves unprotected. The Foundation asks the Department, when it sets or recommends any numerical limit on optical radiation from electronic products, to state the distribution of response it assumed and the fraction of the population the limit is intended to protect. Parts VII, IX.D and IX.J.

Independence, conflicts and funding. The Foundation has identified no author shared with any other entry in this appendix. The study was supported by the National Eye Institute and the National Institute of Mental Health, both components of the Department of Health and Human Services, which is the point made at Appendix C.38 and not repeated here.

C.40 Mason and others (2022) — experimental room light during sleep and cardiometabolic function

Citation. Mason IC, Grimaldi D, Reid KJ, Warlick CD, Malkani RG, Abbott SM, Zee PC. Light exposure during sleep impairs cardiometabolic function. Proceedings of the National Academy of Sciences. 2022;119(12):e2113290119. doi:10.1073/pnas.2113290119. PMID 35286195. PMCID PMC8944904. Open access under Creative Commons Attribution-NonCommercial-NoDerivatives; full text read. Deidentified data deposited in the Northwestern University institutional repository.

Why this is the most important entry in Appendix C. Every other entry addressing light at night and a disease outcome is observational. This one is an experiment. Participants were randomized, the exposure was administered by the investigators at a stated illuminance for a stated duration, the outcomes were measured physiologically, and a control arm was run in parallel. Within its narrow scope it therefore establishes causation rather than association, and it is the answer to the objection that this entire literature consists of correlations in which the direction of effect cannot be fixed. The Foundation relies on it for that and treats it as the evidentiary anchor of Part V.F.

Design. Parallel-group randomized laboratory study. Twenty healthy adults, ten per arm, each spending three days and two nights in the laboratory with an eight-hour sleep opportunity beginning at habitual bedtime. The room light arm slept in dim light below 3 lux on night one and under overhead room lighting at 100 lux on night two. The dim light arm slept below 3 lux on both nights. The comparison is the change from night one to night two between arms, so each participant supplies his or her own baseline and the control arm absorbs any second-night effect. Tests of the change scores were unpaired t tests.

The light source, stated prominently because it governs how this entry may be used. The 100 lux condition was produced by four 60-watt incandescent overhead ceiling bulbs, identified in the methods by manufacturer and part number. Incandescent. Not light-emitting diode. An incandescent lamp is a blackbody radiator of roughly 2,700 kelvin whose emission rises monotonically toward the red and the infrared and whose short-wavelength content is small. The Foundation does not cite this study as evidence of harm from light-emitting diode products, and the FDA should not read it that way. What follows from the choice of source is set out below, and it is more useful to the Foundation than the misreading would have been.

Population. Age 18 to 40, with a mean of about 26.7 in each arm. Habitual sleep duration between 6.5 and 8.5 hours and habitual sleep onset between 9:00 p.m. and 1:00 a.m. Participants with any sleep disorder were excluded, as were those pregnant or breastfeeding, and laboratory stays for female participants were scheduled in the follicular phase. The arms did not differ significantly in age, body mass index, sex, race, or in bedtime, sleep duration and sleep efficiency measured by actigraphy in the preceding week, nor in daytime sleepiness at screening.

Results. Insulin resistance by the homeostatic model assessment rose about 15 percent in the room light arm and fell about 4 percent in the dim arm, the difference in change being significant at $p = 0.018$. The Matsuda insulin sensitivity index fell about 16 percent against a rise of about 3 percent, $p = 0.048$. The thirty-minute insulin area under the curve from a two-hour oral glucose tolerance test was higher in the room light arm. Heart rate during sleep was higher, with a condition-by-night interaction at p less than 0.001, and heart rate variability was lower, indicating a shift toward sympathetic predominance. Higher sympathovagal balance during sleep was associated with higher thirty-minute insulin area under the curve. Sleep architecture shifted: proportionately more stage N2 and less slow wave and rapid eye movement sleep. Melatonin levels did not differ between conditions. In the authors' own summary, a single night of exposure to room light during sleep can impair glucose homeostasis, potentially through increased sympathetic activation.

The melatonin null, reported as the authors report it. This is important and must not be overstated in either direction. The authors chose 100 lux partly because that level has been shown capable of suppressing melatonin and shifting circadian phase, so they expected suppression and did not find it. They offer two explanations. First, only 5 to 9 percent of incident light is estimated to be transmitted through closed eyelids to the retina. Second, interindividual variability in melatonin sensitivity to light is large. They then state plainly that because of the small sample and because waking melatonin samples were not collected under dim conditions, they cannot rule out an effect of light-induced change in melatonin level or phase on the metabolic parameters. The Foundation therefore does not

assert that the observed effect was independent of melatonin. What the study shows is that the effect occurred without a detectable difference in melatonin, and that the pathway its own data support is autonomic.

What follows from an incandescent source, which is the argument. Three things, and together they are the most consequential point in this appendix. First, the effect was produced by a source with little short-wavelength emission, delivered through closed eyelids, which attenuate to between 5 and 9 percent and whose transmittance is itself weighted toward the red. The effective retinal exposure was therefore both small and strongly long-wavelength. Second, the mitigation strategy presently urged for light-emitting diode products — lower correlated color temperature, amber night modes, blue-blocking filters — rests on the premise that short-wavelength content is the hazard and melatonin suppression the injury. This study impaired glucose metabolism in one night with a warm, blue-poor source and no melatonin difference. A spectral fix alone is therefore not shown to be sufficient, and an illuminance limit is doing work that no shift in color temperature will do for it. Third, the case for a product that emits the same illuminance with substantial short-wavelength content added is stronger, not weaker, than the case this study makes. A light-emitting diode lamp at 100 lux delivers everything the incandescent lamp delivered and more. The Foundation submits that any recommendation or performance standard addressing light in a sleeping environment must therefore contain both an illuminance limit and a spectral limit, and that the FDA presently has neither. Parts IV.C, V.C.2, V.F, IX.D and IX.J.

The effective dose, and where it sits in the threshold sequence. If 5 to 9 percent of 100 lux reaches the retina through a closed eyelid, the effective ocular exposure in this experiment was on the order of 5 to 9 lux. That figure lands inside the band the rest of this appendix is converging on. Appendix C.32 applied thresholds of 3 and 10 lux at the head of the bed, taken from the experimental melatonin-suppression literature. Appendix C.10 used 1 lux at the wrist. Appendix C.38 used the 0.1 lux detection floor of its sensor. The sequence now has an experimental rung: at an effective retinal exposure of single-digit lux, sustained across a night of sleep, measurable autonomic and metabolic change occurred in healthy young adults. The Foundation does not present that as a derived limit. It presents it as the reason a limit is now a tractable question rather than a speculative one.

What it does not establish. Anything about chronic exposure. One night. The authors claim no more. It does not establish that the metabolic change persists, reverses, accumulates or leads to disease; the link from a single night of impaired glucose handling to diabetes is an inference this study does not license and the Foundation does not draw. The sample is ten per arm, which is very small, and the design is parallel-group rather than crossover, so randomization is carrying more weight than twenty participants can comfortably bear even though the measured baseline characteristics were balanced. The Matsuda result at $p = 0.048$ is marginal, several outcomes were examined, and the Foundation has seen no indication that the reported p values were corrected for multiple comparisons. Participants were healthy adults aged 18 to 40 screened to exclude sleep disorders, which is the group least likely to be affected and makes the finding more striking while limiting generalization. Nothing in the study bears on any particular product, on outdoor light, or on exposure while awake.

Independence and conflicts. The authors declare no competing interest. Kathryn Reid and Phyllis Zee are also authors of the study at Appendix C.38, and this entry and that one are products of the same group at Northwestern University. The two are therefore not independent of each other, and the Foundation records it as it has at Appendices C.19, C.20, C.24 and C.37. The Foundation notes, without treating it as a qualification, that the pairing is unusually useful: one is an experiment establishing that bedroom light at a stated level alters cardiometabolic physiology, and the other is an observational study finding higher prevalence of the corresponding conditions in older adults with measured

bedroom light. Funding in both cases came from institutes of the National Institutes of Health.

Bearing on the statutory question. This entry does the most work of any in the appendix. On § 360ii(a)(4), which directs the Secretary to study and evaluate emissions and the effects of exposure: here is the study, performed by others, at a cost the Department funded. On § 360ii(a)(2), which directs the Secretary to minimize exposure to unnecessary electronic product radiation: light reaching a sleeping person serves that person no purpose whatever, which places it at the extreme of the necessity analysis at Part II.D.2. On § 360ii(b)(1)(B), which authorizes recommendations: the Foundation has asked the Department what illuminance is acceptable in a bedroom at night, and this is the study a recommendation would be built from, bracketing an effect between an exposure below 3 lux that produced none and an exposure at 100 lux that did. On § 360kk, which provides for performance standards: an indicator lamp, a charging light, a display or a clock face in a bedroom is an electronic product emitting optical radiation into a sleeping person's environment, and this study is the beginning of a basis on which such emissions could be limited. And on § 360ii(b)(1)(A): the Secretary funded this, and the Foundation is aware of no step the Center for Devices and Radiological Health has taken to collect it. Parts II.D.2, V.F, IX.C, IX.D and IX.J.

C.41 McGlashan and others (2021) — light acutely suppresses activity in the human amygdala

Citation. McGlashan EM, Poudel GR, Jamadar SD, Phillips AJK, Cain SW. Afraid of the dark: light acutely suppresses activity in the human amygdala. PLOS ONE. 2021;16(6):e0252350. doi:10.1371/journal.pone.0252350. PMID 34133439. PMCID PMC8208532. Open access under the Creative Commons Attribution license; full text read. First-level model outputs and analysis scripts deposited at the Open Science Framework.

The direction of the finding, stated before anything else. The effect reported in this study is a beneficial one. The authors frame it that way, their title is Afraid of the dark, and their proposition is that light elevates mood by suppressing fear-related activity in the amygdala. A reader looking for a study that cuts against this comment could cite it. The Foundation puts it in the appendix anyway, reports it as the authors report it, and relies on it for two propositions that do not depend on whether the effect is good or bad: the dose at which the human brain responds to light, and the gap between the photometric and the biological measure of the same stimulus. On the second of those it is the most useful study in this appendix.

Design. Twenty-three healthy young adults in a 3-tesla scanner, blood-oxygen-level-dependent functional magnetic resonance imaging. Passive exposure in alternating thirty-second blocks of light and dark, dark being below 1 lux, with the two light intensities presented in separate runs. Light was delivered by a custom fiber-optic device to two 40-millimeter diffusers positioned about 50 millimeters above each eye. Gaze could not be monitored during exposure because delivery was binocular.

The stimulus, in both measures. This is the field that matters. The source was a halogen illuminator with a correlated color temperature of approximately 2,800 kelvin and a peak wavelength of 655 nanometers. Deep red. Intensity was measured at the eye and reported in two ways. The dim condition was approximately 10 photopic lux, equal to 4.3 microwatts per square centimeter, corresponding to a daytime equivalent melanopic illuminance of approximately 3.5 lux. The moderate condition was approximately 100 photopic lux, equal to 42.73 microwatts per square centimeter, corresponding to a melanopic equivalent of approximately 34.67 lux. Spectral characteristics were measured with a spectrometer and the tabulated spectral power distribution in one-nanometer bins from 360 to 760 nanometers is published as supplementary material.

Results. Light, compared with dark, suppressed activity in the amygdala. The 100 lux condition suppressed it more than the 10 lux condition, which is a dose-response. Functional connectivity between the amygdala and the ventromedial prefrontal cortex was enhanced during light relative to dark. The authors propose that these effects may contribute to the mood-elevating action of light, through reduced fear-related affect and altered processing of negative emotion.

The dose, which is the first proposition the Foundation takes from this study. Thirty seconds of exposure at 10 photopic lux — which is 3.5 melanopic lux — produced measurable change in the activity of a subcortical structure governing emotional response, and doubling to the moderate condition produced more of it. That is a very small dose and a very short exposure. The regulatory framework described at Part V.C.2 treats optical radiation below the blue light hazard thresholds as biologically inert and addresses it, if at all, as a visual quantity. This study is evidence that the brain is responding at single-digit melanopic lux within half a minute. The levels are the levels found in bedrooms: compare the 3 and 10 lux thresholds at Appendix C.32, the 1 lux threshold at Appendix C.10, the 0.1 lux sensor floor at Appendix C.38, and the effective retinal exposure of roughly 5 to 9 lux computed at Appendix C.40.

The two measures of one stimulus, which is the second and more important proposition. This study reports, for the same physical stimulus, both the photopic illuminance and the melanopic equivalent daytime illuminance. The ratio is about 0.35: a hundred photopic lux of this 2,800 kelvin halogen source delivered roughly thirty-five melanopic lux. The ratio is a property of the spectrum, not of the brightness. A cool white light-emitting diode source of the kind now standard in streetlights, displays and residential lamps has a melanopic to photopic ratio substantially higher than this, so the same reading on the same photometer corresponds to a materially larger dose to the non-visual system. Part IV.C of this comment states that proposition. This entry is the Foundation's preferred citation for it, because the two quantities are published side by side for one measured source with its spectral power distribution attached. A limit expressed in lux is not a limit on the biologically active quantity, and two products complying identically with a photometric limit may differ severalfold in the exposure they actually deliver. Parts IV.C, V.C.2.j, IX.D.

A second blue-poor source producing substantial effects. The pattern established at Appendix C.40 repeats here. That study used incandescent lamps; this one uses halogen at 2,800 kelvin peaking at 655 nanometers. Both sources are warm and poor in short-wavelength content, and both produced measurable physiological change. The Foundation draws the same inference it draws at Appendix C.40 and no more: the mitigation approach urged for light-emitting diode products, which is to reduce correlated color temperature and filter the blue, has not been shown to be sufficient, because effects are being obtained with sources that have already had the blue taken out. Part IX.D.

Timing, and the limit it places on the entry. Scans began between two and six hours after habitual waketime, with a mean of three hours and fifty-four minutes. These were daytime exposures at a circadian phase at which light is expected to be beneficial. The study therefore does not test, and the Foundation does not infer from it, that the same response at night would be harmful. The proposition that the consequence of a given exposure depends on when it is received is supported in this appendix by Appendix C.40, where the exposure was administered during the sleep period and the measured consequence was sympathetic activation and impaired glucose handling. The two entries should be cited together and for different things: this one for sensitivity and for the measurement gap, that one for nocturnal consequence.

What it establishes. That dim to moderate light produces acute, dose-dependent change in human amygdala activity and in amygdala-prefrontal connectivity, at an exposure of single-digit to low-tens melanopic lux over thirty-second blocks, in healthy young adults

during the daytime. And that for a warm source the photopic and melanopic measures of one stimulus differ by roughly a factor of three.

What it does not establish. Any effect on mood, which was not measured; the mood interpretation is the authors' inference from the imaging and they present it as such. Any harm. Any effect of nighttime exposure. Anything about chronic exposure, the blocks being thirty seconds. Anything about any product. The sample is twenty-three, and amygdala signal is among the more difficult measurements in functional imaging because of susceptibility artifact in that region, so the same small-sample reliability caution recorded at Appendix C.34 applies, though less severely given the within-subject block design. Gaze was not monitored.

Independence from other entries. Sean Cain is an author here and at Appendices C.8, C.24 and C.25, making this the fourth entry in which he appears.40 identifies as a priority acquisition. The Monash group is now the most heavily represented in this appendix. The Foundation records that plainly. It does not reduce the weight of any individual entry, but it means the appendix should not be described as reflecting a consensus of independent investigators without that qualification. Part V.A.1.

Bearing on the statutory question. Two uses, both of which the Foundation has stated above and neither of which concerns harm. First, on § 360ii(a)(4), the duty to study and evaluate the effects of exposure: a response at 3.5 melanopic lux in thirty seconds establishes that the sensitivity of the non-visual system is far greater than the thresholds around which existing optical radiation standards are built, and that the question is one of dose and timing rather than of whether any effect exists. Second, on the measurement convention, which this comment addresses at Part IV.C and which bears on every performance standard the Department might issue under § 360kk and every recommendation under § 360ii(b)(1)(B): until the Department requires that exposure be expressed in a quantity weighted to the responding system, a numerical limit will govern how bright a product looks and not how much biologically active radiation it delivers. Parts IV.C, V.C.2, V.F, IX.D and IX.J.

C.42 Stefani and Cajochen (2021) — practice review of lighting regulations against non-visual recommendations

Citation. Stefani O, Cajochen C. Should we re-think regulations and standards for lighting at workplaces? A practice review on existing lighting recommendations. Frontiers in Psychiatry. 2021;12:652161. doi:10.3389/fpsyt.2021.652161. PMID 34054611. PMCID PMC8155670. Open access under the Creative Commons Attribution license; full text read. Centre for Chronobiology, Psychiatric Hospital of the University of Basel. Received January 11, 2021; accepted April 14, 2021.

Why the Foundation relies on this entry. Every other entry in this appendix is evidence about an effect. This one is evidence about the regulatory record. The central factual premise of this comment is that no federal standard, and indeed no binding standard anywhere, governs the non-visual effects of optical radiation from electronic products, and that compliance with the standards that do exist does not control the biologically active quantity. The Foundation has asserted that premise throughout. This paper is two chronobiologists of standing, writing in a peer-reviewed journal, stating the same thing from the inside of the field. It is the Foundation's preferred citation for the premise, and it means the Department is not being asked to take the proposition from an advocacy organization.

What kind of document it is, and how it was vetted. A practice review, published as a brief report. It is not primary research and the Foundation does not present it as such; its value is as an authoritative description of the standards landscape as of early 2021. The review was handled by an editor at Harvard Medical School and the published record names three reviewers: a scientist at the German Federal Institute for Occupational Safety and Health,

a researcher at the Building Research Establishment in the United Kingdom, and Kevin Houser of Oregon State University, a leading figure in North American lighting research. A descriptive claim about the state of lighting standards, vetted by a government occupational-safety scientist, a building research institute and a senior lighting academic, is about as well tested as such a claim can be outside litigation.

The two findings the Foundation takes from it. First, in the authors' own words in the abstract, as of the date of writing there are "no specific regulations" addressing the non-visual effects of light. Second, and more pointed, that compliance with the common lighting standards, which address visual aspects, often means that only little non-visually effective light reaches the eye. That is the proposition this comment states at Part IV.C, reached independently and from the opposite direction. The authors also observe that recommended practices have proliferated while experts in the field criticize them, which is the condition Part IV.B of this comment describes for the American voluntary standards.

The seven circadian lighting recommendations the authors identify, and what they have in common. The paper lists seven examples, alphabetically. The Foundation reproduces the list because the common feature is the argument:

1. Chartered Institution of Building Services Engineers and Building Research Establishment, Research Insight on circadian lighting.
2. CIE S 026:2018, CIE System for Metrology of Optical Radiation for ipRGC-Influenced Responses to Light.
3. DGUV 215-210, Non-visual Effects of Light on Humans.
4. DIN SPEC 67600:2013-04, a technical report, Biologically Effective Lighting – Planning Recommendations.
5. Recommendations for Healthy Daytime, Evening, and Night-Time Indoor Light Exposure.
6. UL DG 24480, Design Guideline for Promoting Circadian Entrainment with Light for Day-Active People.
7. The WELL standard, Circadian Lighting Design, and the WELL version 2 pilot update.

Not one of them is a regulation. A metrology standard that defines how to measure but sets no limit. Two national technical reports. A professional institution's research insight. An academic consensus paper. A design guideline issued by a product-safety certification organization. And a green-building rating system. Seven documents assembled by experts as the state of circadian lighting guidance, and every one of them is voluntary. The Foundation makes the same observation about IEEE Std 1789-2015 at Part V.D.3, that a recommended practice is not a standard in the sense in which that word is used in 21 U.S.C. § 360kk and imposes no obligation on any manufacturer. The point generalizes. UL DG 24480 is an American document and it is a design guideline. There is no federal rule in the list because there is no federal rule. Parts IV.B, IV.C and IX.D.

What the governing lighting standard says about health, in its own terms. The authors describe DIN EN 12464-1:2011-08, the European workplace lighting standard, as specifying the planning principles for lighting systems but not specifying the requirements for the safety and health protection of employees at work. That is the standard disclaiming the function. The Foundation draws attention to it because the same division runs through the American standards described at Part IV.B: the documents that specify how much light to install are not health standards and do not claim to be, and the documents that address health are not standards. Nothing occupies the space between them. The authors also record that the draft revision raises the workplace horizontal illuminance minimum to 500 lux, with 1,000 lux specified for rooms used by elderly people with reduced eyesight — figures set, on the authors' own account, by visual task requirements.

CIE S 026:2018, and what it is. This discharges a question raised at Appendix C.41. The authors describe the standard as defining spectral sensitivity functions, quantities and

metrics for the ability of optical radiation to stimulate each of the five human photoreceptor types — the short-, medium- and long-wavelength cones, rhodopsin and melanopsin — with measured spectral irradiance weighted accordingly and referenced to the D65 standard illuminant. It is the instrument by which the melanopic quantities reported at Appendix C.41 are derived. The Foundation emphasizes what follows: a complete and internationally agreed system for expressing optical radiation in terms of the receptors that respond to it has existed since 2018. The obstacle to a biologically referenced exposure limit is therefore not the absence of a measurement method. Parts IV.C and IX.D.

The direction of the authors' concern, stated openly. These authors are not arguing for less light. They are arguing that workplaces receive too little biologically effective light during the day, noting that specifications for artificial lighting correspond to outdoor twilight, that 500 lux indoors is on the order of half a percent of the light available on a cloudless day, and that workers are typically exposed to only about 100 lux for more than half the day. Their recommendations are for more and better-timed light at work. The Foundation's concern in this comment is nocturnal exposure, which is the opposite end of the same problem. The Foundation says so plainly rather than presenting this paper as support for its own direction of travel. What the two share is the defect: standards written in visual units do not control the biologically active quantity, and so they fail in both directions at once — too little when it is wanted, too much when it is not. That is a stronger argument for a biologically referenced standard than either direction makes alone, and it is an argument the lighting industry cannot characterize as hostility to lighting.

Conflicts of interest, recorded in full. These are substantial and the Foundation sets them out as it has at Appendices C.25 and C.32. Stefani is named as an inventor on five patents, including United States Patent 8,646,939 B2, a display system having circadian effect on humans, and United States Patent 8,994,292 B2, an adaptive lighting system, together with German patent DE 10 2010 047 207 B4 and international applications WO2006013041A1 and WO2016092112A1. For 2017 to 2020 he discloses investigator-initiated research grants from Derungs, Audi, Volkswagen, Porsche, Festo, ZDF, Toshiba and SBB, and speaker fees from Merck, Fraunhofer, Firalux and Selux. For the same period Cajochen discloses honoraria, travel, accommodation or meals for invited lectures, conference presentations or teaching from Toshiba Materials, Velux, Firalux, Lighting Europe, Electrosuisse, Novartis, Roche, Elite, Servier and WIR Bank. Both are members of the Daylight Academy. Lighting Europe is the European lighting industry association; Derungs, Firalux and Selux are luminaire manufacturers; Velux manufactures daylighting products.

Why those conflicts do not impeach the proposition relied on. The Foundation states its reasoning rather than leaving the disclosure to speak for itself in either direction. The conflicts run in the same direction as the authors' recommendations: a patent holder on circadian lighting systems and a researcher funded in part by the lighting industry both stand to benefit if circadian lighting is specified and installed. For that reason the Foundation does not rest on their recommendations, and cites none of their proposed values. What it relies on is their description of the regulatory record: that there are no specific regulations, that the seven listed documents are what exists, and that visual compliance does not control the non-visual quantity. A commercial interest in circadian lighting gives no reason to misstate that record, the record is independently verifiable, and the claim was reviewed by a scientist at a national occupational safety institute. The Foundation relies on the description and not on the prescription.

What it establishes. That as of 2021, on the account of investigators in the field, no binding regulation anywhere addressed the non-visual effects of lighting; that the guidance which does exist consists of seven voluntary documents of mixed character; that the principal European workplace lighting standard disclaims the health-protection function; and that

an international metrology standard capable of expressing optical radiation in receptor-weighted terms has existed since 2018.

What it does not establish. Any effect of any exposure. It is a review of documents, not of evidence, and the Foundation cites it for nothing about health. It does not establish the state of American regulation specifically, since its focus is European and its treatment of United States material is limited to the UL design guideline and the WELL standard; Part IV.B of this comment must establish the American position from American sources. It is now four years old, and any claim that no regulation exists must be verified as of the date of filing rather than rested on a 2021 review.

Bearing on the statutory question. Directly and at several points. Paragraph 360ii(a)(5) directs the Secretary to develop, test and evaluate the effectiveness of procedures and techniques for minimizing exposure to electronic product radiation; the seven documents listed above are what the field has produced in the Secretary's absence, and none of them binds anyone. Paragraph 360ii(b)(1)(A) authorizes the Secretary to collect and make available information concerning the hazards and control of electronic product radiation; this paper is a compiled account of the control measures that exist, and collecting it is the elementary step. Paragraph 360ii(b)(1)(B) authorizes recommendations the Secretary considers appropriate; six of the seven listed documents are recommendations issued by bodies with no authority to issue them, which is what fills a vacuum that Congress assigned to the Secretary. And § 360kk performance standards: CIE S 026 establishes that the quantity could be specified, so the question before the Department is not whether a biologically referenced limit is measurable but whether it will set one. Parts IV.B, IV.C, IX.B, IX.C, IX.D and IX.J.

C.43 Sun and others (2021) — outdoor light at night and coronary heart disease, Hong Kong prospective cohort

Citation. Sun S, Cao W, Ge Y, Ran J, Sun F, Zeng Q, Guo M, Huang J, Lee RS, Tian L, Wellenius GA. Outdoor light at night and risk of coronary heart disease among older adults: a prospective cohort study. European Heart Journal. 2021;42(8):822–830. doi:10.1093/eurheartj/ehaa846. PMID 33205210. Not open access; drawn from the published abstract and from the accompanying editorial.

Design. Prospective cohort of older adults in Hong Kong, followed for a median of eleven years. Outdoor light at night was estimated from time-varying satellite data, a composite of persistent night-time illumination at approximately one square kilometer scale, assigned annually to the participant's residential address. Cox proportional hazards models, adjusted for both individual and area-level risk factors.

Why the design matters here. Two features distinguish this entry from most of the appendix. The exposure is time-varying: it was reassigned each year rather than fixed at baseline, which means a participant whose neighborhood brightened during follow-up is recorded as having done so. And the follow-up is eleven years with incident events, so exposure precedes outcome. Most entries in this appendix are cross-sectional and cannot establish that order. This one can.

Results. Three thousand seven hundred and seventy-two incident coronary heart disease hospitalizations and 1,695 coronary heart disease deaths were identified. Per interquartile-range increase in outdoor light at night, the interquartile range being 60.0 nanowatts per square centimeter per steradian, the hazard ratio was 1.11, 95 percent confidence interval 1.03 to 1.18, for hospitalization, and 1.10, 1.00 to 1.22, for death, after adjustment for individual and area-level risk factors. The exposure-response function was monotonic. The association did not vary across strata of the hypothesized risk factors the authors examined.

The interquartile range, which discharges a question raised elsewhere in this appendix. This study states its exposure contrast in radiance units: 60.0 nanowatts per square centimeter per steradian. That matters beyond this entry.17 and C.33 record that a hazard ratio per interquartile range is uninterpretable, and not comparable to any other study, unless the interquartile range is stated; Appendix C.33 reports 21.17 nanowatts per square centimeter per steradian for a nationwide Chinese sample and Appendix C.37 reports no figure at all. Hong Kong is among the most brightly lit places on earth and the spread of exposure within it is correspondingly wide, which is part of why the interquartile range here is nearly three times that of the Chinese national sample. Effect sizes per interquartile range from different studies are therefore not directly comparable, and the Foundation will not compare them without stating the contrast each represents. Part V.J.4.

The authors' own caution, which the Foundation adopts. The abstract states that the authors caution against causal interpretation of the findings, and that future studies with more detailed exposure information, with data on individual adaptive behaviors, and on potential mediators are warranted. The Foundation reproduces that rather than omitting it. It is also, in substance, a description of the research program § 360ii(a)(2) and (a)(4) direct the Secretary to plan, coordinate and support: better exposure assessment, measurement of what people actually do in response to light, and identification of mechanism.

The accompanying editorial. The European Heart Journal published the study with an invited editorial: Münzel T, Hahad O, Daiber A. The dark side of nocturnal light pollution. Outdoor light at night increases risk of coronary heart disease. European Heart Journal. 2021;42(8):831–834. doi:10.1093/eurheartj/ehaa866. PMID 33221876. PMCID PMC7897459. Open access under Creative Commons Attribution-NonCommercial. The authors are cardiologists at the University Medical Center Mainz and the German Center for Cardiovascular Research. The Foundation does not treat an editorial as evidence of any effect and cites it for nothing of the kind. It records the editorial for one proposition only, and the proposition is about the field rather than about the hazard: the flagship journal of the European Society of Cardiology published a leading environmental cardiology group placing nocturnal light pollution alongside air pollution and transportation noise as an environmental cardiovascular risk factor warranting attention. Whatever the FDA concludes on the merits, it cannot characterize the question as a fringe one. Part V.A.3.

What the editorial concedes, which the Foundation also records. The same editorial states that the adverse health effects of nocturnal light pollution are not well characterized, by contrast with air pollution, whose role in ischemic heart disease and stroke the authors describe as well established, and with transportation noise, which they associate with approximately 1.6 million disability-adjusted life years in Western Europe. It identifies the generalizability limits of the Hong Kong study, that city being among the most polluted in the world and the sample being older Chinese adults. And it reports that the study's sensitivity analyses suggested light at night and air pollution may act together on coronary mortality. The editorial also presents a figure mapping the co-localization of light pollution, air pollution and road and aviation noise across the United States. That figure is a published illustration of the confounding problem this comment concedes throughout, and the Foundation regards the candor of these authors about it as a reason to credit rather than discount their view of the field.

What it establishes. That in a prospective cohort of older adults followed for a median of eleven years, with exposure reassigned annually and with 3,772 incident hospitalizations and 1,695 deaths, higher modeled outdoor light at night at the residence was associated with a modestly higher risk of coronary heart disease hospitalization and death, along a monotonic exposure-response gradient. The temporal order of exposure and outcome is established; in most of this appendix it is not.

What it does not establish. Causation, which the authors expressly disclaim. The exposure is modeled outdoor radiance over an area of about a square kilometer, which is spectrally blind and is not a measurement of the light reaching any person; it says nothing about indoor exposure, bedroom conditions, or behavior. The effect sizes are modest and the confidence interval for coronary death has a lower bound at 1.00, so that estimate is marginal. Hong Kong is atypical in both light and air pollution and the cohort is of older adults, so generalization to the United States is not available from this study. Light at night, air pollution and transportation noise co-localize, as the accompanying editorial itself illustrates, and the Foundation does not claim this study resolves that. It establishes nothing about any electronic product and nothing about spectral composition.

Position among the cardiovascular entries. This is the fourth cardiovascular entry and the one that adds most to the set, for a reason of independence rather than of strength. Appendix C.2 and Appendix C.8 both draw on the UK Biobank cohort with wrist-instrument exposure, so they are not independent of each other and share whatever features of that cohort and that instrument may bear on the result. Appendix C.17 addresses stroke. This entry is a different country, a different population, a different exposure method and a different decade of ascertainment, and it reaches a result in the same direction with a monotonic gradient. Replication across independent cohorts and independent exposure methods is worth more than a larger estimate from the same cohort twice. The Foundation also notes the contrast in magnitude: the brightest-against-darkest contrast at Appendix C.8 gives 1.32 for coronary artery disease, while a single interquartile-range increase here gives 1.11, and the two are consistent with each other because they are different contrasts, which is the point made above about interquartile ranges.

Independence, conflicts and funding. The Foundation has identified no author shared with any other entry in this appendix. Funding was from the Ministry of Education of China, the Key Laboratory of Public Health Safety, and the Hong Kong Research Grants Council General Research Fund, grant 17613819, under the University Grants Committee. No industry funding is disclosed in the record the Foundation has obtained. Gregory Wellenius, the senior author, is an environmental epidemiologist in the United States, which is of some relevance to the standing of the work before a United States agency.

Bearing on the statutory question. Offered for two propositions. First, on § 360ii(a)(4), that coronary heart disease hospitalization and death are among the outcomes under investigation in relation to ambient light at night, that the investigation now includes prospective designs with hard endpoints and long follow-up, and that it has not reached a conclusion the investigators themselves will call causal. That is the condition the subsection addresses. Second, on the posture the Department should take: when the European Society of Cardiology's journal publishes a cohort study of this kind with an editorial placing the exposure beside air pollution and noise, a federal program with a statutory mandate over electronic product radiation that has collected none of it is not exercising judgment about priorities. It is absent. Parts II.F, V.A.3, V.F, IX.B and IX.C.

C.44 Zhang and others (2021) — artificial light at night and thyroid cancer in a large United States cohort

Citation. Zhang D, Jones RR, James P, Kitahara CM, Xiao Q. Associations between artificial light at night and risk for thyroid cancer: a large US cohort study. Cancer. 2021;127(9):1448–1458. doi:10.1002/cncr.33392. PMID 33554351. PMCID PMC10236487. Not open access; drawn from the published abstract.

Why this entry matters. Three reasons. It is the largest study in Appendix C by a wide margin: 464,371 participants. It is a United States population, which most of this appendix is not. And it is the adult counterpart to Appendix C.11, reporting the same histology from the same exposure at the opposite end of life — Appendix C.11 found an association with

papillary thyroid cancer in children from exposure at the residence of birth, and this study finds one with papillary thyroid cancer in adults aged 50 and over. Two independent American research groups, two cohorts, two life stages, one tumor type.

Design and population. Prospective cohort analysis within the National Institutes of Health–American Association of Retired Persons Diet and Health Study. Incident thyroid cancers were ascertained by linkage to state cancer registries. Cox regression with adjustment for sociodemographic, lifestyle and other environmental factors.

Exposure, as measured. Satellite-estimated light at night linked to the residential address at baseline. The Foundation notes two consequences. The exposure is spectrally blind, as at Appendices C.33, C.37 and C.43. And unlike the cohort at Appendix C.43, where exposure was reassigned annually, assignment here is at baseline only, so a participant who moved or whose neighborhood brightened during follow-up carries the baseline value throughout.

Results. Comparing the highest with the lowest quintile of light at night, a 55 percent increase in thyroid cancer risk: hazard ratio 1.55, 95 percent confidence interval 1.18 to 2.02. The association was primarily driven by papillary thyroid cancer. It was stronger in women, 1.81, 1.26 to 2.60, than in men, 1.29, 0.86 to 1.94, the estimate in men not reaching significance. In women the association was stronger for localized disease; in men it was stronger for more advanced stage. Results were reported as consistent across tumor sizes. The authors conclude that future studies are needed to confirm the association and identify the underlying biological mechanisms.

Thyroid cancer overdiagnosis, which the Foundation raises itself and which is the governing objection. Thyroid cancer is the textbook case of cancer overdiagnosis. Incidence of papillary thyroid cancer in the United States rose several-fold over recent decades while mortality remained essentially flat, a pattern that is widely attributed to the detection of small, indolent tumors through neck imaging performed for other reasons rather than to any true increase in disease. Access to that imaging is not evenly distributed. It concentrates where medical services concentrate, which is where people are dense, which is where it is bright at night. Satellite light at night is among the best available proxies for urban density. There is therefore a direct and well-documented pathway by which brighter residential light at night could be associated with more diagnosed thyroid cancer without any biological effect of light whatever. The Foundation states this before stating anything in the study's favor, because a reviewer who knows the thyroid literature will raise it immediately, and because the same objection applies to Appendix C.11 and to the use this comment makes of that study at Part II.H.

What the stage and size findings do and do not do about it. The authors report analyses that bear on the objection, and the Foundation reads them as cutting both ways. In favor of the finding: the association was consistent across tumor sizes. Overdiagnosis concentrates in small tumors, so an association that does not weaken as tumors get larger is harder to explain by detection alone. Against the finding: the strongest single result in the paper is the association in women, and within women the association was stronger for localized disease, which is precisely the presentation that incidental detection produces. The association in men was stronger for advanced stage, which is less vulnerable to detection bias because advanced disease presents symptomatically, but the estimate in men was not statistically significant. The Foundation therefore does not claim that this study resolves the overdiagnosis question. It claims that the authors addressed it, that the evidence they present is mixed, and that the question is open.

The mechanism the authors hypothesize, and a tension within this appendix. The authors reason from melatonin: that light at night inhibits nocturnal melatonin secretion and causes circadian disruption, that recent studies have linked light at night to breast cancer risk, and that thyroid cancer may share a hormone-dependent etiology with breast cancer. The Foundation records two qualifications to that chain of reasoning, both drawn

from its own appendix. First, the breast cancer premise is not settled here: Appendix C.7, a wavelength-resolved pooled cohort analysis, found no statistically significant association with breast cancer in the overall study population on any measure, with a positive finding confined to a subgroup, and Part V.G of this comment reports that null openly. Second, the melatonin pathway is a hypothesis rather than an established mechanism: at Appendix C.40 a controlled experiment produced autonomic and metabolic effects from nocturnal light with no detectable difference in melatonin between conditions. The Foundation does not adopt the authors' mechanistic reasoning and does not need it. What it relies on is the association they report, with the limits stated above.

What it establishes. That in a prospective cohort of 464,371 American adults with registry-ascertained incident cases, higher satellite-estimated light at night at the baseline residence was associated with a 55 percent higher risk of thyroid cancer in the highest against the lowest quintile, driven by papillary histology and concentrated in women. And that the association has now been reported in two independent American cohorts at two life stages for the same tumor type.

What it does not establish. Causation, which the authors do not claim and which the overdiagnosis objection above makes particularly difficult to reach for this outcome. Nothing about spectral composition. Nothing about personal or indoor exposure, the exposure being modeled outdoor radiance at a baseline address. Nothing about any electronic product. The cohort is a volunteer cohort of older Americans recruited through a membership organization and is not representative of the United States population. The sex difference is interesting but subgroup findings of this kind are frequently unstable, and the Foundation does not build on it.

Position among the cancer entries. The appendix now carries three cancer entries with substantially different standing, and the Foundation sets out the arrangement so that the set is not read as uniformly supportive. This entry and Appendix C.11 report associations with papillary thyroid cancer, from independent American groups, at opposite ends of life, both from satellite-modeled exposure and both subject to the overdiagnosis objection. Appendix C.7 examined breast cancer with wavelength-resolved exposure, which is methodologically the best exposure assessment in this appendix for an outdoor measure, and found no significant association overall. Appendix C.36 is mechanistic work in mice on circadian disruption and colorectal cancer in which the light manipulation was a schedule shift. The honest summary of the set is that the thyroid signal is the most consistent, that it is also the outcome most vulnerable to detection bias, and that the best-measured exposure study in the group returned a null. Part V.G.

Independence, conflicts and funding. The Foundation has identified no author shared with Appendix C.11 or with any other entry in this appendix, so the two thyroid entries are independent of each other. Rachel Jones and Cari Kitahara are investigators at the National Cancer Institute and the record identifies intramural National Institutes of Health support alongside extramural grants from the National Institute on Aging and the National Cancer Institute. No industry funding appears in the record obtained. The Foundation notes, as at Appendices C.36 and C.38, that this is research the Secretary funded and in part performed, through investigators at the Secretary's own cancer institute, and that § 360ii(b)(1)(A) authorizes the Secretary to collect and make available the results of such research.

Bearing on the statutory question. Two uses. First, on § 360ii(a)(4): thyroid cancer is among the outcomes under investigation, the investigation now includes a prospective American cohort of nearly half a million people, and it has not been resolved — including because a well-known methodological problem specific to this cancer has not been eliminated. That is what an unfinished research program looks like, and the subsection addresses it. Second, it bears on the argument at Part II.H. This comment there observes that a journal published by an institute of the Department itself published peer-reviewed

research describing an association between outdoor artificial light at night and papillary thyroid cancer. That argument is strengthened by the existence of a second, independent, larger American study reporting the same association in adults, and it is strengthened further by the fact that investigators at the National Cancer Institute are among its authors. Part II.H should be amended to cite both. Parts II.H, V.G, IX.B and IX.C.

C.45 Gottenbos and others (2021) — blue light accelerated tooth whitening, and the regulatory asymmetry it exposes

Citation. Gottenbos B, de Witz C, Heintzmann S, Born M, Hötzl S. Insights into blue light accelerated tooth whitening. Heliyon. 2021;7(2):e05913. doi:10.1016/j.heliyon.2021.e05913. PMID 33615002. PMCID PMC7881219. Open access under Creative Commons Attribution-NonCommercial-NoDerivatives; full text available. Funding disclosed as Philips.

What the study is. An in vitro bleaching experiment on thirty extracted human teeth with naturally accumulated color, divided among five sequential treatment protocols combining hydrogen peroxide gel at 6 or 25 percent with blue light, alone and together. Blue light was applied at a peak wavelength of 456 nanometers and an irradiance of 190 milliwatts per square centimeter, over exposure periods of roughly nine to eleven hours. Color change was measured and reported after 48 hours of stabilization. Light combined with peroxide produced significantly greater color change than either alone, and the authors conclude that blue light significantly increases both the bleaching rate and the final achievable change, by mechanisms acting in parallel to peroxide bleaching rather than merely accelerating it. They state that the light attacks more stain compounds than peroxide alone.

What it establishes, and what it plainly does not. It establishes that blue optical radiation at 456 nanometers is photochemically active on human dental tissue, and that the activity is not reducible to heating or to acceleration of a chemical process already underway. It establishes nothing about human health, nothing about any effect in a living person, and nothing about ambient lighting. The teeth were extracted. There was no exposed human subject. The Foundation offers this entry for an argument about the FDA's regulatory framework, not as evidence of harm, and it would be misread if taken for the latter.

The dose, stated plainly because the comparison will be made against the Foundation if it is not made by the Foundation. One hundred ninety milliwatts per square centimeter is a large irradiance. For scale, the study at Appendix C.41 reports that 100 photopic lux of a warm source corresponded to 42.73 microwatts per square centimeter at the eye. The whitening irradiance is therefore on the order of four thousand times that of ordinary room light, and over nine hours delivers a radiant exposure on the order of six thousand joules per square centimeter. The Foundation states this because the inference that blue light whitens teeth and therefore ambient light-emitting diode products are dangerous does not follow and must not be advanced. The argument the Foundation does advance is about the framework, and it is set out next.

The asymmetry, which is the point of this entry. An electronic product emitting 456-nanometer radiation at a tooth for cosmetic purposes is regulated by the FDA. It is classified at 21 C.F.R. § 872.6475 under product code EEG, and the agency has cleared at least a dozen premarket notifications for devices of this type, the earliest in 1979 and more recent ones in 2011 and 2012, with more than a hundred establishments registered to the product code. An electronic product emitting the same wavelengths into the eyes of the general public from a street luminaire, a vehicle headlamp, a display or an indicator lamp is subject to no performance standard at all. The Foundation asks the Department to consider which of those two exposures its statute was written to reach. The dental exposure is voluntary, brief, professionally supervised, sought by the exposed person, and serves that person's own purpose. The street exposure is involuntary, nightly, population-

wide, and serves the exposed person no purpose whatever. Paragraph 360ii(a)(2) directs the Secretary to minimize the exposure of people to unnecessary electronic product radiation. Of the two exposures, the one that is regulated is the necessary one. Parts II.D.2, IV.A and IX.D.

The classification describes the wrong mechanism, which is the second and more serious point. The FDA's device name for this product type is Heat Source For Bleaching Teeth. The classification is framed on a thermal model: the regulated characteristic is the production of heat. This study, conducted by the manufacturer, finds that the active principle is not heat. It is wavelength-specific photochemistry at 456 nanometers, operating in parallel to peroxide oxidation and attacking stain compounds that peroxide does not reach. The regulation therefore does not describe what the product does. The Foundation draws the connection to its central argument: this is the same defect identified at Part IV.C in the use of photometric units to govern a non-visual response, and at Part V.C.2 in a hazard framework whose exposure function terminates at 10,000 seconds. Where the FDA has addressed optical radiation from these products at all, it has done so through a physical model that does not correspond to the mechanism by which the radiation acts. That is not an argument that the agency has been idle. It is an argument that the framework needs rebuilding, which is what § 360ii(a)(4) and (a)(5) contemplate and what § 360kk empowers. Parts IV.C, V.C.2 and IX.D.

What the funding source makes this entry worth. The study was funded by Philips and the authors are associated with it. In most entries in this appendix industry funding would be recorded as a reason for caution. Here it runs the other way, and the Foundation says so. A manufacturer of both lighting products and oral care products has no incentive to overstate the photochemical potency of blue light-emitting diode radiation on human tissue, because a finding of potency invites regulation of its own products. The company published it because potency is the product claim. The Foundation relies on this entry as an admission against interest by a manufacturer about the capability of its own technology, and that is the strongest form in which such a proposition can arrive.

The measurement language, which is the third point and the one the Foundation has made throughout. Observe how this study expresses the stimulus. A peak wavelength in nanometers and an irradiance in milliwatts per square centimeter. Radiometric quantities, spectrally specified. That is the language a manufacturer uses when it wants to establish that its light-emitting diode does something. When the same technology is characterized for general illumination, the quantity is lumens per watt — a photometric efficiency ratio that carries no spectral information at all, and the only federal requirement the Foundation is aware of touching light-emitting diode emission is of that kind, as Part IV.G describes. The industry uses radiometric units with a named wavelength to prove efficacy and photometric units to demonstrate compliance. The Foundation does not suggest that is improper. It submits that the Department should require, for health purposes, the units the field itself uses when it is describing an effect. Parts IV.C, IV.G and IX.D.

Bearing on the statutory question. Offered for the proposition that the FDA already accepts, in its own device program, that blue optical radiation from light-emitting diodes acts on human tissue, and that the open question for general lighting is therefore dose and duration rather than whether effects exist at all. That matters because of what it does to the proposition that these products have a long history of safety. A history of safety is not a measurement. It is a report of harms not observed, which is a different thing from a no-effect level established by study. Where the agency concedes that a mechanism exists and has never characterized the dose-response for the exposures the public actually receives, the absence of recorded harm is the signature of the unperformed duty rather than an answer to it. That is the duty at § 360ii(a)(4). Parts II.D.2, IV.A, IV.C, V.C.2, IX.C and IX.D.

C.46 Casiraghi and others (2021) — synchronization of human sleep with the moon cycle, and the comparison of moonlight with urban light pollution

Citation. Casiraghi L, Spiousas I, Dunster GP, McGlothlen K, Fernández-Duque E, Valeggia C, de la Iglesia HO. Moonstruck sleep: synchronization of human sleep with the moon cycle under field conditions. Science Advances. 2021;7(5):eabe0465. doi:10.1126/sciadv.abe0465. PMID 33571126. PMCID PMC7840136. Open access under Creative Commons Attribution-NonCommercial; full text read.

The sentence the Foundation relies on, stated first. In their discussion the authors write that light pollution measurements in the highly urbanized areas of Seattle where their student participants live reveal values above their full moonlight measurements in the rural Toba/Qom environments. That is a measured comparison, made by these investigators between two environments they instrumented themselves, and it is the most useful single fact in this entry. Ambient artificial light at night in an American city exceeded full moonlight in rural Argentina. The remainder of the study establishes what full moonlight does.

Design and populations. Wrist actimetry under field conditions. Three Toba/Qom communities in the Argentinian province of Formosa, indigenous communities of shared recent history living at different levels of electrification: one urban with full access to electric light, 26 participants; one rural with limited electric light, 20; and one rural with no access to electric light at all, 23. Total 69. Field campaigns ran in September to November across 2016, 2017 and 2018, confined to Southern Hemisphere spring so that weather, sunrise and sunset times and daylight intensity would be comparable between them. Separately, sleep recordings from 464 University of Washington undergraduates in Seattle, mean age 21.5, were analyzed across the lunar cycle. Participants were not told the specific prediction under test.

Results. Sleep began later and was shorter on the nights before the full moon, when moonlight is available during the hours after dusk. Fitted sine wave amplitudes across the lunar cycle, with 95 percent confidence intervals, by community. Sleep duration: no electric light, 8.8 minutes, 4.9 to 12.8; limited electric light, 7.5, 4.0 to 11.0; urban, 9.4, 4.6 to 14.2. Sleep onset: no electric light, 10.0 minutes, 6.2 to 13.7; limited electric light, 12.1, 9.1 to 15.1; urban, 6.4, 2.5 to 10.3. The modulation was evident at the individual level for most participants with adequate records, and the same pattern appeared in the 464 Seattle students, whom the authors describe as likely to have little awareness of the lunar phase.

A characterization the Foundation declines to adopt. The discussion states that the amplitude of the lunar effect appears to be stronger the more limited the access to electric light. The amplitudes set out above do not support a gradient. For sleep duration the urban community shows the largest amplitude of the three. For sleep onset the community with limited rather than no electric light shows the largest. Every confidence interval overlaps every other. The authors' phrasing is appropriately tentative and the Foundation reports their figures rather than their characterization, because a reader told that electric light attenuates the lunar signal would be taking away something the published amplitudes do not show. The Foundation looked for that attenuation, expecting to find it, and did not.

The finding about electrification itself, which is separate and more directly relevant. Independently of the lunar question, the authors report that shorter sleep duration and delayed sleep onset were associated with increased access to electric light, and that this is consistent with previous work from several laboratories including their own. That is a comparison across three communities of shared ancestry, shared recent history and shared language, differing in electrification, with sleep measured by instrument rather than reported. It is not a randomized comparison and the communities differ in other respects, but as natural experiments in this literature go it is unusually well matched.

Why the moonlight result bears on a question about limits. Full moonlight is the dimmest nocturnal illumination to which humans have any evolutionary exposure. It is available for part of the night, on some nights of the month, and it is faint. It nonetheless shifted the timing and duration of sleep measurably, in rural and urban communities on one continent and in several hundred students on another. The consequence for this comment is not that moonlight is harmful. It is that the human sleep and circadian system demonstrably responds to nocturnal light at the very bottom of the range in which light exists at night at all. The proposition that artificial light at a few lux is too dim to matter biologically is not available on this record, because the system under discussion resolves a fainter signal than that. Read together with the authors' own measurement comparison, the position is short: the system responds to full moonlight, and urban artificial light exceeds full moonlight. Parts V.F and IX.J.

The reading that cuts against the Foundation, and the answer to it. The authors write that the availability of electric light in the evening mimics the sleep-inhibiting effect of moonlight, and that access to artificial light may emulate the ancestral effect of early-night moonlight. Read without care that is an argument for doing nothing: humans have always had light at night, and artificial light merely reproduces it. The Foundation states the objection because it is the obvious use of this paper against the position in this comment, and answers it on four grounds, each a property of the exposure rather than of the mechanism. Moonlight is faint, and by these authors' own measurements fainter than urban light pollution. It is periodic, waxing and waning across a month, so the organism is released from it for most of every cycle. It is confined to part of the night and, as the authors note, arrives early enough to delay sleep onset but is unlikely to wake a person already asleep. And it is predictable, which is the property that makes a cue a cue rather than an interference. Artificial light at night is brighter, constant, nightly, year-round, and arrives at whatever hour a switch is thrown. A stimulus an organism evolved to read as a monthly signal is not rendered harmless by being delivered continuously and at higher intensity. The ancestral comparison establishes the sensitivity of the channel, not the safety of saturating it.

What it establishes. That human sleep timing and duration are synchronized with the lunar cycle under field conditions, in communities at three levels of electrification and in a large urban student sample; that the effect is of the order of six to twelve minutes in onset and seven to nine minutes in duration; that greater access to electric light was associated with later and shorter sleep; and that these investigators measured urban light pollution in Seattle at levels above the full moonlight they measured in rural Formosa.

What it does not establish. Any health outcome; sleep timing and duration are the measured variables and no disease endpoint is examined. Any causal claim about electrification, that comparison being observational. Any dose-response, any spectral dependence, and nothing about any product. The urban student analysis is not longitudinal, as the authors state: different students were recorded in different academic quarters rather than the same students followed through a lunar cycle. The effect sizes are modest and the Foundation does not inflate them. A shift of ten minutes in sleep onset is a real and detectable physiological response; it is not an injury.

A limitation that is also the Foundation's standing point. The published text reports no illuminance value and the word lux does not appear in it. A study whose entire subject is the effect of nocturnal light on human sleep expresses its exposure as a phase of the moon, and the measurements of moonlight and of Seattle light pollution the authors say they made are referred to but not given in the text the Foundation has read. This is not a criticism of field anthropology conducted in rural Formosa. It is the condition described at Part V.J: the exposure variable in this literature is almost never the quantity a standard would have to specify. Here the investigators appear to hold the two figures that would make the comparison quantitative.

Position in the sequence of thresholds. This entry sits below every other in the appendix and anchors the bottom of the range. Appendix C.38 used the 0.1 lux detection floor of a wrist sensor and found more than half of an older American population above it. Appendix C.10 used 1 lux at the wrist in children. Appendix C.32 used 3 and 10 lux at the head of the bed. Appendix C.41 produced measurable change in brain activity at 3.5 melanopic lux over thirty seconds. Appendix C.40 bracketed a cardiometabolic effect between an exposure below 3 lux that produced none and 100 lux that did. This entry reports a behavioral response to full moonlight, fainter than all of them, and the authors' own instruments put urban artificial light above it. Part V.F.

Independence and funding. The Foundation has identified no author shared with any other entry in this appendix. Funding was from the National Science Foundation, grant 1743364, and the Leakey Foundation, grant 1266. No industry funding is disclosed. The Foundation notes, as a small addition to the argument at Part II.H rather than as a point about this study, that the federal support here came from the National Science Foundation: the research bearing on this question is distributed across the Department of Energy, the National Institutes of Health and the National Science Foundation, and is collected by none of them for the purpose § 360ii(b)(1)(A) describes.

Bearing on the statutory question. This entry answers a question the Department is entitled to ask of the whole of Part V: why should a federal agency concern itself with light levels of a few lux? The answer on this record is that the system at issue resolves a fainter signal than that, and has been shown to do so in the field, in two hemispheres, across three levels of electrification and in several hundred American undergraduates. Paragraph 360ii(a)(4) directs the Secretary to study and evaluate the conditions of exposure to electronic product radiation, and the condition of exposure these authors measured is one in which the artificial light of an American city exceeds the brightest light the night has ever naturally offered. Paragraph 360ii(b)(1)(B) authorizes recommendations the Secretary considers appropriate: this study supplies no numerical limit and the Foundation does not pretend otherwise, but it removes the ground on which a recommendation might be declined for want of biological plausibility at low levels. Parts II.F, V.F, V.J, IX.C and IX.J.

C.47 Cain and others (2020) — measured evening home lighting, individual circadian sensitivity, and energy-efficient lamps

Citation. Cain SW, McGlashan EM, Vidafar P, Mustafovska J, Curran SPN, Wang X, Mohamed A, Kalavally V, Phillips AJK. Evening home lighting adversely impacts the circadian system and sleep. Scientific Reports. 2020;10:19110. doi:10.1038/s41598-020-75622-4. PMID 33154450. PMCID PMC7644684. Open access under the Creative Commons Attribution license; full text read.

Why this entry carries more weight than any other in Appendix C. It is the only study in this appendix that measures exposure with a spectrophotometer near eye level, in people's own homes, and reports the result in the biologically weighted unit. It is also the only one that quantifies how much the response to a given exposure differs between people. And it contains a measured comparison between homes lit by incandescent lamps and homes lit by energy-efficient lamps, which is the proposition this comment advances at Part IV.G and has until now had to argue from first principles. The Foundation treats this entry as the evidentiary anchor of Part IV.C and Part V.J alongside Appendix C.40.

The instrument, and why it matters. The authors built a wearable containing a mini-spectrophotometer, clipped to clothing, recording the full visible spectrum near eye level. From each spectrum the device computes the stimulus to each photoreceptor class, including melanopic illuminance and photopic illuminance, and the spectral signature permits identification of the type of light source. The authors state their reason for building it: light sensors used in research are wrist-worn, prone to sleeve coverage, and do not capture light exposure at eye level. That is a direct and correct criticism of the exposure

method used at Appendices C.10 and C.38, and the Foundation records it as such rather than leaving the reader to notice the inconsistency. Part V.J.

Individual variability, in the unit that matters. The authors report over fifty-fold differences between individuals in the sensitivity of the human circadian system to light. The light level required to suppress melatonin by half, the ED50, ranged from 3.1 to 181 melanopic lux between individuals, computed on updated International Commission on Illumination standards, in a sample of 42. That is a ratio of about fifty-eight to one between the most and least sensitive person measured. These figures come from the dose-response study of 56 healthy young adults reported separately by Phillips and others in 2019 and reanalyzed here.

Measured home lighting. Average melanopic illuminance in the three hours before bedtime ranged from 3.9 to 77.4 melanopic lux across 59 homes, with a mean of 17.9 and a standard deviation of 13.6. The significance is in the overlap: the range of home lighting levels falls inside the range of individual ED50 values. The same home therefore produces materially different circadian stimulation depending on who lives in it, and the authors state the consequence plainly — the circadian impact of lighting for any given individual in any given home is unpredictable without knowing both that person's sensitivity and that home's light level.

What the combination produced, and its status as a prediction rather than a measurement. The authors applied the individual-level dose-response curves to the measured home light levels. On that basis nearly half of homes were bright enough to suppress melatonin by 50 percent, and the average home produced a predicted range of individual responses from 0 to 87 percent suppression. For the least sensitive individual, no home was predicted to reach 50 percent suppression. The Foundation states expressly that these are predictions obtained by combining sensitivity curves measured in one sample with light levels measured in another. Melatonin was not measured in these homes. The prediction is sound in method and is the authors' own, but it is a model output and the comment must not describe it as an observation.

The sleep finding, which is measured and is within-person. Greater melanopic illuminance in the three hours before bedtime, relative to that individual's own average, was associated with increased wakefulness in the 90 minutes after bedtime: beta = 0.89, standard error 0.09, p less than 0.00001. The relationship held on adjustment for age, sex, average bedtime and deviation from average bedtime, and again on further adjustment for chronotype. Because the comparison is each participant against their own average, the usual between-person confounders do not arise. This is the most robust exposure-outcome association in Appendix C that is not from an experiment.

Energy-efficient lamps, which is the finding this comment has been arguing without evidence. Homes with energy-efficient lights had nearly double the melanopic illuminance of homes with incandescent lighting. The authors set up the question themselves in their introduction: incandescent lamps waste energy as heat, a global effort has transitioned lighting to energy-efficient light-emitting diode and compact fluorescent lamps, white light-emitting diodes are typically enriched in blue, and the transition could therefore exacerbate circadian disruption through a greater effect on short-wavelength-sensitive melanopsin. They then measured it. Part IV.G of this comment describes the federal lamp efficiency framework and the absence of any health evaluation accompanying it. This entry supplies the measurement that framework never required: at the level of the lit room, the substitution approximately doubled the stimulus to the circadian photopigment. The quantity the federal requirement specifies is lumens per watt. The quantity that doubled is melanopic illuminance. No federal instrument addresses the second. Parts IV.C, IV.G and IX.D.

The relationship to Appendix C.40, which should be read immediately. The experiment at Appendix C.40 produced measurable autonomic and metabolic impairment from a single night of 100 lux during sleep, delivered by incandescent lamps. This entry finds that homes lit by energy-efficient lamps deliver nearly twice the melanopic illuminance of homes lit by incandescent lamps. The demonstration of harm was therefore obtained using the weaker of the two sources, and the federal efficiency framework moved households toward the stronger one. The Foundation does not claim that the cardiometabolic effect scales linearly with melanopic illuminance, because no study establishes that. It claims that the two entries read together leave the Department without the assumption that the transition was biologically neutral.

The extended twilight, which the Foundation asks the Department to read as the summary of this Part. To compare home light with natural light the authors recorded a sunset with the same instrument, on a day of 11 hours 13 minutes of daylight. Natural light fell from the ED50 of the least sensitive individual, 181 melanopic lux, to the ED50 of the most sensitive, 3.1 melanopic lux, in 22 minutes. Nature traverses the entire span of measured human circadian sensitivity in rather less than half an hour. In modern homes people remain inside that span for hours, which is why the authors conclude that home lighting creates an extended twilight for the circadian system and weakens the distinction between day and night. The Foundation commends that formulation to the Department. It is not an argument that artificial light is unnatural in some aesthetic sense. It is a measured statement that the signal by which the human circadian system distinguishes day from night has been flattened, and that nothing in federal law addresses the quantity in which the flattening is expressed.

What it establishes. That evening melanopic illuminance in real homes spans roughly 4 to 77 melanopic lux; that individual circadian sensitivity spans roughly fifty-eight-fold, with ED50 from 3.1 to 181 melanopic lux; that those two ranges overlap, so the circadian effect of a given home is person-specific; that within individuals, brighter evenings predicted more wakefulness after bedtime; that homes with energy-efficient lamps had nearly double the melanopic illuminance of homes with incandescent lamps; and that a natural sunset crosses the whole range of human circadian sensitivity in 22 minutes.

What it does not establish. Any disease outcome. The measured outcome is wakefulness after bedtime by actigraphy, not health. The melatonin suppression figures are modelled rather than measured in these homes, as stated above. The energy-efficient comparison is observational across 59 homes, and homes with energy-efficient lamps may differ from homes with incandescent lamps in age, size, number of fixtures and occupant behavior; the authors report a difference in measured melanopic illuminance, not an experiment in lamp substitution. The sensitivity curves come from 56 healthy young adults of mean age about 21, so the fifty-eight-fold range is the range within a narrow and healthy slice of the population and may understate variation across the whole of it. The sample is Australian. Nothing here concerns outdoor lighting, vehicle lamps or displays.

Independence, and a problem for the appendix as a whole. Sean Cain is the first author here and appears also at Appendices C.8, C.24, C.25 and C.41. Andrew Phillips is the last author here and an author at Appendix C.41, and the dose-response data relied on here are from his 2019 study. Elise McGlashan and Parisa Vidafar likewise recur. This is the fifth entry in which the Monash University group appears. The Foundation states the consequence rather than the fact alone: Appendix C cannot be characterized as the convergent judgment of independent investigators, and the entries in which this group appears should be read as a connected body of work by one laboratory that has been unusually productive on this question. That is not a criticism of the work, which includes the best exposure measurement in the appendix. It is a limit on the inference the Department should draw from the number of entries pointing the same way. Part V.A.1.

Funding. National Health and Medical Research Council of Australia, grant 1064231. No industry funding is disclosed. The Foundation notes that the measurement which bears most directly on the consequences of the United States lamp efficiency framework was made in Australia on Australian public funds.

Bearing on the statutory question. Four points. On § 360ii(a)(4), the duty to study and evaluate the conditions of exposure: here is the condition of exposure, measured at eye level in 59 homes and expressed in the unit that corresponds to the responding photopigment. The Department has not done this and did not need to; it needs only to collect it, which is § 360ii(b)(1)(A). On the measurement convention at Part IV.C: this study reports both photopic and melanopic quantities from the same instrument and identifies the source type from the spectrum, which demonstrates that a spectrally resolved, biologically weighted exposure metric is not merely definable but portable and wearable. On § 360kk, and on the design of any recommendation under § 360ii(b)(1)(B): a single numerical limit set at a population average will leave a substantial fraction of the population unprotected, because the response to a given exposure differs by nearly sixty-fold, and the Department should say what fraction it intends to protect. And on Part IV.G: the federal efficiency framework changed the quantity that matters by a factor of about two, in the direction of greater biological effect, and no federal evaluation of that consequence exists. Parts II.F, IV.C, IV.G, V.J, IX.C, IX.D and IX.J.

C.48 Elsabagh and others (2020) — white against blue-cut LED in dairy calves: melatonin, intake and growth

Citation. Elsabagh M, Mon M, Takao Y, Shinoda A, Watanabe T, Kushibiki S, Obitsu T, Sugino T. Exposure to blue LED light before the onset of darkness under a long-day photoperiod alters melatonin secretion, feeding behaviour and growth in female dairy calves. Animal Science Journal. 2020;91(1):e13353. doi:10.1111/asj.13353. PMID 32219969. Not open access; drawn from the published abstract.

Why a study of calves is in this appendix, stated first. Three reasons, and the Foundation gives them before the findings because the entry would otherwise look like a digression. First, the Department asked: Question 14 of this request for information concerns environmental and ecological effects, and Part V.I responds to it. Second, paragraph 360ii(a)(4) directs the Secretary to study and evaluate emissions of, and conditions of exposure to, electronic product radiation, and unlike paragraph (a)(2) it does not limit the exposure in question to people. Third, and principally, the exposure in this study is a white light-emitting diode of the ordinary commercial kind, compared against the same technology with the blue content removed. That comparison is the one this comment has been arguing about, and this is the only mammalian experiment in Appendix C in which spectral content was the manipulated variable and the outcome included growth.

What it does not purport to be. Evidence about human health. The subjects are Holstein calves, bovine circadian and photoperiodic physiology differs from human in ways this entry does not attempt to bridge, and the Foundation advances no inference from calves to children. Nor does the Foundation suggest that the electronic product radiation control provisions protect livestock; paragraph 360ii(a)(2) speaks of the exposure of people, and § 360kk(a)(1) conditions a performance standard on the protection of the public health and safety. The FDA has extensive authority over cattle elsewhere in the Act, through the new animal drug provisions and the animal food provisions administered by the Center for Veterinary Medicine, but that authority is not the subject of this comment.

Design. Two experiments, six female Holstein calves each, aged eight weeks, under a long-day photoperiod. In the first, animals were exposed to yellow or blue light-emitting diode illumination for two hours before darkness over seven days; mean body weight 97 kilograms, standard deviation 4.1. In the second, over three weeks, animals were exposed either to blue light from a white light-emitting diode throughout the daytime or to a yellow

light-emitting diode for two hours before darkness, which the authors describe as blue light cut; mean body weight 88.5 kilograms, standard deviation 4.8. Outcomes were plasma melatonin, grass hay intake, rumination time, frequency of water intake and body weight gain.

Results. In the first experiment, blue light mildly suppressed melatonin during the two-hour treatment but did not alter the timing of the nightly melatonin rise; the magnitude of that rise was greater under yellow than under blue. In the second, the white light-emitting diode completely suppressed melatonin secretion during the two-hour treatment, although plasma concentrations were similar between groups during darkness. Grass hay intake, rumination time, frequency of water intake and body weight gain were all higher in the animals exposed to yellow rather than white light. The authors conclude that exposure to blue light from white light-emitting diodes under a long-day photoperiod suppresses melatonin secretion and might negatively affect the development of female dairy calves.

The finding that matters, and it corrects something elsewhere in this appendix. A white light-emitting diode completely suppressed melatonin over two hours, and removing the blue content both preserved the melatonin rise and was accompanied by greater intake, rumination and weight gain. The Foundation draws attention to this because it qualifies the inference it draws at Appendices C.40 and C.41. Those entries record that measurable effects were obtained from warm, blue-poor sources — incandescent in one case, halogen peaking at 655 nanometers in the other — and the Foundation concluded that reducing correlated color temperature has not been shown to be sufficient. That conclusion stands. But it is not the same as saying spectral control does not matter, and this entry shows that it does: when the blue was removed from a white light-emitting diode, the physiological and growth outcomes differed. The defensible position, and the one the Foundation adopts, is that spectral control is necessary and not sufficient. A standard that addressed spectrum alone would leave the illuminance problem untouched, and a standard that addressed illuminance alone would leave this effect untouched. Parts V.C.2, IX.D and IX.J.

What it establishes. That in a controlled experiment in a mammal, using an ordinary white light-emitting diode of the kind sold for general illumination, two hours of evening exposure completely suppressed melatonin secretion; that removing the short-wavelength content of that light prevented the suppression; and that the animals under the blue-reduced light ate more, ruminated more, drank more often and gained more weight over three weeks.

What it does not establish. Any human effect. Any mechanism beyond the melatonin measurement. Six animals per experiment is a very small sample even for a controlled design, and the Foundation does not treat the growth differences as precise. The two experiments are not directly comparable: the first contrasts blue against yellow for the same two-hour window, while the second appears to contrast white light throughout the daytime against yellow for two hours before darkness, which confounds duration and timing with spectrum. No illuminance or irradiance value is given in the abstract, so the dose is unknown. A long-day photoperiod is an imposed agricultural condition and not a natural one. And the authors themselves say the development effect might obtain, not that it does.

A point about the industry that uses this. The baseline condition in both experiments is a long-day photoperiod, which is an agricultural lighting regime imposed deliberately on dairy cattle because manipulating photoperiod alters their physiology and yield. The Foundation notes the parallel with Appendix C.45 without pressing it further than the record supports. An industry installs engineered lighting on mammals precisely because light reliably changes mammalian biology, and the practice is commercially routine. The proposition that light-emitting diode illumination is biologically inert is not one that the users of these products hold.

Independence and funding. The Foundation has identified no author shared with any other entry in this appendix. Funding was from the Japan Society for the Promotion of Science, grant 15K14846. No industry funding is disclosed in the record obtained.

Bearing on the statutory question. Used at Part V.I, which responds to Question 14, and at Part V.C.2. The Foundation offers it for two propositions. First, that a commercially ordinary white light-emitting diode is capable of completely suppressing melatonin in a mammal over a two-hour evening exposure, and that the short-wavelength content is what does it. Second, that the question of what a performance standard should specify is answerable in part by experiment, and that experiments of this kind — one product, one spectral variable, a physiological endpoint and a growth endpoint — are what paragraph 360ii(a)(2) directs the Secretary to plan, conduct, coordinate and support, and what § 360ii(b)(2) authorizes grants for. This one was funded by the Government of Japan. Parts II.B, V.C.2, V.I, IX.C and IX.D.

C.49 Walker and others (2020) — three nights at 5 lux: depressive-like behavior and neurological change in mice

Citation. Walker WH, Borniger JC, Gaudier-Diaz MM, Meléndez-Fernández OH, Pascoe JL, Courtney DeVries A, Nelson RJ. Acute exposure to low-level light at night is sufficient to induce neurological changes and depressive-like behavior. Molecular Psychiatry. 2020;25(5):1080–1093. doi:10.1038/s41380-019-0430-4. PMID 31138889. PMCID PMC6881534. Corresponding author at West Virginia University. Drawn from the published abstract; the Foundation has not obtained the full text.

The governing limitation, stated before anything else. The subjects are mice, and a mouse is nocturnal. Its active phase is the dark phase, and light introduced into that phase interrupts the period in which the animal is awake and foraging. For a diurnal human the same exposure falls during sleep. The circadian architecture is inverted and the behavioral meaning of the stimulus is not the same. The Foundation therefore does not offer this study as evidence that light at night causes depression in people, and asks the Department not to read it that way. What is conserved between the species is the machinery — melanopsin, the retinohypothalamic projection, the suprachiasmatic nucleus and the clock genes — and it is for what this study shows about the sensitivity of that machinery that the Foundation relies on it.

Design. Adult male and female mice were housed either on light days with dark nights, being 14 hours at 150 lux followed by 10 hours at 0 lux, or on light days with low-level light at night, being 14 hours at 150 lux followed by 10 hours at 5 lux. The exposure ran for three consecutive nights. Outcomes were behavioral, molecular and circadian.

The dose, which is why this entry is here. Five lux. Over three nights. That is the lowest experimentally administered nocturnal exposure in Appendix C to produce a behavioral change in a mammal, and it sits inside the band the rest of this appendix has converged on from every direction: 3 and 10 lux at the head of the bed at Appendix C.32, an effective retinal exposure of roughly 5 to 9 lux at Appendix C.40, 3.5 melanopic lux producing measurable brain activity change at Appendix C.41, 1 lux at the wrist in children at Appendix C.10, a 0.1 lux instrument floor exceeded by most older Americans at Appendix C.38, and full moonlight at Appendix C.46. Part V.F.

Results, as reported. Mice exposed to light at night for three consecutive nights showed increased depressive-like responses compared with mice housed in dark nights. Female animals showed increased central tendency in the open field. Hippocampal vascular endothelial growth factor A was reduced in both sexes. Females showed increased VEGFR1 and interleukin-1 beta messenger RNA expression; males showed reduced brain-derived neurotrophic factor messenger RNA. Circadian rhythms of activity and of temperature were significantly altered in females, and circadian gene expression in males. The authors

conclude that acute exposure to light at night alters brain physiology and can be detrimental to well-being in otherwise healthy individuals.

A point of difference from Appendix C.23 that must not be elided. Both entries are rodent experiments in which light during the dark phase altered behavior through a neurotrophin mechanism, and a reader scanning for the abbreviation BDNF would take them to confirm one another. They do not. At Appendix C.23 brain-derived neurotrophic factor was elevated in the basolateral amygdala and the behavioral consequence was heightened stress-evoked aggression. Here it is reduced, as messenger RNA and in males only, in the hippocampus, and the behavioral consequence is a depressive-like phenotype. Different structure, opposite direction, different endpoint. The two findings are not inconsistent, because amygdalar and hippocampal neurotrophin signaling are not the same system and the phenotypes they are associated with differ, but neither replicates the other and the comment must not present them as convergent. The doses also differ by a factor of eighty: 400 lux at Appendix C.23 against 5 lux here.

What it establishes. That in a mammal, five lux introduced into the dark phase for three consecutive nights was sufficient to alter circadian rhythms and circadian gene expression, to change the expression of a neurotrophic factor, a neurotrophin receptor and an inflammatory cytokine in the hippocampus, and to change performance on behavioral assays, with the exposure assigned by the investigators. It establishes that the dose required to perturb this system is very small and the duration required is very short.

What it does not establish. Any human effect, for the reason given at the head of this entry. Nothing about depression as a clinical condition: depressive-like behavior in rodents is assessed by assays whose construct validity is contested, and the Foundation cannot name the assays used because it has not obtained the full text. Nothing about spectral composition, the abstract reporting illuminance only. Nothing about chronic exposure, the exposure being three nights. Nothing about any product. The sex-specific molecular findings are interesting and the Foundation does not build on them, because sex-stratified molecular results across several outcome measures in a rodent study are frequently unstable. The authors' closing phrase, that the effect can be detrimental to well-being in otherwise healthy individuals, extends from mice to individuals; the Foundation reports that they wrote it and does not adopt it.

One further observation about the design. The daytime condition in both arms was 150 lux. The contrast between day and night in the light-at-night arm was therefore thirty to one, against an effectively unbounded ratio in nature. That is the same flattening of the day-night signal that Appendix C.47 measured in human homes and described as an extended twilight. The Foundation notes the parallel because it suggests the operative variable in both may be the amplitude of the daily light signal rather than the absolute level at night, which is a question for the research program at Part IX.C rather than a conclusion available now.

Independence and funding. Randy Nelson is an author of this study and of the review at Appendix C.25, and the two are therefore not independent. The Foundation notes that Appendix C.25 records substantial funder and patent interests among that review's authors and that the Foundation declined to rest an argument on it; the present study is primary research with public funding and the Foundation does not carry that reservation across, but it records the shared authorship. Funding was from the National Institute of Neurological Disorders and Stroke, grant R01 NS092388, and the National Institute of General Medical Sciences, grants U54 GM104942 and T32 GM132494, all components of the Department of Health and Human Services. No industry funding appears in the record obtained.

Bearing on the statutory question. Two uses. First, and this is the structural one: the entries in this appendix addressing affective and psychiatric outcomes in humans — Appendices

C.20, C.21, C.24 and C.35 — are observational, and the Foundation concedes in each of them that confounding is unresolved. This entry supplies what those cannot: an assigned exposure, in a mammal, at an environmentally ordinary intensity, producing both a behavioral and a molecular change. It is the mechanistic plausibility leg of that cluster, and it occupies the same position for the affective domain that Appendix C.36 occupies for the cancer domain. Second, on § 360ii(a)(4): the dose at which this system responds is now bracketed from several directions, and five lux over three nights is a quantity a performance standard could be written against. The Foundation does not say this study supplies the number. It says the number is no longer out of reach. Parts II.F, V.F, V.G, IX.C and IX.J.

C.50 Nash and others (2019) — daily blue light, lifespan and extraocular neurodegeneration in Drosophila

Citation. Nash TR, Chow ES, Law AD, Fu SD, Fuszara E, Bilska A, Bebas P, Kretzschmar D, Giebultowicz JM. Daily blue-light exposure shortens lifespan and causes brain neurodegeneration in Drosophila. npj Aging and Mechanisms of Disease. 2019;5:8. doi:10.1038/s41514-019-0038-6. PMID 31636947. PMCID PMC6797782. Open access under the Creative Commons Attribution license; full text read. Department of Integrative Biology, Oregon State University.

The governing limitation, stated first. The subject is the fruit fly. The evolutionary distance from a human is very large and the photoreceptive biology is not homologous: the fly uses rhodopsins and cryptochrome rather than melanopsin, has a compound eye rather than a camera eye, and is a translucent organism of a few millimeters in which light reaches every tissue as a matter of course. Nothing in this entry transfers to a human by analogy, and the Foundation does not offer it as evidence of any human effect. It is here for a design feature and a single finding, both set out below, and for nothing else.

Why the design nonetheless deserves the Department's attention. The comparison arms were constructed to isolate the spectral variable, and the Foundation has asked for exactly this kind of study throughout Part V. Flies were maintained in daily cycles of twelve hours of light and twelve of darkness under four conditions: constant darkness; white fluorescent light; blue light-emitting diode illumination peaking at approximately 460 nanometers; and white light-emitting diode illumination with the blue wavelengths removed by a yellow filter. Critically, all light sources were adjusted to emit similar photon flux density, 20 to 30 micromoles per square meter per second at the level of the animals. The blue and the blue-blocked conditions therefore delivered the same number of photons per second, and differed only in which photons. One hundred animals were used for each genotype in each light condition.

Results. Against constant darkness, median lifespan was reduced by approximately 50 percent under blue light but by only 4 percent under white light with the blue removed, in one strain; in a second strain the reductions were approximately 30 percent and 10 percent respectively. Constant darkness extended median lifespan by 42 percent against a white fluorescent cycle. A dose-response was established: raising photon flux density from 4 to 11, from 11 to 17, and from 17 to 24 micromoles each produced a significant increase in mortality, by log-rank tests with Bonferroni correction. Blue light accelerated aging phenotypes, producing damage to retinal cells, brain neurodegeneration and impaired locomotion measured by a climbing assay. Stress-responsive genes were induced by blue light in old flies but not in young ones. Cryptochrome was tested as a candidate mediator and excluded, and the authors report that several known blue-light-sensitive proteins are not acting in the pathways mediating the detrimental effects, so the mechanism is not identified.

The finding the Foundation relies on. Brain damage and locomotor impairment did not depend on retinal degeneration. The authors demonstrated this in flies whose eyes had

been genetically ablated: those animals, having no eyes, still showed the brain and locomotor phenotypes under blue light. That is a direct experimental demonstration that blue optical radiation can damage neural tissue by a route that does not pass through an image-forming eye. The Foundation relies on it for that proposition and states immediately what it does not show.

What that finding does not show, stated at once. It does not show that blue light reaches the human brain. A fly is a translucent organism a few millimeters across; a human brain sits behind skin, skull and dura, which attenuate short-wavelength radiation severely. The question of tissue penetration in humans is unresolved and the review at Appendix C.28 identifies it as such. These authors themselves put the human proposition no higher than a suggestion, writing in their introduction that recent data suggest extraocular light may impact human brain physiology. The Foundation adopts that formulation and no stronger one. What this study establishes is conditional: where blue light reaches neural tissue, it is capable of damaging it. Whether it reaches human neural tissue in any relevant quantity is a question for the research the Foundation asks the Department to undertake. Parts V.C.2.h and IX.C.

A second point, which answers a criticism the Foundation makes elsewhere. At Appendices C.18 and C.26 the Foundation objects that mechanistic light research commonly uses exposures far above anything encountered in ordinary life, and that findings so obtained cannot be carried to ambient conditions. These authors make the same distinction about their own field and then avoid it. They note that numerous studies have reported blue-light damage to retinal cells in mammals and in Drosophila, that those studies employed acute strong light, and that what they show by contrast is degeneration in response to twelve hours of daily exposure at a photon flux matched to ordinary room lighting. A chronic moderate exposure producing a dose-dependent effect on lifespan is a different kind of evidence from an acute high-intensity exposure producing tissue injury, and it is the kind this comment has repeatedly said is missing. Part V.C.2.d.

A statement in the paper worth quoting for a different purpose. In their introduction the authors describe the source in terms this comment uses throughout: commonly used light-emitting diodes emit a high fraction of blue light, often peaking at 460 nanometers, and these lights appear white because of the addition of a broad-spectrum yellow garnet phosphor. That is a compact and citable description of the phosphor-converted white light-emitting diode spectrum, from a peer-reviewed source, and it supports the account at Part I.G and Part V.B.

What it establishes. That in Drosophila, twelve hours of daily blue light at approximately 460 nanometers shortened median lifespan by roughly 30 to 50 percent against darkness, in a dose-dependent manner, while light of the same photon flux with the blue removed shortened it by 4 to 10 percent; that the exposure produced retinal degeneration, brain neurodegeneration and locomotor impairment; that the brain and locomotor effects occurred in animals without eyes; and that the mediating mechanism was not identified.

What it does not establish. Anything about humans. Anything about any product; a blue-only twelve-hour daily cycle is not an environmental human exposure, whatever the photon flux. Any mechanism, the authors having excluded their principal candidates without identifying a replacement. And nothing about the quantities in which this comment asks the Department to express exposure: photon flux density is a radiometric quantity and the Foundation welcomes its use, but it is not convertible to illuminance or to melanopic quantities without the spectral power distribution and the conversion is not performed here.

The successor study, which supplies the mechanism this one lacked. The preceding field records that the mediating mechanism was not identified. Three years later the same laboratory identified a candidate. Appendix C.69 reports that blue light inhibits succinate

dehydrogenase and the activity of mitochondrial Complex II, that susceptibility rises sharply with age, and that the mechanistic work was conducted entirely in eyeless animals. Read the two entries together; C.69 is the sequel to this study and shares three authors with it.

Position among the non-human entries, and a problem the Foundation should address. Appendix C now contains a substantial body of animal evidence: hepatic injury in mice at Appendix C.15, the year-long murine exposure at Appendix C.26, amygdalar signaling in rats at Appendix C.23, clock disruption and colorectal cancer in mice at Appendix C.36, dairy calves at Appendix C.48, depressive-like phenotype in mice at Appendix C.49, and this. Seven entries, across four species, with this one the most distant from a human subject. The Foundation does not present them as seven confirmations of anything. They differ in species, exposure, intensity, duration and endpoint, and the weight each can carry differs accordingly. Part V.A.2 sets out the standard of evidence this comment applies, and the Foundation notes here that it needs a statement of how non-human evidence is weighted, placed before the entries rather than inferred from them.

Independence and funding. The Foundation has identified no author shared with any other entry in this appendix. The funding statement was not captured in the record obtained and must be supplied.

Bearing on the statutory question. Offered for two propositions and no others. First, on the scope of the existing hazard framework: Part V.C.2.h argues that the blue light hazard framework addresses injury to the retina and does not reach non-ocular routes at all. This entry is an experimental demonstration, in an organism where the question can be settled by removing the eyes, that a non-ocular route exists and is damaging. The framework's silence on such routes is therefore a gap rather than a considered exclusion. Second, on § 360ii(a)(2) and (a)(4): the design here is what a funded, coordinated research program produces when it asks the right question — photon flux held constant, spectrum varied, dose titrated, a whole-organism endpoint, and the candidate mechanism tested and excluded rather than assumed. The Foundation asks the Department to note what the study cost and who paid for it, and to compare that with the absence of any equivalent study of a human exposure. Parts V.A.2, V.C.2.h, IX.C and IX.D.

C.51 Marek and others (2019) — melanopsin and trigeminal pathways in blue-light photosensitivity

Citation. Marek V, Reboussin E, Dégardin-Chicaud J, Charbonnier A, Domínguez-López A, Villette T, Denoyer A, Baudouin C, Réaux-Le Goazigo A, Mélik Parsadaniantz S. Implication of melanopsin and trigeminal neural pathways in blue light photosensitivity in vivo. Frontiers in Neuroscience. 2019;13:497. doi:10.3389/fnins.2019.00497. PMID 31178682. PMCID PMC6543920. Open access under the Creative Commons Attribution license; full text read.

The conflict of interest, stated first and at length because of its direction. The published statement reads that two of the authors are employed by Essilor International and that the remaining authors declare no commercial or financial relationships constituting a potential conflict. The funding statement reads that the work was funded by Essilor International within a research collaboration with Sorbonne Université and the Institut de la Vision. The first author and one co-author are the Essilor employees. Essilor International is among the largest manufacturers of ophthalmic lenses in the world and it sells lenses marketed for filtering blue light. The Foundation sets this out before the findings, and at more length than it has for other entries, because the direction of the interest matters and is the opposite of the case at Appendix C.45. There, a manufacturer of lighting and oral-care products published evidence of the photochemical potency of blue light, which invites regulation of its own products, and the Foundation treated the funding as an admission against interest. Here, a manufacturer of blue-filtering lenses funded and

co-authored a study finding that blue light causes aversion and ocular inflammation, which is a commercial case for its product. That is a reason for caution and the Foundation records it as one. The findings below are reported because the pharmacological design is testable and because the critical result is a negative one that a sponsor seeking a marketing claim would not have needed, not because the Foundation regards industry-funded research as reliable by default.

Design. Adult male C57BL/6J mice were exposed for three hours to either blue light-emitting diode illumination, 400 to 500 nanometers, or yellow, 530 to 710 nanometers, at an average irradiance of 6 milliwatts per square centimeter, between 9 a.m. and 1 p.m. Photosensitivity was measured as time spent in the dark against the illuminated part of the cage. A series of pharmacological interventions was then applied to identify the mediating pathway: topical atropine, pilocarpine and oxybuprocaine; intravitreal lidocaine, norepinephrine and a blocker of visual photoreceptor transmission; and an intraperitoneal melanopsin antagonist at 30 milligrams per kilogram given fifteen minutes before exposure. Clinical assessment of the ocular surface, corneal mechanical sensitivity and tear quantity was performed immediately after exposure and again after three days of recovery in standard lighting. Trigeminal ganglia, brainstems and retinas were analyzed.

The dose, and the authors' own placement of it. Six milliwatts per square centimeter is 60 watts per square meter, and the total radiant exposure over three hours was 64.8 joules per square centimeter. This is a strong exposure and far above ambient indoor lighting. The authors address the point directly and the Foundation reports their answer rather than only the criticism: they state that the irradiance used, while strong enough to induce light-aversive behavior, was still within the range one may receive from daily sun exposure, and they compare their total radiant exposure of 64.8 joules per square centimeter with the 1,000 joules per square centimeter that another group required to produce a significant increase in corneal fluorescein staining. The exposure is therefore high relative to a lit room and modest relative to the literature on corneal injury.

The central result, which is a pharmacological dissection. Mice showed strong aversion to blue light and no aversion to yellow. The authors state that the photophobic effect was wavelength-dependent and was not simply induced by bright light of random spectrum, and the yellow arm is what establishes that. Of every intervention tried, only one reduced the aversion: the intraperitoneal melanopsin antagonist, significant at the first hour and at three hours. The intravitreal blocker of visual photoreceptor transmission did not abolish the difference between blue and yellow; the blue-against-yellow contrast remained significant in animals that had received it.

What that result means, and it is the most consequential finding in Appendix C for this comment's measurement argument. Light aversion, in this model, is not a visual response. Blocking transmission from the visual photoreceptors left it intact; blocking melanopsin reduced it. The discomfort is therefore mediated by the non-visual photopigment, which has its own spectral sensitivity peaking near 490 nanometers, and not by the cone-mediated system whose sensitivity the photopic luminous efficiency function describes. Every quantity in which this exposure would ordinarily be specified — lux, lumens, candelas, luminance, and the lumens per watt of the federal efficiency requirement at Part IV.G — is weighted by that visual function. A response that does not run through the visual system cannot be governed by a limit expressed in visual units. Appendix C.41 and Appendix C.47 establish that the melanopic and photometric measures of one stimulus diverge; this entry supplies the reason it matters for discomfort specifically. Parts IV.C, V.C.2, V.E.2, V.E.4 and IX.D.

The inflammation findings, and the point about absent outward signs. Slit-lamp examination with fluorescein staining revealed no epithelial damage to the cornea, which the authors describe as expected at this exposure. They then state that the absence of outward signs cannot guarantee the absence of more intrinsic damage, and report that in

vivo confocal microscopy revealed inflammatory signs in the corneal epithelium, the sub-basal nerve plexus and the stroma of blue-exposed animals. Dry-eye-related inflammatory signs were observed, and notably were present after three days of recovery in standard lighting. In the retina, immunoreactivity for GFAP, ATF3 and Iba1 was increased and corroborated by quantitative PCR, and the distribution of both visual and non-visual photopigments was altered. In the trigeminal pathway, messenger RNA expression of cFOS and ATF3 was increased and cytokine levels were altered. The authors conclude that the phototoxic message was transmitted to the trigeminal system, inducing inflammation at the ocular surface and stress in the retina.

Why this bears on the aversion response as a safety assumption. Part V.C.2 describes an international framework which treats the natural aversion response as the mechanism that limits exposure, and which in one passage treats a lamp being uncomfortable to look at as the reason it presents no hazard. This entry is evidence, in a controlled animal experiment, that aversion to blue light is a receptor-mediated response accompanied by inflammatory and stress markers at the ocular surface, in the retina and in the trigeminal pathway, and that the ocular surface signs were still present three days after the exposure ended. On that evidence the aversion is not the protection operating; it is a signal that something is happening, and the something outlasts the stimulus. The Foundation does not claim this study settles the human case. It claims that a framework which counts discomfort as a safety margin has adopted an assumption that the available mechanistic evidence does not support, and that this is a question paragraph 360ii(a)(5) directs the Secretary to resolve by testing rather than assuming. Parts V.C.2, V.E.2 and IX.D.

What it establishes. That in mice, three hours of blue light at 6 milliwatts per square centimeter produced strong light-aversive behavior while yellow light at the same irradiance produced none; that the aversion was reduced by a melanopsin antagonist and not by blockade of visual photoreceptor transmission; that no gross corneal epithelial damage occurred but inflammatory signs were detectable by confocal microscopy and persisted at three days; and that stress and activation markers were raised in the retina and in the trigeminal pathway.

What it does not establish. Any human effect. The subjects are mice, nocturnal animals with a baseline preference for darkness; the yellow arm controls for that preference and is what makes the result interpretable, but the species gap remains. The exposure is three hours at an irradiance far above indoor lighting, and the Foundation does not extend the finding to ambient exposures. The study does not establish photophobia as a clinical condition, does not involve any product, and reports no spectral power distribution for the sources beyond the stated bands. Male animals only. The melanopsin antagonist was given systemically, so its site of action is inferred rather than demonstrated, and the authors themselves put the conclusion as most likely in the retina and note that other potential pathways of light reception remain to be considered.

Position in this comment. Part V.E.2 and Part V.E.4 are at present headings without content, for migraine and photophobia and for trigeminal and melanopsin-mediated pathways respectively. This is the entry on which both should be built. The Foundation notes that the reports collected at Part VII include accounts of eye pain and aversion from light-emitting diode sources, that Part I.G distinguishes the neurological family of effects from the photobiological, and that until now the comment has had no mechanistic citation for the neurological family at all.

Independence and funding. Funded by Essilor International, as set out above. The academic co-authors are at Sorbonne Université and the Institut de la Vision, with clinical affiliations at the Centre Hospitalier National d'Ophtalmologie des Quinze-Vingts and elsewhere. The Foundation has identified no author shared with any other entry in this appendix.

Bearing on the statutory question. Three uses. First, on the measurement convention at Part IV.C, for the reason given above: a discomfort response mediated by a non-visual photopigment cannot be controlled by a limit expressed in units weighted to the visual system, and this is the mechanistic basis of that proposition rather than an inference from it. Second, on § 360ii(a)(5): the aversion response is relied upon as a mitigation, and this entry indicates that the assumption has not been tested and that the available evidence runs against it. Third, on § 360ii(a)(4): the conditions of exposure the Secretary is directed to study include exposures that produce pain and aversion without producing injury detectable by the methods the existing framework uses, and this study shows the two can be separated. Parts IV.C, V.C.2, V.E.2, V.E.4, VII, IX.C and IX.D.

C.52 Alasiri and others (2019) — ocular hazards of dental curing light units, systematic review

Citation. Alasiri RA, Algarni HA, Alasiri RA. Ocular hazards of curing light units used in dental practice – a systematic review. The Saudi Dental Journal. 2019;31(2):173–180. doi:10.1016/j.sdentj.2019.02.031. PMID 30983826. PMCID PMC6445451. Open access under Creative Commons Attribution-NonCommercial-NoDerivatives. King Abdulaziz University, Jeddah.

Article type. Systematic review conducted and reported according to the PRISMA guidelines. PubMed and Google Scholar were searched, using Medical Subject Headings terms for PubMed. Randomized controlled trials, original studies and in vitro studies in English up to 2018 were eligible. Eight articles met the criteria.

Scope, which is narrow and squarely on point. The subject is the ocular hazard presented to the operator, the patient and the auxiliary staff by the light-curing units used in dental clinics. That is a defined product class, in routine use, regulated by this Department, and emitting in the blue. The Foundation is not aware of another systematic review in this appendix whose subject is the ocular hazard of a single regulated light-emitting diode product class.

Findings, as reported. The review concludes that blue light poses the maximum risk of causing retinal degeneration on the evidence evaluated. On dose, the authors report that the total wavelength dose received can cause ocular damage, that light intensity is correlated with the duration required to cause a given level of damage, and that a long exposure can be substituted by use of a lower intensity light. On mitigation, they report that most of the included studies recommend protective eyewear to limit the exposure of patient, operator and assistant, that it is not advisable to stare directly into the source, and that recommended safe exposure times and distances must be strictly adhered to in practice.

What it establishes. That a systematic review of the ocular hazard from a regulated dental light-emitting diode product class, conducted to PRISMA, found eight eligible studies; that the reviewers identified blue light as presenting the greatest retinal risk among the exposures considered; that the governing relationship is one of intensity against duration, which is a dose relationship; and that the mitigation the literature relies on is protective eyewear, avoidance of direct viewing, and adherence to recommended times and distances.

What it does not establish. Any injury rate, incidence or prevalence among dental personnel or patients. Eight studies of mixed design, including in vitro work, is a thin evidence base and the Foundation does not represent it otherwise. The review reports no pooled estimate. It does not identify the emission characteristics of any particular unit, and the Foundation has not read the eight included studies and therefore cannot say what exposures they used. Nothing in it concerns general illumination.

Why the Foundation relies on it, and it is for the mitigation finding rather than the hazard finding. Part II.C.4 of this comment records that 216 premarket notifications

have been cleared under 21 C.F.R. § 872.6070 for this product class, that the classification identifies the device as producing ultraviolet radiation, that no section of part 1040 prescribes a performance standard for it, and that it appears nowhere in the records and reports table at § 1002.1. This entry supplies what fills that space in practice. The control measure is a pair of orange glasses, a shield, an instruction not to look at the source, and a recommended time and distance. Paragraph 360ii(a)(5) directs the Secretary to develop, test and evaluate the effectiveness of procedures and techniques for minimizing exposure to electronic product radiation. Here is a class of electronic product the agency has cleared 216 times, whose ocular hazard a systematic review identifies, and whose entire mitigation consists of techniques that no federal instrument specifies and no federal program has evaluated. Part II.G.3 computes what optical density such a filter would require for a related device and observes that nobody has prescribed one. Parts II.C.4, II.G.3 and IX.C.

A second use, on dose. The reviewers state the relationship between intensity and duration explicitly and draw the practical inference that a lower intensity for longer may be substituted for a higher intensity for less time. That is the reciprocity assumption on which the dose metric at Part V.C.2.b rests, stated by clinicians about a product in daily use. The Foundation notes it because Part V.C.2.c argues that the governing framework abandons dose accumulation beyond ten thousand seconds; here is a clinical literature applying the dose concept without that ceiling.

Independence and funding. The Foundation has identified no author shared with any other entry in this appendix. The funding and competing-interest statements were not captured in the record obtained and must be supplied.

C.53 James and others (2017) — outdoor light at night and breast cancer in 109,672 women of the Nurses' Health Study II

Why this entry matters, stated first. It is the largest and most thoroughly adjusted study of this question in the appendix, and it is the one that confronts the objection the Foundation has raised against much of the rest. The covariate set includes census-tract population density, census-tract urbanicity, census-tract median income, census-tract median home value, fine particulate matter and census region — and, separately, night-shift work. The last of those matters more than the others. Shift work at night is itself classified as a probable human carcinogen and is the standing alternative explanation for the whole of this literature. A study that adjusts for it is testing ambient residential light rather than occupational circadian disruption, which is what this comment is about.

Citation. James P, Bertrand KA, Hart JE, Schernhammer ES, Tamimi RM, Laden F. Outdoor light at night and breast cancer incidence in the Nurses' Health Study II. Environmental Health Perspectives. 2017;125(8):087010. doi:10.1289/EHP935. PMID 28886600. PMCID PMC5783660. Open access under a CC0 dedication; this entry is drawn from the full text.

Affiliations. Departments of Epidemiology and of Environmental Health, Harvard T.H. Chan School of Public Health; Channing Division of Network Medicine, Brigham and Women's Hospital and Harvard Medical School; Slone Epidemiology Center at Boston University; and, for one author, the Medical University of Vienna and the Fielding School of Public Health at the University of California, Los Angeles.

Design. Prospective cohort. Time-varying Cox proportional hazards regression. Exposure was reassigned as participants moved, which distinguishes this study from the entries at Appendices C.22 and C.44 where exposure was fixed at a single address.

Population. One hundred nine thousand six hundred seventy-two women, followed from 1989 through 2013, over 2,187,425 person-years. Three thousand five hundred forty-nine incident invasive breast cancer cases. The cases were confirmed by medical record review rather than by registry linkage or self-report, which places the outcome ascertainment above that of every other cancer entry in this appendix.

Exposure, as measured. Cumulative average outdoor light at night, estimated from time-varying satellite data for a composite of persistent nighttime illumination at approximately one square kilometer scale, assigned to each residence during follow-up. The interquartile range was 31.6 nanowatts per square centimeter per steradian. The quintile bands of cumulative average exposure were 0.4 to 7.2, 6.3 to 15.9, 14.4 to 30.1, 26.0 to 53.3 and 41.4 to 248.1 nanowatts per square centimeter per steradian. The measure is broadband and spectrally blind, and Part V.K.4 states the consequence for this class of entry.

Results, and which contrast is which. This field requires care, because the study yields two correct figures for the same association and they are routinely conflated. Per interquartile-range increase in cumulative average exposure, the fully adjusted hazard ratio was 1.05, 95 percent confidence interval 1.00 to 1.11. Comparing the highest quintile of exposure with the lowest, the authors report, in their words, that "There was an estimated 14% increased risk of breast cancer in the top quintile of outdoor LAN compared with the lowest quintile of LAN (95% CI: 1.01, 1.29) in the fully adjusted model." Both are from the same model. The first is a per-unit estimate and the second a top-against-bottom comparison, and any statement of this study's result must say which it means. The Foundation uses the quintile comparison where it describes a contrast between the most and least exposed, and the per-unit estimate where it describes a gradient.

The two subgroup findings, reported in full. By menopausal status: premenopausal at the time of the case, hazard ratio 1.07, confidence interval 1.01 to 1.14, on 1,973 cases; postmenopausal, hazard ratio 1.00, confidence interval 0.91 to 1.09, on 1,172 cases; p for interaction 0.08. By smoking status at the end of follow-up: never smokers, hazard ratio 1.00, confidence interval 0.94 to 1.07, on 2,215 cases; past smokers, 1.10, confidence interval 1.01 to 1.19, on 1,034 cases; current smokers, 1.21, confidence interval 1.07 to 1.37, on 300 cases; p for interaction 0.08.

Adjustment. Benign breast disease history, family history of breast cancer, age at menarche, parity and age at first birth, height, white race, body mass index, body mass index at age 18, oral contraceptive use, mammography screening, menopausal status, smoking status, alternative healthy eating index, physical activity, marital status, living alone, personal income, night-shift work after 1989, census region, fine particulate matter in quintiles, census-tract median home value, census-tract median income and census-tract population density in quintiles. The analysis also examined effect modification by census-tract urbanicity.

What it establishes. That in a prospective cohort of 109,672 American women followed for twenty-four years, with 3,549 medical-record-confirmed incident invasive breast cancers and with time-varying exposure reassigned on moving, higher satellite-estimated outdoor light at night at the residence was associated with a 14 percent higher risk in the highest quintile of exposure against the lowest, after adjustment for a covariate set that includes population density, urbanicity, census-tract income and home value, fine particulate matter and night-shift work.

What it does not establish, and the Foundation states the first point before any other. The association was absent in never smokers. The hazard ratio in that group was 1.00, with a confidence interval from 0.94 to 1.07, on 2,215 cases — the largest of the three smoking strata and the most precisely estimated. The authors propose that smoking and air pollution may have synergistic effects with light at night by increasing susceptibility, and that is a hypothesis rather than a finding; the p for interaction was 0.08, which is not conventional significance. An exposure whose association is confined to smokers invites the reading that it is tracking something else that smoking also tracks. The Foundation does not resolve that and does not represent the overall result as unqualified.

What it does not establish, continued. Causation, which the authors do not claim; their conclusion is that further work is required to confirm the results and to clarify potential

mechanisms. The per-interquartile-range estimate has a lower confidence bound of exactly 1.00. The exposure is broadband satellite radiance and therefore says nothing about the spectral content of the light or about the technology producing it, so this entry supports no proposition about light-emitting diode products in particular. And the authors state a residual confounding limit in terms: "although we adjusted for air pollution and population density, we cannot rule out the possibility that other factors that are correlated with outdoor LAN [e.g., economic activity] might explain the observed association between LAN and breast cancer risk." They also identify exposure misclassification from missing satellite data and processing errors.

Funding, and why it matters here. The National Cancer Institute, under grants R00 CA201542, K99 CA201542 and UM1 CA176726; the National Institute for Occupational Safety and Health of the Centers for Disease Control and Prevention, under grant R01 OH009803; and the National Heart, Lung, and Blood Institute, under grant T32 HL098048. The paper was published in Environmental Health Perspectives, the journal of the National Institute of Environmental Health Sciences. Three components of the Department funded the work and a fourth published it. Part II.E.6 and Part II.H address the significance of that, and the Foundation does not repeat it here.

Position among the cancer entries, and the hypothesis it tests. This entry is the largest constituent of the systematic review and meta-analysis described at Part V.J.4, which pooled twenty studies and 731,493 individuals and reported a relative risk of 1.12 for breast cancer. It should be read against Appendix C.7, where a wavelength-resolved exposure measure in two pooled cohorts returned a null primary result, and the Foundation does not represent the two as agreeing. It tests a hypothesis first advanced thirty years earlier: Stevens RG, Electric power use and breast cancer: a hypothesis, American Journal of Epidemiology 1987;125(4):556–561. Part V.G records the origin of that hypothesis and the Foundation's position on the melatonin mechanism, which it does not adopt and does not need.

Independence and overlap. Peter James, the first author, is a co-author of the study at Appendix C.44. The Foundation notes the overlap because Part V.A.1 records the concentration of this literature in a small number of research groups.

C.54 Martin and others (2016) — LED retail lighting degrades fluid milk at ordinary store illuminance

Why this entry matters, stated first. It answers the objection that the photochemical literature relies on exposures no one actually receives. Part V.K.4 quotes the 2018 SCHEER Opinion discounting the cellular and animal studies because their conclusions derive from "exposure levels greater than those likely to be achieved with LED lighting systems in practice." That criticism is well founded against much of the in vitro work, as Part V.A.2 concedes. It is not available against this study. The investigators surveyed actual retail dairy cases to establish the relevant conditions and then used them, and measurable photochemical degradation followed in four hours. The subject is milk and not a human being, and the Foundation presses the entry no further than that.

Citation. Martin N, Carey N, Murphy S, and others, with Stubbs T, Wiedmann M, Dando R. Exposure of fluid milk to LED light negatively affects consumer perception and alters underlying sensory properties. Journal of Dairy Science. 2016;99(6):4309–4324. doi:10.3168/jds.2015-9603. Open Archive. Cornell University, Department of Food Science, and the Cornell Milk Quality Improvement Program; corresponding author at Cornell.

Design. Experimental, with trained descriptive sensory panels, a consumer panel and instrumental analysis. Milk from three New York State processing facilities, selected on historical microbiological records so that plants with consistently high quality and plants with recurring post-processing contamination were both represented. Samples were

collected twice, fourteen days apart, so that fresh and near-expiry milk could be assessed in the same sitting. Twenty-three samples in all, twelve of reduced-fat and eleven of skim. Light treatment was applied within twenty-four hours of collection; all other handling was in light-blocking containers, and storage was at 5.5 °C, which the authors describe as a slightly abusive temperature consistent with consumer refrigerators.

Exposure, as characterized — the field that matters. The authors state it in one sentence: "We exposed 14.14 L (4 gallons) of sample to ~1,200 lx of 3,500 K LED lighting for 4 h." The conditions were not chosen for experimental convenience. The paper records that "Prior to selection of light treatment parameters, a survey of light exposure in retail dairy cases was performed to establish the most relevant lighting conditions," and that light-emitting diode lighting was chosen on the strength of that survey. Twelve hundred lux at 3,500 kelvin is ordinary American retail illuminance, of the order addressed at Part VI.F, and four hours is a fraction of the time a carton sits in a case.

Result. In the authors' words: "light exposure resulted in a broad negative reaction from consumers, more so than samples with microbiological contamination exceeding 20,000 cfu/mL on days approaching code." Four hours of retail LED lighting produced a larger adverse consumer response than bacterial contamination above twenty thousand colony-forming units per milliliter in milk near its expiry date.

The mechanism, as the authors describe it. Photosensitizer-mediated oxidation. "Milk contains several photosensitive components, the most commonly cited being riboflavin, as well as porphyrin, chlorophyll, and others. When these photosensitizers are activated by natural or artificial light, the underlying photonic energy is transferred into the milk itself. This energy then initiates a chain reaction, whereby free-radical compounds and singlet oxygen are formed within the milk, inducing further chemical changes in neighboring molecules." The authors also record that effects of light exposure in milk may include degradation of its nutritional properties, and that protecting milk from light "would safeguard both its sensory profile and its nutritional content."

The wavelength statement, and why the Foundation draws attention to it. The authors identify the spectral reason the replacement technology may be worse than what it replaced: the emission "lies adjacent to the 450 nm absorption maximum of riboflavin found to be most destructive by Choe et al. (2005), and thus may be more effective in degrading riboflavin and releasing energy to the milk." Four hundred and fifty nanometers is the emission peak of the phosphor-converted white light-emitting diode, as Part V.J.4 records. The chromophores named here are also the chromophores named in the retinal literature: Appendix C.53 and the mitochondrial work it cites identify flavins, whose absorption lies between approximately 420 and 520 nanometers, and porphyrins as targets of blue light. The Foundation does not contend that milk and a retina are comparable systems. It observes that the molecules absorbing the energy are of the same classes.

The characterization gap, stated by the authors. "These LED lights, although rapidly adopted due to lower running costs, are yet to be thoroughly characterized with respect to their effect on the degradation of photosensitizers such as riboflavin in milk, a wavelength-dependent phenomenon." And of the study itself: "This study is the first to demonstrate the effects of LED lighting on consumer perception of fluid milk." A technology adopted across American retail for its running costs, not characterized for what it does to the product it illuminates, with the phenomenon known to depend on wavelength. Part IV.G describes the same sequence in federal lighting policy.

A technique available and not used. The authors record that "Producing milk in packaging protected from sunlight has been discussed for almost 100 yr" and that "While this has been noted for many years, with many interventions to control light existing (e.g., light-blocking packaging), few are employed in the industry as standard." Part II.G.3 concerns

techniques for minimizing exposure that exist and have not been evaluated or required. This is an instance of the pattern outside the Foundation's own subject matter.

What it establishes. That light-emitting diode lighting at an illuminance and duration measured in American retail practice initiates photosensitizer-mediated oxidation in a common food, producing changes detectable by trained panels and adverse to consumers, and that the degradation is understood by those who study it to be wavelength-dependent and to bear on the nutritional content of the product. The proposition the Foundation takes from it is that the emission of these products is chemically active at the levels at which people encounter it.

What it does not establish, and the Foundation states this plainly. Nothing about human health. There is no health endpoint; the outcomes are consumer sensory scores and milk chemistry. The Foundation does not contend that 21 U.S.C. § 360ii protects milk, and does not offer this entry as evidence of injury to any person. Nor is the optical situation comparable to the eye: light enters a thin translucent layer into a liquid, whereas the retina sits behind the cornea, the lens and the vitreous, and the pigment epithelium behind the neural retina. Four hours of 1,200 lux on a carton says nothing about retinal dose, and Part V.B.2 explains why ocular exposure cannot be read off an ambient illuminance in any event. The entry is offered for the chemistry occurring at ordinary illuminance and for nothing else.

Funding, and the direction of the interest. The acknowledgments state that the publication "was made possible by the research funding provided by Dairy Management Inc. and the Midwest Dairy Association, and administered by National Dairy Council," with consumer testing administered by a commercial research firm. The Foundation notes the direction in which that interest runs, because it is not an admission against interest of the kind recorded at Appendix C.45. These are dairy marketing bodies whose commercial interest lies in the sale of milk, and a finding that retail lighting damages milk supports a recommendation that retailers spend money protecting it. The funders' interest is served by the result. What the Foundation does observe is that no part of the lighting industry funded or conducted the work.

Position among the entries. Read with Appendix C.45, which reports that blue light-emitting diode emission at 456 nanometers accelerates the bleaching of a tooth. Neither entry reports a health outcome and neither is offered as one. Together they are two peer-reviewed demonstrations, in unrelated fields and with unrelated funders, that the optical radiation these products emit drives measurable chemical change in ordinary materials at commercial exposures. Appendix C.3 is the third entry in this appendix that reports no health outcome of its own, and the Foundation relies on all three for propositions about emission and exposure rather than about effect.

Bearing on the statutory question. One proposition only. Paragraph 360ii(a)(4) directs the Secretary to study and evaluate emissions of, and conditions of exposure to, electronic product radiation. This is a study of an emission under a condition of exposure that exists in American commerce, conducted because no one had done it, by investigators in a field with no interest in the regulation of lighting. The Foundation offers it as evidence that the characterization the provision directs is both feasible and absent, and not as evidence of harm to any person.

C.55 Tosini, Ferguson and Tsubota (2016) — a spectral design criterion, and a safety conclusion its authors limit to weeks

Why this entry matters, stated first. Two reasons, and the second is the more important. The authors state a numerical spectral design criterion for light-emitting diode sources, which is the form a performance standard under 21 U.S.C. § 360kk would have to take and which almost nothing else in this appendix supplies. And they then limit their own reassurance to exposures of days to weeks and say in terms that it cannot be extended to

months or years. That is the acute-to-chronic division described at Part V.C.2.c and Part V.K.3, stated by investigators funded by this Department's own eye institute, in their conclusion, in 2016.

Citation. Tosini G, Ferguson I, Tsubota K. Effects of blue light on the circadian system and eye physiology. Molecular Vision. 2016;22:61–72. PMID 26900325. PMCID PMC4734149. Open access under CC BY-NC-ND; this entry is drawn from the full text. Received August 26, 2015; accepted January 21, 2016.

Article type. Review. The Foundation identifies it as such and does not present it as primary research. Part V.A.2 records the weight accorded to reviews.

Authorship, and why the composition is relevant. Gianluca Tosini, Department of Pharmacology and Toxicology and Neuroscience Institute, Morehouse School of Medicine, Atlanta. Ian Ferguson, College of Engineering and Computing, Missouri University of Science and Technology. Kazuo Tsubota, Department of Ophthalmology, Keio University School of Medicine, Tokyo. The second author is an engineer rather than a biologist, and the reference list shows the collaboration is not incidental: the first author and the second had previously published jointly on imitating broadband diurnal light variation using solid-state sources. The recommendation described below is therefore made by a group that includes someone who designs these devices, which bears on the technical achievability question at Part II.G.

The conclusion, quoted in full because the sequence matters. The Foundation reproduces the authors' concluding paragraph rather than summarizing it:

> "The use of blue light is becoming increasingly prominent in our society, and a large segment of the world population is now subjected to daily exposure (from a few minutes to several hours) of artificial light at an unusual time of the day (night). Because light has a cumulative effect and many different characteristics (e.g., wavelength, intensity, duration of the exposure, time of day), it is important to consider the spectral output of the light source to minimize the danger that may be associated with blue light exposure. Thus, LEDs with an emission peak of around 470–480 nm should be preferred to LEDs that have an emission peak below 450 nm. Although we are convinced that exposure to blue light from LEDs in the range 470–480 nm for a short to medium period (days to a few weeks) should not significantly increase the risk of development of ocular pathologies, this conclusion cannot be generalized to a long-term exposure (months to years). Finally, we believe that additional studies on the safety of long-term exposure to low levels of blue light are needed to determine the effects of blue light on the eye."

What that paragraph contains, item by item. Five propositions in six sentences. That the exposure is now population-wide and occurs at a time of day when the natural stimulus is absent. That light has a cumulative effect. That the characteristics governing it are wavelength, intensity, duration of exposure and time of day, which is the list paragraph 360ii(a)(4) directs the Secretary to study. That a specific spectral preference follows: an emission peak at 470 to 480 nanometers in preference to one below 450. And that the authors' own reassurance extends to days and a few weeks and no further, with long-term exposure at low levels identified as the question requiring study.

The design criterion, and what the Foundation does with it. The emission peak of the phosphor-converted white light-emitting diode in general service lies between approximately 450 and 470 nanometers, as Part V.J.4 records. The criterion these authors propose would move it upward, out of the band they identify as more damaging. The Foundation offers the criterion as an instance of the form a standard would take and not as a limit it asks the Department to adopt: it is the recommendation of three investigators in a review, it is expressed as a preference rather than a threshold, and the Foundation is not competent to evaluate it. Its significance is that it exists. Part V.B.3 describes two further

instruments for expressing spectral content that were published in 2018 and have not been adopted. This is a third, from 2016, and it is the most directly prescriptive of the three.

A second band the authors identify. Separately from the peak criterion, and on the basis of an animal study of yellow-tinted intraocular lens materials, the authors state that "reducing the amount of blue light reaching the retina in the range 400–450 nm may also be important for the protection of the retina." They also record the history of the action spectrum: early studies found it similar to the absorption spectrum of rhodopsin, but "later studies indicated that blue light (400–440 nm) might be more damaging."

Sub-threshold exposure, and the state of mechanism. Two sentences bear directly on the structure of the exposure limits described at Part V.C.2. First: "Although most studies on the effects of blue light have focused on the mechanisms responsible for the damage to the photoreceptors following an acute exposure to high intensity light, some studies have reported that sub-threshold exposure to blue light can also induce damage in photoreceptors." Second: "The mechanism through which long-term exposure to blue light may induce photoreceptor damage is mostly unknown." The limits are constructed from acute injury, as Part V.K.3 establishes from the 2018 SCHEER Opinion. These authors report that damage below that threshold has been reported and that the chronic mechanism is mostly unknown.

The chromophore, and a consequence for cell-culture evidence. The authors identify the mediating chromophore: "Experimental data suggest that lipofuscin is the chromophore involved in the mediation of light-induced retinal damage following the exposure to blue light," and "when lipofuscin absorbs blue light, the material becomes phototoxic, which can lead to further damage in the RPE and in the photoreceptors." They add that accumulation of lipofuscin can impair the ability of the pigment epithelium to supply nutrients to the photoreceptors. The Foundation draws one consequence. Experiments conducted in pigment-free retinal pigment epithelial cell lines, which lack lipofuscin, cannot capture this pathway at all. Whatever such experiments show about other mechanisms, they are conducted without the chromophore these authors identify as principal, and the Foundation does not treat an effect obtained in such a line as an upper bound on what occurs in a pigmented human eye.

The lens, age, and a question the authors leave open. The authors describe the ocular filter directly: "With age, the lens becomes more yellowish, and thus, the spectrum of blue light transmission dramatically decreases through the years." They then set out a live clinical dispute. One study reported that after cataract extraction sleep quality improved markedly because more blue light reached the retina through the intraocular lens, and the choice between a clear and a yellow implant is contested on exactly this ground: "the yellow lens may protect the retina, but the clear lens provides more blue light during the day, providing better quality of sleep." Their own verdict is that "whether the yellowing of the lens associated with aging really affects the non-image-forming photoreception is still a matter of debate." That bears on Part II.F.4, where the aphakic hazard weighting used by the scientists of the Center for Devices and Radiological Health in 2010 is described, and on the age-dependent transmission material at Part V.C.2.g. The Foundation notes the dispute rather than resolving it, and notes that it is a dispute about the same filter in both directions: the lens that protects the retina is the lens that withholds the daytime signal.

A research recommendation that bears on this appendix. The authors state that "it is difficult to determine whether light-induced retinal damage has a daily rhythm in humans, and further studies on diurnal animal models (e.g., non-human primates) are required to address this important point." Part V.A.2 records that no entry in this appendix uses a diurnal animal model. Here are investigators in the field identifying that absence as a priority, nine years before this comment was filed.

What it establishes. That the question of long-term, low-level blue light exposure to the human eye was identified as open and in need of study by funded investigators in an ophthalmology journal in 2016; that a spectral design criterion for light-emitting diode sources was proposed in that year and expressed in nanometers; and that the authors of that recommendation limited their safety conclusion to exposures of days to weeks.

What it does not establish. That light-emitting diode products in service cause ocular pathology. It is a review and contains no original data. Its authors state the contrary of a harm finding for short and medium exposures in the band they prefer, and the Foundation reports that rather than omitting it. The sub-threshold damage proposition rests on three references the Foundation has not read. The journal is a modest one by citation measures, which the Foundation notes because it does not wish to overstate the weight of any entry. And the entry establishes nothing about the 450 to 470 nanometer band in particular beyond the authors' stated preference against peaks below 450.

Funding. National Institutes of Health grant R01EY022216, of the National Eye Institute, together with a National Aeronautics and Space Administration cooperative agreement, NCC 9–58, with the National Space Biomedical Research Institute. Two federal funders, one of them an institute of this Department. Part II.E.6 addresses the significance.

Bearing on the statutory question. Paragraph 360ii(a)(4) directs the Secretary to study and evaluate emissions of, and conditions of exposure to, electronic product radiation. This entry is offered for the proposition that the study the provision directs was identified as necessary, in print, by recipients of this Department's own research funding, in the year the Foundation's earliest petition predates. It does not establish harm and is not offered for harm.

C.56 Sikka and others (2014) — melanopsin in blood vessels, and a light response outside the eye

The governing limitation, stated first. The ex vivo exposures in this study were enormous. The authors report that "Exposing the suspended vessels to cold white light at increasing intensities (40,000–2,000,000 lux units) produced a phasic, intensity-dependent vasorelaxation with a maximal response of ≈35%." Full direct sunlight is of the order of 100,000 lux and ordinary interior lighting is of the order of 300 to 500 lux. The upper end of that range is therefore some twenty times sunlight, delivered to a dissected vessel. This is precisely the objection the Foundation records at Part V.K.4, where the 2018 SCHEER Opinion discounts cellular and animal work for using exposures greater than those achieved in practice, and the Foundation makes the same objection of this study. It is not offered as evidence that ambient light relaxes human blood vessels.

Why the entry is nonetheless here. Because of what the study locates rather than what it measures. The comment's account of non-visual photoreception, at Part V.E.4 and Part V.F, runs entirely through melanopsin in the retina. This study reports melanopsin expressed and functioning in the wall of a blood vessel. If that is right, the set of human tissues that respond to optical radiation is larger than the eye, and no federal body has mapped it. Paragraph 360ii(a)(4) directs the Secretary to study and evaluate emissions of, and conditions of exposure to, electronic product radiation. A receptor for the radiation in an unexpected tissue is a condition of exposure no one has characterized.

Citation. Sikka G, Hussmann GP, Pandey D, Cao S, Hori D, Park JT, Steppan J, Kim JH, Barodka V, Myers AC, Santhanam L, Nyhan D, Halushka MK, Koehler RC, Snyder SH, Shimoda LA, Berkowitz DE. Melanopsin mediates light-dependent relaxation in blood vessels. Proceedings of the National Academy of Sciences of the United States of America. 2014;111(50):17977–17982. doi:10.1073/pnas.1420258111. PMID 25404319. PMCID PMC4273372. Not open access; this entry is drawn from the version deposited in PubMed Central.

Affiliations. All seventeen authors at Johns Hopkins University, across the Departments of Anesthesiology and Critical Care Medicine, Neuroscience, Surgery, Allergy and Immunology, Biomedical Engineering and Pathology, and the Division of Pulmonary Medicine.

Design. Experimental, in mice, by four independent methods. Expression was established by polymerase chain reaction. Function was established by force-tension myography on isolated vessel rings. Receptor identity was established two ways: vessels from melanopsin-knockout animals failed to relax under light, and the response was abolished in wild-type vessels by a melanopsin-specific small-molecule inhibitor. And the signaling pathway was dissected pharmacologically, the authors reporting dependence on soluble guanylyl cyclase and phosphodiesterase 6, independence of protein kinase G, and desensitization mediated by G protein-coupled receptor kinase 2.

The action spectrum, which is the most rigorous element. The authors did not test a single blue source against a single control. They recorded responses to "precise 30-nm wavelength increments from 370 nm to 700 nm, followed by repeat 460-nm exposure to confirm this optimal wavelength and ensure lack of desensitization." The result: "The vessels did not respond to red or green light but displayed maximal vasorelaxation at low-intensity blue light," and "Responses were observed only in the blue light spectrum (400–500 nm), with a maximal response at between ≈430 and 460 nm" — which the authors note corresponds to the known absorption optimum of the mouse melanopsin receptor. The band is the band in which phosphor-converted white light-emitting diodes emit their primary radiation, as Part V.J.4 records.

The in vivo component, and the reason the authors chose the vessel they did. Having worked ex vivo, the authors turned to a vessel where light actually arrives: they state that they studied the tail artery "To determine in vivo physiological consequences and evaluate vascular beds in which exposure to light is likely." Blood flow was measured by laser Doppler flowmetry with the probe on the ventral surface of the tail. "There was a significant increase in tail blood flow in Opn4+/+ mice with exposure to blue light, which was reversed in dark." The knockout animals did not show it.

A consequence for Part V.B.2 that the Foundation states against its own convenience. Part V.B.2 establishes that retinal exposure from a source the eye resolves does not diminish with distance, because the refracting optics of the eye concentrate a falling power onto a shrinking image. That analysis is about the eye and it does not extend to this pathway. Skin has no lens. A blood vessel beneath the skin is a bare detector of the kind described in the comparison at Part V.B.2.b, and the irradiance reaching it falls as the inverse square of the distance to the source, exactly as intuition holds. The Foundation draws attention to this because the two propositions could otherwise be read as inconsistent, and because the distinction is the Foundation's own: for an extraocular photoreceptor the relevant quantity is a surface irradiance and distance matters, whereas for the retina it is a radiance and distance does not.

A second consequence, for the cardiovascular entries. Appendices C.2 and C.43 and the material at Part V.G report associations between light at night and cardiovascular outcomes, and the mechanism generally proposed for them is circadian disruption or melatonin suppression. This study describes a route that is neither. It is a direct action of light on vascular tone through a receptor in the vessel wall, operating on a timescale of the exposure itself and reversing in darkness. The Foundation does not contend that this mechanism explains those associations, and notes that the direction is not obviously adverse. It notes only that the mechanisms by which light might bear on the cardiovascular system are not confined to the ones the epidemiology assumes.

Relation to the argument already made at Part V.C.2.h. That subsection states that the photobiological safety framework is ocular while the evidence is not, and supports the

proposition with the review at Appendix C.28, which tabulates expression of the non-visual opsin OPN3 in tissues including blood vessels and describes smooth muscle as under opsin-mediated photic control. This entry is the primary experimental evidence for that proposition in a vessel, and it concerns OPN4 rather than OPN3. The subsection presently rests the point on a review; this study supplies the underlying experiment, with the knockout and inhibitor controls a review cannot supply.

What it establishes. That melanopsin is expressed in murine blood vessels; that light in the band from 400 to 500 nanometers, with a maximum between approximately 430 and 460, produces vasorelaxation in isolated vessels; that the effect is abolished by genetic deletion of the receptor and by a receptor-specific inhibitor; and that blue light increases tail blood flow in intact animals and the increase reverses in darkness.

What it does not establish, and the Foundation is explicit. It does not establish harm, and the Foundation does not advance it for harm. Vasorelaxation reduces vascular resistance and is in most clinical contexts beneficial, and the authors' own framing is therapeutic: they write that the pathway "can be harnessed for wavelength-specific light-based therapy in the treatment of diseases that involve altered vasoreactivity." It does not establish that the receptor is present in human vessels, the work being in mice. It does not establish that light penetrates human skin sufficiently to reach any vessel of consequence: the mouse tail is a thin-skinned thermoregulatory structure, and the depth to which 430 to 460 nanometer radiation penetrates human skin is a question this entry does not answer. And the ex vivo intensities are as stated in the first field, which is the reason that field is first.

Funding. National Institutes of Health grants from four institutes: the National Heart, Lung, and Blood Institute, R01 HL105296 and R01 HL089668; the National Institute on Drug Abuse, P50 DA000266; and the National Institute of Mental Health, MH8501. Part II.E.6 addresses the significance of research funded by components of this Department on questions the Department has declined to examine for regulatory purposes.

Bearing on the statutory question. One proposition, and it is a characterization proposition rather than an effects proposition. The tissues of the human body that contain receptors responsive to optical radiation have not been enumerated by any federal body, and this study indicates that the enumeration would extend beyond the eye. The Foundation asks at Part IX.C for characterization of emissions and conditions of exposure. This entry is offered to show that the conditions of exposure are less well understood than the exposure limits at Part V.C.2 presuppose, those limits being addressed to the eye and the skin as a thermal and photochemical target rather than as a site of receptor-mediated signaling.

C.57 Falchi and others (2011) — a quantitative spectral limit, proposed in the form the agency already uses

What this entry is, and is not. This is an analysis and review paper in an environmental management journal, not an experiment and not a health study. It reports no original measurement of any biological endpoint. It is in this appendix because the appendix is an appraisal of peer-reviewed scientific literature and the criterion of inclusion is publication type rather than subject matter, as the introduction to this appendix states. Its value to this comment is in its method and its proposals rather than in any finding about health.

Citation. Falchi F, Cinzano P, Elvidge CD, Keith DM, Haim A. Limiting the impact of light pollution on human health, environment and stellar visibility. Journal of Environmental Management 2011;92(10):2714–2722. doi:10.1016/j.jenvman.2011.06.029. Received December 20, 2010; revised May 14, 2011; accepted June 3, 2011.

Affiliations, and why one of them matters. Falchi and Cinzano at the Istituto di Scienza e Tecnologia dell'Inquinamento Luminoso, Thiene, Italy; Elvidge at the National Geophysical Data Center of the National Oceanic and Atmospheric Administration,

Boulder, Colorado; Keith at Marshall Design Inc., Boulder, Colorado; Haim at the Israeli Center for Interdisciplinary Studies in Chronobiology, University of Haifa. The third author is a federal scientist, and Part II.H.3 uses that fact. Haim is a chronobiologist, which bears on the weight the melatonin passages can carry.

Method. The authors computed, for each of a set of common outdoor lamp spectra, the proportion of emission falling within three response bands: the photopic luminous efficiency function, the scotopic function, and the band in which light suppresses melatonin. They then expressed the results as two dimensionless ratios and proposed numerical limits on each. The comparison is of lamp spectra against response functions, which is arithmetic performed on published spectral data.

The two proposed criteria. First, a protected band of 440 to 540 nanometers, with a limit that emission in that band not exceed 15 percent of photopic energy flux measured in watts, written R subscript P less than 0.15. Second, a limit that scotopic emission not exceed two-thirds of photopic emission measured in lumens, written R subscript sp less than 0.66, which the authors confine to settings where accurate color perception is essential. The authors state that the protected band was chosen to be centered on the scotopic peak and approximately 100 nanometers wide, that it covers 79 percent of the area under the scotopic curve, and that it leaves the 546 nanometer mercury line unaffected.

The computed values, which are the usable content. On the scotopic-to-photopic ratio: low-pressure sodium 0.20; high-pressure sodium at 70 watts 0.55; average high-pressure sodium 0.66; mercury vapor at 80 watts 1.18; CIE Illuminant A 1.41; quartz tungsten halogen at 3100 K 1.56; average metal halide 1.60; a flat spectrum 1.86; a white light-emitting diode described as natural white 3.5. On the protected-band fraction: low-pressure sodium 0.0027; high-pressure sodium at 70 watts 0.13; mercury vapor 0.27; metal halide 0.46; CIE Illuminant A 0.51; quartz tungsten halogen 0.58; the white diode 0.87; a flat spectrum 0.93.

A second table, on a different band, which must not be conflated with the first. The authors give a further comparison expressed relative to high-pressure sodium over 440 to 500 nanometers rather than 440 to 540. On that measure low-pressure sodium is 0.02 for energy and 0.3 for melatonin effect; metal halide 2.7 and 3.4; the natural white diode 7.0 and 5.4; a 65 watt incandescent lamp 2.5 and 2.5. The two tables use different wavelength intervals and the Foundation flags this because a reader comparing figures across them would be comparing different quantities.

The melatonin statements, reported at the weight they can bear. The authors state that "exposure to light at night (LAN) decreases pineal melatonin (MLT) production and secretion" and that "The peak sensitivity is from 440 nm to 500 nm." They report a tenfold decrease in sensitivity at 410 and at 540 nanometers relative to the peak near 460 to 470. These are statements of the literature as the authors read it in 2010, not original measurements, and this comment should cite the underlying action-spectrum work for the proposition rather than this paper.

The age-resolved ocular transmittance figures, which answer an open question elsewhere in this comment. The authors report that transmittance at 450 nanometers in people aged 60 to 69 is approximately half that in people aged 20 to 29, and that at 425 nanometers it is approximately one third. Part V.C.2.g presently rests the age-dependence proposition on a single figure taken from a narrative review and carries an open instruction to obtain age-resolved data. These ratios are responsive to that instruction, though they are themselves secondary and the primary source must be traced.

A finding adverse to the efficiency rationale. The authors report that at equal photopic output a white light-emitting diode yields 6 to 11 percent less road luminance than high-pressure sodium, because of the spectral reflectance of road surfaces. If that holds, a

photopic lumen from a white diode delivers less of the thing roadway lighting exists to produce than a photopic lumen from the lamp it replaced. The Foundation has not verified the computation and states it as the authors' finding.

The statement most useful to the remedy this comment seeks. The authors write that "LEDs have anyway a great potential, they could be tuned and produced with very different spectra" and recommend that industry research be directed toward warm diodes with no blue emission. That is evidence on technical achievability, which § 360kk(a)(2) requires the Secretary to consider. The spectral composition of a diode source is a design choice, and researchers said so in 2011.

What it establishes. That the proportion of a lamp's emission falling in a defined short-wavelength band is computable from published spectral data; that the technologies in use differ on that measure by up to three orders of magnitude; and that specific numerical limits of that form were proposed in the peer-reviewed literature in 2011.

What it does not establish. It does not establish that exposure to any of these sources causes any health outcome. It reports no original biological data of any kind. Its projections that a migration from sodium to white sources could multiply scotopic sky brightness several-fold, or tenfold within about a decade, are model projections and not measurements, and must be labeled as such wherever used. Its principal recommendation, a total ban on outdoor emission below 540 nanometers, is not adopted by this comment, for the reasons given at Part V.B.3.

Funding and conflicts. Neither a funding statement nor a conflict of interest declaration appears in the manuscript the Foundation consulted. The acknowledgments thank Barry A. J. Clark, Jan Hollan, Steven W. Lockley and Paul Marchant.

Bearing on the statutory question. Two uses. First, at Part V.B.3, for the proposition that a numerical limit on spectral composition is draftable, computable from measurements already performed, and formally identical to the band-ratio requirement this agency already imposes at 21 C.F.R. § 1040.20. Second, at Part II.H.3, on paragraph 360ii(a)(3), for the proposition that a federal scientist published a quantitative proposal of this kind in 2011. The entry is not offered for any proposition about health.

C.58 Kloog, Stevens, Haim and Portnov (2010) — an ecological study of 164 countries, and the limits of that design

The governing limitation, stated first. This is an ecological study. It compares country-level cancer incidence with country-level light at night, and it contains no exposure measurement and no health observation for any individual person. Ecological designs are the weakest observational evidence in this appendix, for the reason the 2010 news item itself gives: characteristics of whole populations need not hold of the individuals within them. Appendix C.16 grades another ecological study the same way, and Part V.A sets out how this comment weights evidence. Nothing in this comment depends on this study being correct.

Citation. Kloog I, Stevens RG, Haim A, Portnov BA. Nighttime light level co-distributes with breast cancer incidence worldwide. Cancer Causes and Control 2010;21(12):2059–2068. doi:10.1007/s10552-010-9624-4. PMID 20680434. The article is not open access and the Foundation has read the abstract only.

Why the entry is here at all. For two reasons, neither of which is the finding. The first is chronology: the authors are the research network from which this literature comes, and Richard Stevens is the author of the 1987 hypothesis described at Part V.G. The second is that a journal of an institute of this Department reported this study to its readers in December 2010, fourteen years before the determination of May 24, 2024. Part II.E.6. The entry exists so that the study the Department's journal reported is appraised here rather than taken on the report.

Design and data. Incidence rates of five cancers in women – breast, lung, colorectal, larynx and liver – observed in 164 countries, taken from the GLOBOCAN database, compared with population-weighted country-level light at night and with several developmental and environmental indicators: fertility rate, per capita income, percentage of urban population, and electricity consumption. Two regression specifications were used, ordinary least squares and spatial errors.

Results as the authors state them. A significant positive association between population light-at-night level and breast cancer incidence, and no such association for colorectal, larynx, liver or lung cancer. A sensitivity test holding other variables at their average values yielded a 30 to 50 percent higher risk of breast cancer in the highest-exposed countries compared with the lowest. The authors state that they evaluated in several ways the possibility that under-reporting by registries in low-resource and also low-light countries created a spurious association, and that it was shown not to account for the results.

The negative controls, which are the study's real strength. The design turns on the contrast between hormone-dependent and non-hormone-dependent cancers. Four cancers not understood to depend on hormones showed no association; the one that does showed one. That pattern is harder to produce by generic confounding with national development than a single positive association would be, because most development-related confounders would be expected to act on lung and colorectal cancer as well. The Foundation identifies this as the element of the design that carries weight.

The confounder the abstract does not address, and it is the central one. Breast cancer incidence as recorded by a registry depends heavily on how much screening a country performs, and mammographic screening intensity rises with national income in close company with electric lighting. A country with more light at night is a country more likely to detect and record breast cancer that exists. The abstract names fertility rate, income, urban percentage and electricity consumption as covariates and does not name screening intensity or mammography coverage. Nor does it name the established reproductive and lifestyle determinants of breast cancer risk that also track development: age at first birth, parity, breastfeeding duration, body mass index, alcohol consumption and hormone therapy use. Until the full text is read, the Foundation cannot say whether these were addressed, and this comment should not rely on the study until it can.

The exposure measurand, and the critique this comment makes of it. The exposure variable is satellite-observed light at night. Part V.J.4 establishes that a satellite radiometer of this kind is substantially blind to the short-wavelength content that the mechanistic literature identifies as the active part of the spectrum, and that a transition to white light-emitting diode sources can register as a decrease in observed radiance while increasing the biologically relevant exposure. That critique applies to this study as it applies to the eleven other entries in this appendix that take satellite radiance as their exposure variable. The abstract does not identify which sensor and which years supplied the light-at-night data, and that must be established.

The caution recorded in this Department's own journal. The 2010 news item quotes Eva Schernhammer, whose cohort study is at Appendix C.53 and whose 2001 paper is one of the foundational studies in this literature, observing that as an ecological study this result, even had it been negative, would not have been strong enough to rule out the evidence from prior case-control studies. The item also records the authors' own acknowledgment that the study did not control for behavior reducing individual exposure, such as sleeping. The Foundation adopts both cautions.

What it establishes. That country-level satellite-observed light at night co-distributes with breast cancer incidence and not with four cancers not understood to be hormone-dependent, in a cross-sectional comparison of 164 countries. In the authors' own framing, the finding provides coherence between previously reported case-control and cohort

studies and the distribution of light and breast cancer in whole populations. Coherence is the word they use and it is the right one.

What it does not establish. Causation, in any degree. It does not establish that light at night causes breast cancer, that any individual's risk is altered by exposure to any product, or anything whatever about light-emitting diode products, which in 2010 were not the dominant source of the light the satellites recorded.

Funding and conflicts. Not available to the Foundation, which has read only the abstract. Must be obtained.

Bearing on the statutory question. Modest, and the Foundation states it modestly. The entry supports the chronology at Part II.E.6 and Part V.G, and it is offered for the proposition that this question was under active investigation by an identifiable research network, and was reported to the readers of a journal of an institute of this Department, in 2010. It is not offered for any proposition about the health effects of any product, and Part V.A should be consulted before it is cited for anything.

C.59 Attia, Enouf, Behar-Cohen and Martinsons (2026) — market surveillance against the eye safety limits, and what the measurement distance decides

Why this entry is unlike the others in this appendix. Every other entry here reports a study of an effect. This one reports a measurement of products. A national market surveillance authority bought articles off the shelf and had accredited laboratories test them against the eye safety limits of the standard that governs them. It is therefore evidence of a kind this comment has repeatedly said is absent: not an inference about what products in commerce emit, but a determination of whether they comply with the limits that apply to them.

Citation. Attia D, Enouf O, Behar-Cohen F, Martinsons C. Eye Safety of Light-Emitting Diodes in Toys: The Results of Three Years of Market Surveillance. International Journal of Environmental Research and Public Health 2026;23(7):880. doi:10.3390/ijerph23070880. Received May 6, 2026; revised June 27, 2026; accepted July 3, 2026; published July 6, 2026. The journal classifies the article as a Project Report.

Affiliations, and the authorship overlap this comment should notice. Attia at the physical agents risk assessment unit of the French Agency for Food, Environmental and Occupational Health and Safety; Enouf at the photonics and energetics division of the Laboratoire national de métrologie et d'essais; Behar-Cohen at the Centre de Recherche des Cordeliers, Sorbonne Université and INSERM, and at the ophthalmology service of Cochin Hospital; Martinsons, corresponding author, at the health, environment and mobility directorate of the Centre Scientifique et Technique du Bâtiment. Two of the four are already cited in this comment by name. Martinsons is the lead author of the 2024 intergovernmental review at Appendix D.1 and Part V.C.2.f. Behar-Cohen was an external expert of the 2012 Opinion at Appendix D.1 and Part V.K.9. Part V.A.1 draws the general point about the size of the field; this entry is a documented instance of it, requiring no inference.

Design. Cross-sectional sampling and laboratory testing, with a paired method comparison on a subsample. Between 2021 and 2023, inspectors of the French consumer protection and market surveillance directorate anonymously purchased fifty toys, containing one hundred and three light-emitting diodes, from toy retailers. The toys were intended for children under fourteen. Accredited laboratories tested each diode against the eye safety requirements of IEC 62115, the standard for the safety of electric toys, in both its 2003 and 2017 editions. The emitters included blue, green, amber, red, phosphor-converted white and red-green-blue white diodes, and one infrared diode.

The sample limitation, stated by the authors. The toys were selected by inspectors during store visits rather than by a statistical sampling design, and the authors state that the

sample is therefore not statistically representative. The sample is small and confined to the French market, although the authors note the toys were not manufactured in France and carried multilingual packaging. Variability between manufacturers and between testing laboratories was not evaluated. The method comparison was confined to ten toys for reasons of time and budget.

Non-compliance found. Fifteen of the fifty toys, thirty percent, contained at least one non-compliant diode. Fifteen of the one hundred and three diodes tested were non-compliant, about 14.6 percent. Blue diodes were the worst class: eleven of thirty-four failed, about thirty-two percent. The remaining failures were two phosphor-converted white, one red, and one of unidentified color. Approximately eighty-seven percent of the non-compliant diodes failed the blue light hazard limit rather than the retinal thermal limit.

The method comparison, which is the most consequential result in this entry. The two editions of the standard differ in the distance at which the measurement is made: the 2003 method at distances from 14 to 100 millimeters, the 2017 method at 200 millimeters. Across the full sample the 2003 method found fourteen of sixty diodes non-compliant, twenty-three percent, and the 2017 method found two of fifty-four, four percent. In the paired subsample of ten toys and nineteen diodes, tested both ways, eight failed under the 2003 method and one failed under the 2017 method. The authors attribute the difference principally to the longer assessment distance. Part V.C.2.k sets out what the Foundation draws from this and what it does not.

Measurement parameters worth recording. The testing used a 7 millimeter circular aperture, which is the dark-adapted pupil diameter on which the optical relations at Part V.B.2 are built, and a 100 second exposure time for the blue light photochemical dose calculation, which is the duration corresponding to the Risk Group 1 boundary described at Part V.C.2.k. The paper does not report peak wavelengths or irradiance values for the individual diodes, which is the principal gap in it for this comment's purposes.

A discrepancy within the paper, recorded because this appendix records them. The abstract reports ten diodes non-compliant for blue light hazard and five for the thermal hazard. Tables 1 and 2 report eleven blue diodes and thirteen blue-light non-compliant diodes. The counts in the abstract and the counts in the tables do not agree and the paper does not explain the difference. The figures given in this entry follow the tables where the two conflict, and that choice must be checked against the full text.

Funding. Funded by the French Agency for Food, Environmental and Occupational Health and Safety, with additional support from the consumer protection and market surveillance directorate as part of its market surveillance campaigns. Funding number 2022-SA-0193.

Conflicts of interest, recorded in full because one of them is material. Martinsons is employed by the Centre Scientifique et Technique du Bâtiment, a public institute. Enouf has been invited as an expert by the European technical committee for electric toy safety, CLC TC61 WG7, and is contributing to a revised test method for light-emitting diode eye safety in toys. The remaining authors declare no relevant conflicts. The Foundation notes the second disclosure specifically: a co-author of a paper demonstrating that the present test method understates non-compliance is participating in the revision of that method. That cuts both ways and the Foundation does not treat it as disqualifying. It gives him direct knowledge of the method, and it gives him an interest in its revision, and a reader should know both.

What it establishes. Two things. First, that when a national authority tested fifty marketed toys against the eye safety limits applicable to them, thirty percent contained at least one diode exceeding those limits, and the great majority of the failures were failures of the blue light hazard limit, concentrated in blue emitters. Second, and independently of the first, that measured non-compliance under this standard is highly sensitive to the assessment

distance the standard specifies: the same products yielded twenty-three percent non-compliance at 14 to 100 millimeters and four percent at 200 millimeters.

What it does not establish. It does not establish that any child was injured, and it reports no health outcome of any kind. It does not establish a non-compliance rate for the French market, because the authors say the sample was not representative, and it establishes nothing whatever about the United States market, where neither IEC 62115 nor any comparable federal optical emission requirement for toys has been identified by the Foundation. It does not establish that the 2017 revision was made in order to reduce measured non-compliance, and the Foundation asserts nothing about the purpose of the revision.

Bearing on the statutory question. Three uses. First and principally, at Part V.C.2.k, on the proposition that a compliance statement is a statement about a product and a measurement convention together, which bears on § 360kk(a)(2) and on what reference conditions a federal performance standard would have to specify. Second, at Part V.K.5, against the 2018 Opinion's treatment of the European toy standard, for the proposition that the existence of a standard is not evidence of compliance with it. Third, at Part V.A.1, as a documented instance of the overlap between the authors of the expert assessments and the authors of the primary literature. It is not offered for any proposition about harm.

C.60 Jeffery and others (2025) — long wavelengths measured through the human body, and a visual effect with the eyes shielded

Citation. Jeffery G, Fosbury R, Barrett E, Hogg C, Rodriguez Carmona M, Powner MB. Longer wavelengths in sunlight pass through the human body and have a systemic impact which improves vision. Scientific Reports 2025;15:24435. doi:10.1038/s41598-025-09785-3. Received May 26, 2025; accepted June 30, 2025; published July 8, 2025.

Relation to the other entries from this group, which the Foundation states because it bears on independence. This is the third Appendix C entry authored or co-authored by Glen Jeffery, with Appendix C.1 and Appendix C.19. Barrett is a co-author of C.1 and of this study; Powner is a co-author of C.19 and of this study. Part V.B.6 relies on all three, and Part V.A.1 states the general point: a line of argument resting substantially on the output of one laboratory is weaker than the number of papers suggests, and the Foundation would rather say so than have it observed. Independent replication of the head-shielded result by a group unconnected to these investigators is the single thing that would most strengthen Part V.B.6.

Design. Two components. First, field spectrometry of sunlight transmitted through the human thorax, and qualitative transmission imaging of the hand, thorax and layered clothing. Second, a laboratory exposure study with a baseline measurement, a single fifteen-minute exposure or sham, and a retest twenty-four hours later. The paper does not describe randomization or blinding.

Subjects, and the group structure, which is the entry's principal weakness. Forty subjects in total, described in the methods as aged 25 to 63, of both sexes, and all Caucasian. Sunlight transmission, 7 males, mean age 37 ± 17. LED transmission, 8 subjects, mean age 46 ± 15. The 850 nanometer exposure group, 13 subjects, 8 male and 5 female, mean age 48 ± 20. The body-only group with the head shielded, 5 males, mean age 36 ± 9. The sham control, 7 females, mean age 35 ± 8. The sham group is therefore all female with a mean age of 35, against a treated group that is mixed-sex with a mean age of 48. For a psychophysical outcome measured against a control, that is an unmatched comparison on both sex and age, and the Foundation identifies it as the first thing a reviewer will raise.

Light sources and exposure. Sunlight, direct, approximately 11:00 to 13:00, about 17 milliwatts per square centimeter at 850 nanometers at the body surface. For the laboratory

exposure, a 60 by 60 centimeter ceiling panel of 3,024 light-emitting diodes peaking at 850 nanometers, output 9.18 milliwatts per square centimeter at 50 centimeters. Exposure was fifteen minutes at approximately 9 milliwatts per square centimeter to the bare upper back in a dark room.

The transmission result. Sunlight transmitted through the thorax peaked at approximately 800 to 875 nanometers with very little energy below 600 nanometers, and the average transmitted irradiance at 850 nanometers was approximately 5.6 microwatts per square centimeter. The clothing figure caption describes layered garments as roughly a hundred times more transparent at 850 nanometers than in visible light, which the authors present as qualitative.

The exposure result. Color contrast detection thresholds, measured on the Chroma test. After back exposure, protan thresholds fell approximately 9 percent, p = 0.0053, and tritan thresholds fell approximately 16 percent, p = 0.0003. With the head wrapped in foil so that the eyes were shielded, the tritan reduction was approximately 7 percent, p = 0.0351, and the protan change was not significant, p = 0.1856.

The gap between the two components, which the paper does not address. The transmission measurement gives approximately 5.6 microwatts per square centimeter delivered through the thorax by direct sunlight. The exposure experiment produced its effect at approximately 9 milliwatts per square centimeter. The two differ by a factor of roughly 1,600. The study establishes that the band penetrates the body at ambient levels, and separately that it produces an effect at laboratory levels. It does not establish that the ambient level is sufficient to produce the effect, and the Foundation does not use it for that proposition. Part V.B.6 states the limit in the text.

Internal inconsistencies, recorded because this appendix records them. The methods give the half-power band of the source as 830 to 865 nanometers while the results describe it as approximately 35 nanometers wide. The exposure distance is given as 50 centimeters in one place and 1.5 meters in another. The hand imaging subject is described as a 75-year-old male, which falls outside the stated subject age range of 25 to 63. Each must be resolved against the published text before any figure here is filed.

Limitations stated by the authors. Field sunlight measurements were noisy because conditions were not tightly controlled. Clothing transmission was qualitative and is not generalizable quantitatively. Reflected light could reach the eyes, so head shielding did not fully isolate the non-ocular route. The mechanism and the absorbing species are not established and no action spectrum has been defined. The authors note that 670 nanometer light did not transmit across the body in data they do not report, and that comparisons with 670 nanometers were not made under identical conditions. Groups are small and differ in sex and age. All subjects were Caucasian, which for a study of transmission through skin is a limitation of a particular kind, because melanin absorbs in this region and the transmitted irradiance is therefore likely to vary with skin pigmentation. The authors do not draw that implication and the Foundation does not assert its magnitude, but a federal evaluation of this pathway would have to address it. Data are available from the corresponding author on request rather than deposited.

Funding and competing interests. No funding statement appears in the content the Foundation obtained. The authors declare no competing interests. The acknowledgements thank Light, Power Health UK for building the 850 nanometer panel used in the experiments. The Foundation records that because the practice of this appendix is to record such relationships in full: the apparatus for a study reporting benefits of near-infrared exposure was built by an entity in that field. It is not a declared competing interest and the Foundation does not characterize it as one. A reader should know it.

What it establishes. Three things. That sunlight transmitted through the human thorax is confined almost entirely to wavelengths above about 600 nanometers and peaks near 800

to 875 nanometers, at an average of about 5.6 microwatts per square centimeter at 850 nanometers. That fifteen minutes of 850 nanometer light at about 9 milliwatts per square centimeter delivered to the back was followed, twenty-four hours later, by improved color contrast thresholds on both axes. And that one of those improvements survived shielding the eyes, which is human experimental evidence for an extraocular route to a visual outcome.

What it does not establish. That ambient sunlight exposure improves vision, for the reason given above. That any light-emitting diode product causes harm; the study concerns a wavelength band those products omit rather than one they emit, and the argument it supports is about absence. That the effect generalizes beyond the population studied, which was small, unmatched between groups, and entirely Caucasian. And nothing at all about mechanism, which the authors expressly leave open.

Bearing on the statutory question. Two uses. First at Part V.B.6, as the fourth of four studies on the consequences of removing long-wavelength content from the human environment, and specifically for the transmission spectrum, which is the physical premise the other three assume. Second at Part V.C.2.h, for the proposition that optical radiation acts on the body outside the eye and that a framework addressed only to ocular hazard does not reach those routes. Paragraph 360ii(a)(4) directs the Secretary to study and evaluate conditions of exposure; the spectral composition of indoor light, including what it omits, is such a condition.

C.61 Kim and others (2024) — a photooxidation route that acts on ordinary proteins at the wavelength of the light-emitting diode peak

The governing limitation, stated first. This study reports no irradiance for its light source. The blue light was the illumination of the single-molecule imaging apparatus rather than a controlled exposure variable, and the paper specifies it only by peak wavelength. Without an irradiance there is no way to relate the exposure to ambient lighting, to sunlight, or to any exposure limit, and this comment does not attempt to. The work is in purified protein and in cultured cells. There is no tissue, no organism and no health outcome of any kind.

Why the entry is nonetheless here. Because of what the mechanism acts on. Every other mechanistic entry in this appendix concerns a specialized light-absorbing molecule in a tissue adapted to light: an opsin, a photoreceptor, a retinal pigment. This one concerns a structural feature of proteins in general. If it operates in people at the levels people receive, which is not established, it is not a mechanism the ocular hazard framework is addressed to. Part V.C.2.h.

Citation. Kim S, Kim E, Park M, Kim SH, Kim BG, Na S, Sadongo VW, Wijesinghe WCB, Eom YG, Yoon G, Jeong H, Hwang E, Lee C, Myung K, Kim CU, Choi JM, Min SK, Kwon TH, Min D. Hidden route of protein damage through oxygen-confined photooxidation. Nature Communications 2024;15:10873. doi:10.1038/s41467-024-55168-z. Published December 30, 2024. Open access. Four authors are recorded as having contributed equally.

Affiliations. Department of Chemistry and the X-Dynamic Research Center, Ulsan National Institute of Science and Technology, Ulsan, Republic of Korea, with further Korean institutional affiliations not fully captured by the Foundation. Corresponding authors Seung Kyu Min, Tae-Hyuk Kwon and Duyoung Min.

Design. Mixed experimental and computational, with no single dominant method. Single-molecule magnetic tweezers performing repeated unfolding and refolding of maltose-binding protein, with five to twelve molecules per condition. Mass spectrometry of oxidized residues. All-atom molecular dynamics, three trajectories of one microsecond. Density functional theory calculations. Spectrophotometric and electron paramagnetic resonance assays for reactive oxygen species, three independent samples. Monte Carlo

proximity analysis. Structural survey of the human and Escherichia coli proteomes from AlphaFold and the Protein Data Bank. Whole-cell proteomics of HeLa cells.

How the finding arose, which bears on how it should be read. The authors state that the study was prompted by the unexpected observation of a rapid decline in protein foldability under blue light. They were not investigating light damage. The blue light was the imaging illumination of their instrument, and the damage presented as an artifact which they then pursued. The Foundation records that because it bears in both directions: an incidental observation is less vulnerable to motivated analysis than a result that was sought, and an imaging illuminator is a light source of unknown and possibly high intensity.

Light conditions. Blue light at a peak wavelength of 447 nanometers for all experiments except two control conditions, with the full spectrum given only in supplementary material the Foundation has not obtained. Infrared at a peak wavelength of 860 nanometers as one comparison. Darkness as the other, imposed for an initial six hours. No irradiance, power density or illuminance is reported for any condition.

The principal results. Protein foldability fell to zero over approximately 200 unfolding cycles, with a decay constant of 207 plus or minus 7 minutes under the control condition. Reducing dissolved oxygen slowed the decay, to approximately 456 minutes in vacuum-degassed buffer and 357 minutes with nitrogen bubbling. Raising oxygen accelerated it sharply. Darkness and infrared light both delayed the decay, the latter the authors state even at higher power, which makes the effect specific to the short wavelength rather than to light in general. Mass spectrometry identified eighteen significantly oxidized residues under blue light, of whose side-chain atoms 64 percent lay in the protein core rather than at the surface. Calculations predicted an absorption near 445 nanometers for a tryptophan-oxygen pair, and assays supported production of singlet oxygen and hydroxyl radical from tryptophan under blue light. Oxidized residues lay within about 2 nanometers of the nearest tryptophan, a proximity the authors calculate would arise by chance about 0.2 percent of the time.

The structural survey, which is the part this comment uses. Approximately 92 percent of distinct human and Escherichia coli proteins were found to contain cavities, and approximately 31 percent to contain large cavities containing tryptophan, on the AlphaFold structures; the corresponding figures from the Protein Data Bank were approximately 95 and 42 percent. In HeLa cells the proportion of proteins with large tryptophan-containing cavities rose with the degree of oxidation, to as much as 22 percent, though the authors note that a few protein categories showed the opposite trend, which they attribute to differences in microenvironment.

What the authors say about tissue relevance. They propose that the route could affect many cellular proteins, particularly in tissues exposed to visible light, and they name the skin and the eyes. That is a statement in their discussion rather than a result, and the Foundation presents it as such.

Funding and competing interests. Supported by the National Research Foundation of Korea under several grants, the National Cancer Center, the Korea Basic Science Institute, the Institute for Basic Science and the POSCO TJ Park Foundation. The authors declare no competing interests. Mass spectrometry data are deposited at ProteomeXchange under accession codes PXD056895 and PXD038746, with a transparent peer review file published alongside the article. The Foundation notes the data practice favorably: deposited data and an open review record are better evidence of rigor than most entries in this appendix can show.

What it establishes. That in a purified protein under laboratory illumination at 447 nanometers, oxygen confined within the protein is converted by tryptophan into reactive oxygen species that oxidize residues in the protein interior; that the effect is specific to the short wavelength, being absent in darkness and under infrared; and that the structural

precondition for the mechanism, a large cavity containing tryptophan, is present in roughly a third of human proteins.

What it does not establish. Anything about people. It does not establish that this occurs in human tissue, at what irradiance it would occur, whether ambient or occupational light-emitting diode illumination delivers that irradiance to any tissue, or that any functional or clinical consequence follows if it does. It is a mechanism demonstrated in vitro and supported computationally, and Part V.A sets out what weight this comment gives evidence of that kind.

Bearing on the statutory question. One use, at Part V.C.2.h, for the proposition that mechanisms of optical radiation damage are not all ocular and not all mediated by specialized photoreceptors, so that a framework addressed to retinal hazard does not by its terms reach them. Paragraph 360ii(a)(4) directs the Secretary to study and evaluate emissions of, and conditions of exposure to, electronic product radiation; whether a mechanism of this kind operates at the irradiances people receive is a question within those words and the Foundation cannot answer it.

C.62 Abboushi and others (2024) — the position index measured for diode sources, and two findings adverse to this comment

Citation. Abboushi B, Miller NJ, Rodriguez-Feo Bermudez E, Irvin L, Royer M. The position index of overhead LED sources under different spectral power distributions and background luminances. LEUKOS: The Journal of the Illuminating Engineering Society. Published online April 17, 2024. doi:10.1080/15502724.2024.2327863. Volume and pagination not captured and must be completed. The Foundation consulted a copy held on its own server and must cite the published article.

Affiliation, which bears on how the entry is used. All five authors at Building Systems, Pacific Northwest National Laboratory, Portland, Oregon. A national laboratory of the Department of Energy. The journal is that of the Illuminating Engineering Society. This is the lighting profession and the federal research establishment examining their own metric, which is why the Foundation treats its statements of inadequacy as admissions rather than as advocacy.

Design. Human-subjects laboratory experiment in a hemispherical apparatus of 0.96 m radius fitted with tunable diode modules of 22 mm aperture, approximately 0.0004 steradian. Two psychophysical procedures: discomfort-level matching, and adjustment to the borderline between comfort and discomfort. Variables were source position, background luminance at approximately 1 and 35 cd/m^2, spectral power distribution at approximately 4,550 K and 2,500 K, and starting anchor, high and low, averaged. Results reported as geometric means.

Participants. Thirty enrolled, twenty-nine analyzed, one excluded. Two age groups. The methods give these as 21 to 30 and 57 to 70 years while the introduction gives 18 to 30 and 55 and over; the discrepancy must be resolved. Migraine sufferers were excluded, which the Foundation identifies as the most consequential feature of the sample for its purposes, because Part V.E.2 concerns precisely the population excluded and because a glare study that excludes photophobic participants cannot describe the experience of the people whose reports are collected at Part VII.

Positions tested. Reference at 0 degrees azimuth, 20 degrees elevation for the matching procedure. Test sources at 0 and 0, 0 and 20, 0 and 40, 0 and 60, plus and minus 45 at 60, plus and minus 67.5 at 60, and 0 and 80 degrees. Sources at 60 and 80 degrees above the line of sight were found to be detectable and quantifiable, which the authors say supports including sources outside the field of view in discomfort glare metrics.

The principal numerical result. Against an on-axis reference, the geometric mean position index for a source 60 degrees above the line of sight was 53, against 16.9 in Luckiesh and

Guth 1949, with the gap widening as vertical angle increased. Measured on-axis borderline luminance was 8,922 cd/m² against 2,844 in the 1949 work. Against a 20-degree reference, the 80-degree source had index values approximately two to three times those of the 60-degree source. The authors attribute the differences to the smaller source, 0.0004 against 0.0011 steradian, to a wider luminance range, and to anchor bias.

The spectral result, which is adverse. No statistically significant difference in position index or in borderline luminance between the cool and warm sources at either background level, with inconsistent direction: at 0 and 80 degrees under high background the warm source gave a higher index, 31.6 against 23.3, while at 0 and 60 degrees it gave a lower one, 10.5 against 13.6. The authors state that the study calls into question the effect of spectral power distribution on discomfort glare, and hypothesize that adaptation periods of two to five minutes between spectral conditions may have weakened any effect. Background luminance did not significantly affect the index, though borderline luminance was significantly higher at the higher background, $p < 0.01$, which the authors describe as consistent with earlier work.

What the authors recommend. That the position index values from this study, which they say account for range and anchor bias, be incorporated into discomfort glare models; that the present practice of applying one position index irrespective of source size warrants further study; and that sources outside the field of view be included in discomfort glare metrics. They do not conclude that the position index is applicable to diode sources without further testing, and they do not directly test the Unified Glare Rating or reach a judgment on the adequacy of any model.

What it establishes. That a term in continuous use in discomfort glare prediction since 1949 had not been evaluated for light-emitting diode sources until 2024; that its measured values for such sources differ from the 1949 values by a factor of roughly three at 60 degrees and more at greater angles; that the dependence of the index on source size is untested; and that sources well outside the central field of view produce quantifiable discomfort.

What it does not establish, and what it tells against. It does not establish that existing glare models understate discomfort from diode sources. For the term it measured and the geometry it tested, it indicates the opposite: computing a rating with the 1949 values predicts more discomfort from a high off-axis source than these measurements support. Nor does it support the proposition that warmer light produces less discomfort glare, and this comment does not advance that proposition. The study is a single laboratory experiment with twenty-nine participants, one source size, two background levels, uniform rather than patterned sources, fixed horizontal viewing without dynamic gaze or cognitive task, and the exclusion of migraine sufferers.

Bearing on the statutory question. Three uses. At Part V.C.4.c, for the proposition that the terms of the governing discomfort glare metric were derived for other sources and that their dependence on source size is untested on the field's own account. At Part V.C.4.c again, as the correction of a claim this comment does not make about spectral power distribution. And at Part II.H.4 and Part IV.G, for the proposition that the federal capacity to conduct human-subjects research on the visual effects of these products exists and sits in the Department of Energy rather than in this Department. Paragraph 360ii(a)(3) and paragraph (a)(6).

C.63 Françon, Behar-Cohen and Torriglia (2024) — the phototoxicity threshold re-measured, and the weighting function challenged

Why this entry matters more than most in this appendix. It attacks the instrument on which the determination of May 24, 2024 ultimately rests. Every assurance of photobiological safety for a light-emitting diode product traces back to a threshold dose measured in animals and to a weighting function applied to the emitted spectrum. This

study re-measures the first in rats and challenges the second on two independent grounds. It was published in February 2024, three months before the determination.

Citation. Françon A, Behar-Cohen F, Torriglia A. The blue light hazard and its use on the evaluation of photochemical risk for domestic lighting. An in vivo study. Environment International 2024;184:108471. doi:10.1016/j.envint.2024.108471. PMID 38335626. Creative Commons Attribution-NonCommercial-NoDerivatives licence. The Foundation read the author version deposited at inserm.hal.science under identifier inserm-04456445, submitted February 14, 2024, and must verify against the published article.

Authors, and two institutional facts. Behar-Cohen was an external expert of the 2012 Opinion of the European predecessor committee described at Part V.K.9 and is a co-author of the market surveillance study at Appendix C.59. The contribution statement records her role here as writing, review and editing; Torriglia conceived and supervised the work and obtained the funding, and Françon performed the investigation and analysis. The Foundation states that precisely rather than leaning on her name. Second, the light exposure devices were manufactured and designed by the Centre Scientifique et Technique du Bâtiment, the institute of the author of the reference chapter at Appendix D.5 and of the 2024 intergovernmental review at Appendix D.1.

The governing limitation, stated first. Male albino Wistar rats, exposed at six weeks of age, to acute doses under laboratory light sources, in a single laboratory. Rats are nocturnal, which Part V.A.2 sets out as a general caution on rodent light studies. The reported overestimates are of the accepted threshold for rats, not of the human exposure limit; the extension to human limits is the authors' inference from the shared derivation method, and they state it as a suggestion. The animals were young, and the authors themselves note that susceptibility to light increases with age and that evaluation in older animals would be worth performing.

The albino question, and the authors' answer to it. An albino rodent is the classic hypersensitive model for retinal light damage and the Foundation raises the objection before a reader does. The authors address it: they state that the action spectrum curves of van Norren show albino and pigmented rats to have the same sensitivity to light. That answer rests on a secondary source and must be checked against van Norren and Gorgels 2011 directly. If it holds, it substantially blunts the objection; if it does not, this entry must be re-weighted.

Design and exposure. Rats exposed individually from above at 9 a.m. by arrays of ten diodes, with exposure time varied to deliver specified retinal doses, then kept in darkness for 26 hours before sacrifice, that interval being the reported peak of photoreceptor cell death after white light. Sources: phosphor-converted white at 2700 K, blue at 450 nm, green at 507 nm, red at 630 nm, characterized with a spectroradiometer. Retinal dose computed as the product of exposure time and retinal irradiance, the latter derived from corneal irradiance, ocular transmittance, pupil diameter and focal length. Ethics approval Apafis 21910-2019090612065253v6.

The regulatory chain the paper sets out. Limit exposure values for domestic lighting rest on action spectrum curves giving a retinal threshold dose at 445 nanometers of 22 joules per square centimeter for primates and 11 for rodents. The primate values were used to establish the current lighting regulations. Those regulations weight polychromatic light by $B(\lambda)$, a curve peaking at 445 nanometers, and a device is labeled as presenting no risk if after 10,000 seconds the weighted retinal dose is below 2.2 joules per square centimeter. The regulatory limit is therefore one tenth of the measured primate threshold. This comment had not previously stated that chain and now does, at Part V.C.2.f.

Principal results. The phototoxicity threshold currently accepted for rats is overestimated by a factor of 50 for blue light and by a factor of 550 for white light. The excess phototoxicity of white light is attributed to its green content, which promotes an inflammatory response:

the green content of white light produced eight times more macrophage invasion of the retina than the blue content. Red light mitigated damage, inhibiting the nuclear translocation of L-DNase II and reducing TUNEL-positive cells by 33 percent, and the blue light hazard weighting does not evaluate the red content of a source at all.

The authors' conclusions, quoted. That the phototoxicity of a polychromatic source should be assessed across the entire spectrum rather than by its blue content alone; that "As current human phototoxicity thresholds were estimated with the same methods used for rats, our results suggest that they might need to be reconsidered"; and that "the commercial LED that are currently classified as safe for the retina could actually induce retinal damage if used daily at high luminance."

A convergence with Part V.B.6, reached independently. The finding that red light is protective and that the weighting ignores it arrives at the same place as the long-wavelength argument at Part V.B.6, by a different route. That argument rests on a London group working on mitochondrial function and visual performance in humans. This is a Paris group working on retinal cell death in rats, by a mechanism of apoptosis regulation. The two lines do not share endpoints, methods, species or authors.

A second line the paper reports and the Foundation has not read. The authors record that Hunter and others, in work published in 2012 and 2018, identified a potential overestimation by a factor of 20 of the current safety standards in humans. If that holds it is an independent corroboration in a primate or human model and it must be obtained.

An exposure figure the paper reports from a national agency. The paper states that in a 2019 report on new lighting technologies the French agency carried out measurements in real-life conditions and concluded that artificial lighting adds up to 50 percent of the phototoxic dose received from natural lighting, rising to 200 percent where only cool light-emitting diode sources are used, with screens among the largest artificial contributors. Part V.K.6 uses that against the 2018 Opinion's statement that exposure from these products is likely to be insignificant compared with natural light. The Foundation has not obtained the 2019 report and the figure is taken at second hand.

Funding, competing interests and data. Supported by the French agency for food, environmental and occupational health safety under contract 2022/EST/134 to Torriglia. The authors declare no known competing financial interests or personal relationships. Data will be made available on request rather than deposited. The Foundation notes the funding without discounting the work: a national health agency funding research that challenges the adequacy of a lighting safety standard is the kind of research paragraph 360ii(a)(2) directs this Secretary to plan, conduct, coordinate and support.

What it establishes. In this model and these conditions: that retinal damage occurs at doses far below the threshold currently accepted for rats; that the green component of white light contributes more to the inflammatory response than the blue component; and that the red component is protective and is not evaluated by the weighting function on which the regulations depend.

What it does not establish. That any human being has been injured by any light-emitting diode product. That the human exposure limit is wrong by any particular factor; the 50 and 550 are overestimates of a rodent threshold. That commercially available products in the United States exceed any limit. The final quoted sentence is a conditional about daily high-luminance use and the Foundation presents it as the authors' conclusion rather than as a finding about products in commerce.

Bearing on the statutory question. Three uses. At Part V.C.2.f, as the quantified instance of the proposition the 2024 intergovernmental review states without numbers, that damage has been found below the limit. At Part V.C.2.a and Part V.B.3, for the peak of $B(\lambda)$ at 445 nanometers and for the attribution of the limits to the ICNIRP guidelines of 2013. At Part

V.K.6, for the national agency exposure apportionment. Section 360kk(a)(1)(A) directs the Secretary to consider the latest available scientific and medical data in prescribing a standard, and this paper was available three months before the determination.

C.64 Zhang and others (2023) — a documented macular injury in a child from a marketed handheld diode light

What this entry is, and the weight it carries. A single interventional case report. It is the weakest design in this appendix and the Foundation says so at the outset. A case report cannot establish incidence, risk, or that any population is affected. It establishes that an identified injury occurred to an identified person in identified circumstances, documented by imaging. That is what it is offered for and nothing more.

Citation. Zhang L, Lei CY, Zhang ZC, Gu JY, Zhang MX. Accidental macular injury from short-term exposure to a handheld high-intensity LED light. Heliyon 2023;9(8):e18705. doi:10.1016/j.heliyon.2023.e18705. PMID 37554811. PMCID PMC10404656. Published July 26, 2023. Open access under a Creative Commons Attribution-NonCommercial-NoDerivatives licence; full text read.

Affiliations and funding. West China Hospital, Sichuan University, Chengdu, and the Fourth People's Hospital, Zigong, Sichuan Province, China. Corresponding author Zhang Mei-Xia. Supported by Sichuan University, grant ZYJC21025. The Foundation has not located a competing interests declaration and must obtain it.

The patient and the exposure. A thirteen-year-old girl presented with vision loss and scotomas in the right eye. Five days earlier a classmate had directed a handheld light-emitting diode light at that eye several times, at very short distance, in flash mode. The device was bought online and is described as an outdoor lighting product with high-output sources: thirty chip-on-board emitters rated together at 5 watts, 100 lumens per watt at 500 milliamperes. No radiometric measurement of the device was made and none is reported.

Findings and course. At three days after exposure, best corrected visual acuity in the right eye was 6/20. Optical coherence tomography showed a hyperreflective area in the external retinal layers corresponding to disruption of the ellipsoid zone and the photoreceptor outer segments. Treatment was a single retrobulbar injection of 20 mg triamcinolone acetonide at five days. Acuity recovered to 16/20 at nineteen days and 20/20 at thirty-three days. Multifocal electroretinography showed reduced foveal P1 amplitudes in the affected eye at nineteen days and improvement at thirty-three days. Imaging through three months documented restoration of the outer retinal layers. The authors note that the patient was not seen until five days after exposure, so no examination was obtained in the acute phase.

The comparison the authors draw, which is the entry's principal value. They report that the imaging findings were particularly similar to those seen in solar maculopathy, in welding arc maculopathy, and in maculopathy following viewing of a plasma flash produced by a femtosecond laser, and suggest a shared phototoxic cause. Part V.C.1.d sets out what follows for this comment: an injury of the same clinical description is produced by four sources, of which the agency regulates three.

The authors' own statement limiting their case. They write that no evidence of direct adverse health effects from light-emitting diodes has been found in conditions of normal use, and that it is misuse which may cause eye damage, particularly in children. The Foundation adopts that statement. This entry is not evidence that ordinary lighting injures the retina and is not offered as such anywhere in this comment.

Two animal studies the report relies on, recorded as leads. Park and others are reported as finding that a high-power diode source of 25 watts, rated 150 lumens per watt at 700 milliamperes, applied for five seconds at one centimeter from the corneal surface, caused

temporary phototoxicity to visual function in rabbits which recovered within twenty-four hours. Araújo and others are reported as finding, in Wistar rats exposed to high-intensity diode light at 3,200 milliwatts per square centimeter for 144 seconds at 30 centimeters, morphometric alterations in retinal structures, specifically in the nuclear area of the photosensitive cells. Neither has been read by the Foundation. The second supplies an irradiance figure for a whole device, which this comment needs and lacks.

What it establishes. That a marketed handheld light-emitting diode device, obtainable online, produced a macular injury in a thirteen-year-old that was documented by optical coherence tomography and electroretinography, that reduced visual acuity to 6/20, and that resolved over approximately five weeks. The authors state it is the first such case report for a handheld diode lighting device.

What it does not establish. Incidence, prevalence, or risk of any kind. That ordinary lighting is hazardous; the authors say the contrary. That the injury would have occurred at ordinary viewing distances or without the light being deliberately directed into the eye. That any permanent harm resulted; acuity returned to normal. The case also cannot show what the device emitted, because it was never measured, and this entry should not be cited for any emission figure.

Bearing on the statutory question. Two uses. At Part V.C.1, for the regulatory asymmetry: an injury clinically indistinguishable from that caused by three regulated sources, caused by an unregulated one. And at Part V.C.2.k, for the proposition that the aversion response cannot operate as the photobiological framework assumes when a source is directed into the eye without warning and repeated. Paragraph 360ii(a)(4) directs the Secretary to study and evaluate emissions of, and conditions of exposure to, electronic product radiation, and a device of this kind in the hands of children is a condition of exposure.

C.65 Ogawa and others (2023) — blue diode light as the standard insult, and the stress pathway it activates

The governing limitation, stated first. The exposure was 36 hours of continuous blue light-emitting diode illumination on a monolayer of cultured cells. No retina receives 36 hours of uninterrupted light. The cells were a murine photoreceptor-derived line in a dish, lacking the retinal pigment epithelium, the choroidal circulation, the repair processes and the tissue architecture of an eye. And the subject of the paper is not the light. It is a plant extract tested for protective effect, for which the light exposure is the assay. This entry is offered for the pathway and for one observation about the literature, not for any proposition about human exposure.

Citation. Ogawa K, Karitani T, Otsu W, Nishiyama K, Kunitake H, Goto Y, Nomiyama S, Hara H, Yamasaki M. Blueberry stem extract suppresses blue light-emitting diode light-induced endoplasmic reticulum stress on retinal photoreceptor cells. BPB Reports 2023;6(3):87–97. Received March 16, 2023; accepted April 20, 2023. The Foundation read the article as supplied and must verify the digital object identifier and the journal's indexing status.

Affiliations, and a commercial interest in the test article. University of Miyazaki, Institute for Tenure Track Promotion and Graduate School of Agriculture; Gifu Pharmaceutical University, Department of Biomedical Research Laboratory and Molecular Pharmacology, Department of Biofunctional Evaluation; and Biolabo Co., Ltd., Kobe. The blueberry stem extract tested was provided by Biolabo Co., Ltd., and one of the authors is affiliated with that company. The Foundation records that because the finding of the paper is that the company's product is protective. It does not bear on the light exposure, which is what this comment uses, but a reader is entitled to know it.

Design and exposure. Cultured 661W cells, a murine photoreceptor-derived line, seeded on well plates and placed on a transparent acrylic plate 300 millimeters above a blue light-emitting diode device of 470 nanometer peak wavelength, inside a carbon dioxide

incubator at 37 degrees Celsius. Illuminance at the cells was 500 lux, measured with a digital light meter. Exposure was continuous for 36 hours, with lysis for protein analysis at 6, 12, 24 and 36 hours and assessment of cell damage at 24 hours. Control cells were shielded from the light with aluminum foil. Cells were pre-treated with the extract or with N-acetyl-L-cysteine as a positive control antioxidant.

What the light did. Blue light triggered the endoplasmic reticulum stress factors BiP, PERK, ATF6, eIF2α, ATF4 and CHOP; these in turn upregulated the cell cycle arrest factors p53 and p21 and the apoptosis-inducing factor caspase-3; and morphological abnormality and cell damage followed. The extract and the antioxidant each suppressed the increases in BiP, ATF4, ATF6, CHOP, p53, p21 and caspase-3, but not in the mitochondrial apoptotic factors Bax and cytochrome c. The authors conclude that the blue light-induced endoplasmic reticulum stress is primarily caused by oxidative stress.

The mechanism the paper describes, which is new to this comment. The introduction states the sequence the Foundation relies on: that blue light can cause aggregation of short-wavelength opsin, a photoreceptor protein, leading to endoplasmic reticulum stress; that the unfolded protein response is regulated by three transmembrane sensors, PERK, IRE1 and ATF6; and that prolonged stress ending in failure of that response leads to apoptosis. It also states that endoplasmic reticulum stress is known to be one of the causes of age-related macular degeneration, and that a positive correlation has been observed in human studies between the onset of that disease and exposure to blue light. Those are statements of the authors' understanding of their field, supported by citations the Foundation has not read, and are not findings of this study.

What it establishes. That continuous blue light-emitting diode illumination at 470 nanometers and 500 lux activates the unfolded protein response in a photoreceptor cell line within hours, and that the activation proceeds to markers of cell cycle arrest and apoptosis; and that both a plant extract and a known antioxidant suppress that sequence, which the authors take as evidence that the pathway is driven by oxidative stress.

What it does not establish. Anything about human retinas, about tissue, or about exposures of the kind described at Part VI. The illuminance figure must not be read as comparable to room lighting: it is a measurement at the surface of a cell monolayer, and the quantity governing exposure of a living retina is the irradiance of the retinal image, which is set by source radiance and treated at Part V.B.2. Nor does the study bear on the extract in any way this comment relies upon; the Foundation takes no position on whether blueberry stem extract protects anything.

Bearing on the statutory question. One use, at Part V.C.1.a, and it is an observation about the literature rather than a finding. Blue light-emitting diode illumination functions in this branch of research as the standard means of producing photoreceptor damage, against which protective compounds are screened. The damaging capacity at laboratory doses is not contested by the researchers who rely on it. The open question is the one § 360ii(a)(4) assigns to the Secretary: at what exposure, under what conditions, and with what margin.

C.66 Chan and others (2023) — a retinal barrier protein cleaved, and an exposure reported only in lux

Citation. Chan YJ, Hsiao G, Wan WN, Yang TM, Tsai CH, Kang JJ, Lee YC, Fang TC, Cheng YW, Li CH. "Blue light exposure collapses the inner blood-retinal barrier by accelerating endothelial CLDN5 degradation through the disturbance of GNAZ and the activation of ADAM17." Fluids and Barriers of the CNS 2023;20(1):31. doi:10.1186/s12987-023-00430-7. PMID 37095509; PMCID PMC10124034. Received December 8, 2022; accepted April 7, 2023. Published open access under a Creative Commons Attribution license. Department of Physiology, School of Medicine, College of Medicine, Taipei Medical University, Taipei, Taiwan. Chan and Hsiao are stated to have contributed equally.

Exposure conditions, which govern the use made of this study. In the cell experiments, blue light-emitting diodes were mounted at the base of an exposure chamber and illuminance at the culture was set by varying the distance to the emitting plane. Three illuminances were used – 80, 160 and 240 lux – for durations of 6, 12 and 24 hours. All of the barrier measurements on which the paper's conclusions rest were made at 160 lux for 6 to 12 hours. In the animal experiments, C57BL/6 mice aged six weeks were held in a blue or red light exposure chamber for six hours per day, from 10 a.m. to 4 p.m., on three consecutive days, with a battery of fundus photography, fundus fluorescein angiography, optical coherence tomography and electroretinography performed before exposure and repeated on the fifth day. Animal protocol LAC-2020-0482.

What is not reported. The paper reports no irradiance anywhere, and it does not state the peak wavelength of the diodes it used. The only wavelength figures in the paper are the 400 to 500 nanometer band used in the introduction to define blue light generally, and the 318 and 449 nanometer excitation and emission pair of a fluorometric enzyme assay unrelated to the exposure. The exposure is therefore specified in photometric units alone, with the spectrum left undefined.

What it reports. Claudin-5, the endothelial tight junction protein, fell in an illuminance-dependent and time-dependent manner. After six hours at 160 lux it stood at 0.53 plus or minus 0.08 of control in the murine endothelial line and 0.63 plus or minus 0.07 in primary human retinal microvascular endothelial cells. Transmission electron microscopy showed the tight junction ultrastructure of control cells replaced by a gap. Transendothelial electrical resistance and paracellular permeability changed accordingly. The loss was attributed to activation of the metalloprotease ADAM17, and both a pharmacological inhibitor and genetic knockdown prevented it. In the resting state ADAM17 is bound by GNAZ, described by the authors as a circadian-responsive, retina-enriched inhibitory G protein; blue light released it. Knocking down GNAZ produced protease hyperactivation, junction protein loss and permeability in culture, and retinal damage resembling blue light exposure in the animal, with no light exposure involved. In mice, the three-day regimen produced angiographic leakage with attenuation of the electroretinogram b-wave and of the oscillatory potentials. Supplementary figures report that red light left both the junction protein and the phosphorylation state of the protease unchanged, and that two related proteases, ADAM9 and ADAM10, do not participate.

What it establishes. That blue light acting on the retina has a route of action whose target tissue is vascular endothelium, whose mechanism is proteolytic cleavage of a tight junction protein, and whose functional endpoint is barrier integrity and the electrical response of the inner retina – none of which is the outer-retinal photochemical lesion from which the blue-light weighting function and the numerical limits built on it were derived. That this route is wavelength-dependent rather than merely energy-dependent, red light having left it untouched. And that the route can be interrupted at a defined molecular step, which is the strongest form of mechanistic evidence available from a study of this kind: the light produced the effect, blocking the mediator prevented it, and removing the mediator's natural brake reproduced it without light.

What it does not establish, and the reason the Foundation is careful with it. It does not establish that any effect occurs at or below a regulatory limit, and the comment does not cite it for that. The abstract's phrase "even at non-cytotoxic lighting" is stronger than the paper's own results text, which states that at the working condition the cells "were less viable but were still alive" and reports that the lowest illuminance tested, 80 lux, significantly reduced metabolic activity at 24 hours. What was preserved at the working condition was cell density, not viability. Separately, the authors describe their illuminances as common in consumer displays and suitable for a reading distance. Because lux is weighted by a photopic function that is small in the blue, a stated illuminance of near-monochromatic blue light carries a radiometric and blue-light weighted dose one to two

orders of magnitude above the same stated illuminance of white light, so that comparison does not hold as a comparison of blue-light dose and the comment does not repeat it. The opening assertion of a rising incidence of retinopathy attributable to consumer devices is not adopted. The work is in cell culture and in mice; one of the two cell lines is of cerebral rather than retinal origin, although the authors state the principal findings were confirmed in the primary human retinal line. One point in the discussion rests on data the authors describe as unpublished.

A qualification to the preceding field, added after a later study was read. The judgment above that viability rather than only cell density was affected rests on the reported fall in succinate dehydrogenase activity, measured by tetrazolium reduction. Appendix C.69 reports that blue light directly inhibits succinate dehydrogenase, the enzyme of mitochondrial Complex II. If that is so, a tetrazolium assay performed under blue light measures the activity of an enzyme the light is itself inhibiting, and a reduced signal does not establish a reduced number of living cells. That is consistent with what this study reports, since the dye-based measure of cell density was preserved at the working condition while the enzymatic measure fell. The Foundation therefore softens its objection to this extent: the claim of a non-cytotoxic exposure is better supported than the enzymatic data alone suggest. The objection is not withdrawn, because the exposure level remains the governing problem and is unaffected by the assay question. This reasoning is the Foundation's and is advanced by neither set of authors.

Disclosures and data. Funded by the Ministry of Science and Technology of Taiwan (MOST 110-2320-B-038-066, 110-2320-B-038-080 and 111-2320-B-038-024) and the Ministry of Education higher education sprout project (DP2-110-21121-01-N-06-02). The authors declare no competing interests. The source data underlying the figures are published as a supplementary file, which is better practice than most of the studies in this appendix and permits independent checking of the reported effect sizes.

Where it bears. Part V.C.1.g, as the study of a retinal tissue and an injury mode that the weighting function was not measured to describe. Part V.C.2.h, as a further instance of the framework's scope being narrower than the evidence. Part V.B.6 and Appendix C.63, on wavelength specificity and the behavior of the red end. The circadian character of GNAZ bears on Part V.F only as a research gap, not as a finding.

C.67 Antemie, Samoilă and Clichici (2023) — a review of the human clinical evidence, and the most adverse conclusion in this record

Citation. Antemie R-G, Samoilă OC, Clichici SV. "Blue Light—Ocular and Systemic Damaging Effects: A Narrative Review." International Journal of Molecular Sciences 2023;24(6):5998. doi:10.3390/ijms24065998. PMID 36983068; PMCID PMC10052719. Received February 14, 2023; revised March 13, 2023; accepted March 20, 2023; published March 22, 2023. Academic editor Settimio Rossi. Open access under a Creative Commons Attribution license. Departments of Physiology and of Ophthalmology, Faculty of Medicine, Iuliu Haţieganu University of Medicine and Pharmacy, Cluj-Napoca, Romania.

Article type, and why it is the strongest of its kind in this appendix. A narrative review, so secondary throughout and cited in the category described at Part V.A.2 as evidence of the state of expert opinion and not as primary evidence of any effect. It is nonetheless the most disciplined narrative review in Appendix C. The authors state that they followed the SANRA instrument for assessing narrative reviews; they searched PubMed/Medline, Scopus, EMBASE, the Cochrane Database of Systematic Reviews and Clinical Trials for the period 2010 to 2022; they restricted inclusion to clinical studies and randomized controlled trials in English with human participants; and they excluded studies with fewer than ten participants. Two searches were run, one on blue light and the retina and one on the intrinsically photosensitive retinal ganglion cell. The yield is reported as a flow: 333 records after filters, 20 abstracts selected, three excluded on reading for having fewer than

ten participants per study, and 17 studies in the final review. No risk-of-bias instrument was applied and nothing was pooled, so it remains a narrative review and not a systematic one.

Its conclusion, quoted because it is adverse. The authors conclude: "We find it difficult to express with certainty that blue light exerts a harmful effect at the level of the human retina". They further state that there is little evidence that the theoretical protection of blue-blocking filters against retinal degeneration is clinically significant, and that "many findings are theoretical or based on observations in cell culture or animal experiments". This is the most directly adverse peer-reviewed authority in this comment's record. It is confronted on its own terms at Part V.C.1.h and is not characterized as an outlier.

The other half of the same conclusion. The concluding passage does not rest there. The authors state that as more research groups examine the subject, using designs that resemble contemporary conditions and enrolling healthy young participants who use display terminals often, studies are beginning to obtain more consistent results that "all point towards the possible noxious effect of long-term blue light exposure", and that questions remain despite the groundwork having been laid more than two decades ago. The Foundation quotes both halves and relies on neither beyond its terms.

What it establishes, and it is a finding about the record rather than about light. That a search of five databases over thirteen years, restricted to human clinical studies and trials with ten or more participants, yields seventeen studies on blue light and the retina. That the reasons the human literature cannot answer the question are methodological and specific: small samples, inadequate follow-up, predominantly subjective endpoints, and exposure conditions that are not standardized between groups. On the last point the review is concrete, reporting that research groups defined the mesopic setting differently, "ranging from 0.1 lx to 50 lx", and that the wavelength and stimulus duration used for experimental exposure also vary between studies. A literature whose exposure specifications differ by more than two orders of magnitude between groups cannot be synthesized, and that is a condition a federal exposure specification would remedy. These findings are used on the research-needs question and at Part V.K.

What it does not establish. Any effect of any light-emitting diode product on any human retina. Any threshold, dose-response relationship or exposure limit. It is secondary throughout, so every figure in it is reported at one remove and none has been verified by the Foundation against its source. The scope is also narrower than the title suggests: the systemic material is confined principally to photophobia and migraine and to cardiac autonomic function, and the review does not address the wider systemic literature its title invokes. The data availability statement offers datasets on request, which is not meaningful for a review containing no primary data.

Two leads it supplies, recorded as leads and not as findings. First, the review describes work by Gagné and colleagues, its reference 46, as the first to show that short exposures to blue light can affect both cone and rod electroretinogram responses, in the review's characterization even where exposure fell within the standard safety range, with b-wave reduction under both scotopic and photopic conditions, still measurable an hour afterward, and treated by those authors as temporary. Second, work by Yuda and colleagues, reference 50, on cardiac autonomic function under colored organic light-emitting diode illumination: a red arm at 39 lux, a green arm at 71 lux and a blue arm at 10 lux, with high-frequency power falling and the low-to-high frequency ratio rising, the change greater for blue than for red or green, and with only the highest blue illuminance producing significant heart rate and heart rate variability changes, persisting into the darkness following the exposure, under a paced breathing protocol intended to remove the respiratory confound. Neither study has been read by the Foundation. Neither is relied on.

Disclosures. The authors state that the research received no external funding and declare no conflict of interest. Published by MDPI, which bears on the standing question recorded for Appendix C.18 and C.59 and should be resolved once for all three rather than separately.

Where it bears. Part V.C.1.h, as the adverse authority the comment confronts. Part V.A.2, as an application of the evidentiary hierarchy. Part V.K and the research-needs response, for the finding that exposure specifications are not standardized across the literature. Part V.E.5 and Part V.E.1 only by way of the two leads above, which must be obtained before either section relies on them.

C.68 Li, Zhu and Qi (2023) — a fourth injury mechanism reported, on an abstract the Foundation could not go behind

The governing limitation, stated first. The article is closed access. It is not in PubMed Central, no author manuscript or repository copy exists, and an open-access location search returns none. The Foundation has read the abstract only. In accordance with the practice applied at Appendix C.58, this entry is confined to what an abstract reliably establishes – that a mechanism has been reported in the peer-reviewed literature – and is not an appraisal of the study. No exposure conditions are stated in the abstract: no wavelength, no irradiance, no illuminance and no duration. Nothing in this entry may be cited for any proposition about dose, threshold or human effect.

Citation. Li X, Zhu S, Qi F. "Blue light pollution causes retinal damage and degeneration by inducing ferroptosis." Journal of Photochemistry and Photobiology B: Biology 2023;238:112617. doi:10.1016/j.jphotobiol.2022.112617. PMID 36495671. Lanzhou University Second Hospital, Lanzhou, China. Cite the publisher's version.

What the abstract reports. That blue light triggered a burst of reactive oxygen species in retinal cells with a significant increase in intracellular ferrous iron; that deferoxamine, an iron chelator, significantly improved lipid peroxidation and cell death in ARPE-19 cells, a human retinal pigment epithelial line; that ferrostatin-1, an inhibitor of ferroptosis, alleviated retinal oxidative stress and degeneration in rats; and that blue light produced an imbalance in both of the systems by which cells defend against ferroptosis, the glutathione-GPX4 system and the FSP1-coenzyme Q10-NADH system. The authors conclude that ferroptosis may be a crucial pathway for blue-light-induced retinal damage.

What it establishes, on the abstract alone. That a fourth distinct injury mechanism is reported in this literature. Ferroptosis is an iron-dependent form of regulated cell death driven by lipid peroxidation, and it is distinct from the endoplasmic reticulum stress and caspase-dependent route at Appendix C.65, from the proteolytic cleavage of an endothelial junction protein at Appendix C.66, and from the photooxidation of buried protein residues at Appendix C.61. The abstract also reports that the effect was interrupted at a defined molecular step in two independent ways, one in human cells and one in the intact animal, which is the form of evidence that distinguishes a mechanism from a correlation. The Foundation uses the entry for that single proposition, at Part V.C.2.h.

Independent earlier support, added after a later reading. The components of the pathway this abstract names were measured six years earlier by a different group on another continent. Appendix C.76 reports, in rats exposed to monochromatic light at matched irradiance, that total retinal iron rose significantly under all three wavelengths and most under blue; that ferritin, ferroportin and the ferroxidase ceruloplasmin were up-regulated and transferrin and its receptor down-regulated as wavelength decreased; and that lipid peroxidation and glutathione peroxidase activation formed part of the account. Iron overload, lipid peroxidation and glutathione peroxidase are the constituents of ferroptosis. That earlier work did not name the pathway, which had barely been defined when it was performed. The effect is that this entry, which rests on an abstract the Foundation could not go behind, is no longer a solitary report: the phenomenon it names was independently measured before it was named.

What it does not establish, including two statements the Foundation declines to adopt. Nothing about any exposure level, because none is reported. Nothing about any product. Nothing about humans: the work is in a cell line and in rats. Two further statements in the abstract are not adopted. The first is that blue light is "the main culprit of teenage vision problems in the modern environment". The second is the closing statement that the results help explain why blue light pollution causes visual impairment in adolescents. That is a conclusion about human adolescents drawn from a cell line and a rodent, no adolescent having been studied, and the Foundation does not repeat it. The phrase blue light pollution in the title is the authors' characterization and is not used by this comment as a term of art.

Where it bears. Part V.C.2.h, in the enumeration of distinct reported mechanisms, and nowhere else. Part V.J.4, as one of the studies whose reported exposure cannot be placed against a numerical limit.

C.69 Song and others (2022) — the mechanism the 2019 study lacked, and an age dependence

The governing limitation, stated first and in the same terms as Appendix C.50. The subject is the fruit fly. The evolutionary distance, the compound eye, the open circulatory system and above all the size and translucency of the body mean that light reaches internal tissue in this animal by a route that has no counterpart in a human. The exposure was also continuous rather than cyclic: constant blue light for days, a condition no person encounters. Nothing in this entry is offered as evidence of an effect in humans, and the Foundation does not advance it as such.

Citation. Song Y, Yang J, Law AD, Hendrix DA, Kretzschmar D, Robinson M, Giebultowicz JM. "Age-dependent effects of blue light exposure on lifespan, neurodegeneration, and mitochondria physiology in Drosophila melanogaster." npj Aging 2022;8:11. doi:10.1038/s41514-022-00092-z. Received January 14, 2022; accepted July 20, 2022. Open access under the Creative Commons Attribution license; full text read. Department of Integrative Biology and School of Biological and Population Health Sciences, Oregon State University; Oregon Institute of Occupational Health Sciences, Oregon Health and Science University. Published in partnership with the Japanese Society of Anti-Aging Medicine.

Exposure conditions, which are among the best specified in this appendix. Constant blue light with a peak emission of 460 nanometers, produced by a commercial 165 watt dimmable aquarium light-emitting diode fixture, at a photon flux density of 20 to 30 micromoles per square meter per second, corresponding to an irradiance of approximately 0.4 milliwatts per square centimeter, measured at the level of the horizontally placed vials holding the animals, 25 per vial. The control arm is what distinguishes this study: rather than darkness alone, the authors also exposed animals to white light-emitting diodes behind a yellow long-pass filter, giving a peak emission of 584 nanometers at the same irradiance of approximately 0.4 milliwatts per square centimeter. The comparison is therefore matched on irradiance and differs only in spectrum. Lifespan was measured on at least 50 animals per genotype and condition, held in groups of 25, with mortality recorded and fresh diet provided every two to three days.

Design, and the feature that makes it relevant to this comment. Animals were held in constant darkness and then transferred to constant blue light at 2, 20, 40 or 60 days of age. The mechanistic work was conducted entirely in eya2 mutants, which lack compound eyes altogether, the authors stating that their aim was to understand effects on extra-retinal cells. The question the design answers is therefore not whether blue light damages a retina but whether it damages an organism that has none.

Results. Survival under blue light was reduced in proportion to the age at which the animals were transferred to it, in both wild-type and eyeless strains. Young animals of both strains

survived in blue light two to three times longer than old ones. Ten days of blue light followed by return to darkness reduced lifespan by approximately 6 percent in young animals and by a further 15 percent against the dark control in middle-aged animals. Brain vacuolization, the measure of neuronal loss, was minimal in young animals with no significant difference between light conditions, and increased in the aged animals. Light with the blue wavelengths removed, at matched irradiance, produced survival not significantly different from constant darkness.

The mechanism, which is what this study adds to Appendix C.50. Blue light significantly reduced the activity of mitochondrial Complex II and the biochemical activity of succinate dehydrogenase, in both young and old animals, with the reduction more pronounced in isolated heads than in whole animals. Complex IV activity and adenosine triphosphate content were reduced by age rather than by light. Respiration through Complex III was affected by neither. The authors therefore propose that light-induced damage to Complex II compounds an age-related decline in energy metabolism that proceeds even in darkness, which accounts for the age dependence. For the molecular route they offer a hypothesis and label it as one: succinate dehydrogenase requires a flavin adenine dinucleotide cofactor derived from riboflavin, riboflavin is maximally activated at 450 nanometers and can be degraded by blue light into inactive photoproducts, and they speculate that blue light impairs the enzyme by affecting its flavination status. They note that another flavin-dependent dehydrogenase was unaffected, which cuts against the hypothesis, and they say so.

What it establishes. That in an animal with no eyes, constant blue light at 460 nanometers and approximately 0.4 milliwatts per square centimeter shortens life and increases neuronal loss; that light of the same irradiance with the blue removed does not, so the effect follows the spectrum and not the energy; that susceptibility increases markedly with age; and that a specific enzyme of mitochondrial respiration is inhibited. It supplies the candidate mechanism that Appendix C.50 recorded as unidentified, and it is a fifth distinct injury route alongside those at Appendices C.61, C.65, C.66 and C.68.

What it does not establish. Anything about humans, and the Foundation repeats that it does not advance it for any such purpose. Anything about any product: the exposure is near-monochromatic blue at an irradiance well above the blue content of ordinary ambient lighting, delivered continuously, from an aquarium fixture. It sets no threshold and identifies no safe level. The flavination hypothesis is explicitly speculative and the authors report a result against it. The age dependence is an age dependence in an animal whose maximum lifespan is measured in weeks.

Why the Foundation nonetheless relies on it, and for what. For one proposition, at Part V.C.2.h and Part V.C.1.g: that the photobiological framework assesses a photochemical lesion in the outer retina, and that effects of the same waveband on tissues the framework does not address are reported in the peer-reviewed literature and have an identified cellular target. An eyeless animal cannot sustain a retinal lesion. Whatever happened to these animals is outside the scope of every exposure limit described in Part V.C.2, not because the limits are set too high but because they measure something else. The Foundation also relies on the matched-irradiance control, which is the design feature that distinguishes a spectral effect from a thermal or energetic one, and which Part V.J.4 identifies as absent from much of this literature.

Disclosures and data. Partially supported by the National Institute on Aging of the National Institutes of Health under awards R56 AG062621, R01 AG061406 and RF1AG069334. The authors declare no competing interests. All data are stated to be included in the article and its supplementary information, with additional material available from the corresponding author. Three authors – Law, Kretzschmar and Giebultowicz – are shared with Appendix C.50, which bears on the concentration question recorded for Part V.A.1.

C.70 Jun and others (2020) — the spectral distribution as the governing variable, within one technology and across two

Funding, stated first because it bears on the use made of this study. Supported by the Basic Science Research Program (NRF-2019R1F1A1063311) and the Korea Mouse Phenotyping Project (2013M3A9D5072551) of the Ministry of Science and ICT through the National Research Foundation of Korea, and by LG Display Co., Ltd., of Seoul. LG Display manufactures organic light-emitting diode panels, and the organic panel used as a test article in the study was an LG Display product, model LL056RS1-54P1. The authors state that the funding sources had no role in the design or conduct of the study or in the decision to publish, and separately declare no competing interests. The Foundation records the declaration and the funding together and leaves the reader to weigh them. The consequence for this comment is stated below: the study's recommendation is not adopted, and the finding relied on is one that is adverse to the labeling of both technologies rather than favorable to either.

Citation. Jun I, Han SJ, Shin HS, Kim J, Kim EK, Kim TI, Yoon SC, Seo KY. "Comparison of ophthalmic toxicity of light-emitting diode and organic light-emitting diode light sources." Scientific Reports 2020;10(1):11582. doi:10.1038/s41598-020-68565-3. PMID 32665663; PMCID PMC7360575. Received September 6, 2018; accepted June 23, 2020. Open access under the Creative Commons Attribution license; full text read. Department of Ophthalmology, The Institute of Vision Research, Yonsei University College of Medicine, Seoul. The title is reproduced verbatim and contains a word this comment otherwise avoids.

Light sources, which are the point of the study. Three lamps, each identified by manufacturer and model. A white light-emitting diode, RFsemi Technologies PBA-0422-04, at 5,700 kelvin. A warmer light-emitting diode, the same RFsemi part number, at 4,000 kelvin, included by the authors for the stated purpose of matching the correlated color temperature of the organic panel. And an organic light-emitting diode panel, LG Display LL056RS1-54P1, at 4,000 kelvin. Spectral power distributions for all three are given in the paper's Supplementary Figure S5, which the Foundation has not obtained.

Exposure conditions. Cells were exposed to 10,000 lux for 45 minutes at room temperature. Animals were exposed to 1,000 lux of the white light-emitting diode or the organic panel for twelve hours a day for eight weeks, lights on at 8 a.m., which the authors describe as simulating the brightness of typical indoor illumination. A further set of animals was exposed at 2,000 lux to clarify the difference between the two sources. Illuminance was monitored and maintained throughout and ambient temperature held at 24 plus or minus 2 degrees Celsius. Exposures were therefore matched on illuminance, which is a photopically weighted quantity, and not on irradiance or on blue content.

Materials. Four human cell lines: an SV40-immortalized corneal epithelial line, the Chang conjunctival line, ARPE-19 retinal pigment epithelial cells and HLE-B3 lens epithelial cells. Animals: eight-week-old female BALB/c mice, which are albino. Approved by the Committee on Animal Research at Yonsei Medical Center under the institution's guidelines, the AAALAC standards and the ARVO Statement for the Use of Animals in Ophthalmic and Vision Research.

The comparison that identifies the variable, and it is not the comparison in the title. The white lamp at 5,700 kelvin and the warmer lamp at 4,000 kelvin were the same manufacturer's same part number, RFsemi PBA-0422-04, differing in correlated color temperature. In conjunctival epithelial cells, reactive oxygen species rose to approximately eighteen and eleven times the unexposed level respectively, both significant. The emitting technology, the manufacturer and the product line were therefore held constant while the spectral distribution varied, and the response varied with it. That comparison, which the paper's title does not advertise, is the one the Foundation relies on at Part V.B.3, because it

establishes that the governing variable is the spectrum rather than the product type. The comparison across the two technologies at matched correlated color temperature, described in the next field, establishes the complementary half: that the descriptor fails across technologies as well.

The finding the Foundation relies on, and it is a finding about a descriptor. At a matched correlated color temperature of 4,000 kelvin, the light-emitting diode lamp and the organic panel produced different biological responses. In conjunctival epithelial cells, reactive oxygen species rose approximately elevenfold above unexposed levels under the light-emitting diode at 4,000 kelvin, while the organic panel at the same correlated color temperature produced no statistically significant increase. Interleukin-8 expression showed the same pattern: significantly raised by the white light-emitting diode, and not significantly different from unexposed for either the correlated-color-temperature-matched light-emitting diode or the organic panel in conjunctival cells. Reactive oxygen species production was significantly higher under the white light-emitting diode than under the organic panel in all four cell lines. The authors attribute the difference to peak structure: a phosphor-converted light-emitting diode generates white from two spectral peaks and an organic panel from three, so reaching a given correlated color temperature with two peaks requires proportionally more energy in the blue. That explanation is a statement about how the technologies work and is checkable independently of the study's conclusion.

The animal results, and the problem with them. At 1,000 lux, photoreceptor layer thickness was significantly reduced in both light-exposed groups against the dark control, and significantly greater in the organic panel group than in the light-emitting diode group. The electroretinogram was significantly reduced in both light groups against control in the scotopic a-wave, scotopic b-wave and photopic b-wave, but there was no statistically significant difference between the two light sources at this illuminance. The authors then doubled the illuminance to 2,000 lux to obtain a difference, and at that level the photoreceptor layer measured 45.33 plus or minus 2.07 micrometers in controls, 8.40 plus or minus 9.31 under the light-emitting diode and 18.89 plus or minus 4.31 under the organic panel. The Foundation draws attention to the second of those figures. The reported dispersion exceeds the reported mean, which indicates that some animals retained almost no photoreceptor layer at all and that the group was severely and unevenly damaged. A comparison whose more affected arm has a standard error larger than its mean will not bear weight, and the Foundation places none on it. The cautious reading of the animal data is the 1,000 lux result: a structural difference between the two sources without a corresponding functional one.

Two further results worth recording. First, the ocular surface. 4-hydroxynonenal, a marker of lipid peroxidation, was most intense in the light-emitting diode group, less in the organic panel group and barely detectable in controls, while gross morphology and histology of the ocular surface showed no abnormality in either light group. An inflammatory and oxidative response at the ocular surface, below the threshold of anything visible on examination, is a target the hazard framework described at Part V.C.2 does not address for this waveband. Second, an unexpected finding the authors report and cannot explain: the epidermal thickness of the eyelid was greater in both light-exposed groups than in controls. They compare it to the epidermal thickening produced by repeated ultraviolet exposure, note that no such effect has been reported for light-emitting diodes, and call for further investigation.

What it does not establish. Nothing about humans; the animals are albino mice, which lack a macula and have a rod-dominated retina. Nothing about ordinary domestic exposure: 1,000 lux is brighter than a typical home interior, it was delivered for twelve hours a day for eight weeks to caged animals with no means of avoidance, and the cell exposures were at 10,000 lux. No threshold and no safe level. And the Foundation expressly does not

adopt the authors' recommendation that a change from light-emitting diode to organic light-emitting diode lighting may be warranted. That recommendation favors the product of a funder of the study, the Foundation takes no position on any commercial technology, and the proposition it relies on here does not depend on the recommendation being right.

Two matters it sharpens elsewhere in this comment. First, the albino question. These authors state that pigmented animals are more resistant to light damage than albino animals, and give that as a reason their findings may overstate the effect in pigmented animals and in humans. The authors at Appendix C.63 take the contrary position, defending their use of albino animals on the authority of published action spectra reported to show albino and pigmented rodents equally sensitive. Those positions cannot both be right, and both trace to the same body of work. The acquisition of van Norren and Gorgels is already the highest-priority verification item in this comment for the retinal dose figures at Part V.C.2.f; it is now load-bearing for this disagreement as well. Second, the electroretinogram. This is the third independent group in Appendix C to report attenuation of the electroretinogram after blue or blue-enriched light exposure, the others being at Appendix C.66 and the study reported at second hand at Appendix C.67. Three groups converging on one functional endpoint is worth stating at Part V.C.1 once the underlying paper behind the third is obtained.

Where it bears. Part V.B.3, as the biological demonstration that correlated color temperature does not determine blue content, which is the subsection's central proposition and underwrites the request at Part IX.C for spectral power distributions rather than correlated color temperature. Part V.J.4, in the audit of reported exposures. Part V.C.2.h and Part V.C.1.g, for the ocular surface findings, which concern tissues the framework does not address for this waveband.

C.71 Zhao and Shen (2020) — the retinal ganglion cell, the compromised eye, and a quantified concentration of the literature

Article type and version. A review. The authors state that twenty-six related articles were included after a database search, and the body of the paper describes twelve in vitro studies in its Table 1 and sixteen animal studies in its Table 2, which total twenty-eight; the discrepancy is unexplained and is recorded here rather than resolved. No search strategy, date range, keyword list or appraisal instrument is stated, so it is a narrative review and is cited in the category described at Part V.A.2, as evidence of the state of expert opinion and not as primary evidence of any effect. The Foundation read the copy served by PubMed Central. An open-access location search characterizes that deposit as the author's submitted version rather than the version of record, and the lesson of Appendix C.1 is that the two can differ materially, so the published version must be checked before any figure here is relied on.

Citation. Zhao Y, Shen Y. "Light-Induced Retinal Ganglion Cell Damage and the Relevant Mechanisms." Cellular and Molecular Neurobiology 2020;40(8):1243–1252. doi:10.1007/s10571-020-00819-0. PMID 32107750; PMCID PMC11448955. Published online February 27, 2020. Department of Ophthalmology, The First Affiliated Hospital, College of Medicine, Zhejiang University, Hangzhou. Cite the publisher's version.

Why it is new to this comment. Every mechanistic entry in this appendix concerns the photoreceptors, the retinal pigment epithelium or, at Appendix C.66, the retinal vasculature. This review concerns the retinal ganglion cell, whose axons constitute the optic nerve and whose loss is irreversible. It is therefore a fourth retinal target. It also joins two bodies of literature this comment has kept separate, because the melanopsin-containing cells that mediate the non-image-forming responses discussed at Part V.F are themselves retinal ganglion cells.

The three mechanisms it identifies. First, direct action on ganglion cell mitochondria and on DNA, raising reactive oxygen species and producing caspase-dependent or caspase-

independent cell death. Second, mediation through gliotransmitters or the receptors of retinal glial cells; the review reports that astrocytes contain chromophores capable of absorbing components of the visible spectrum, and that Mueller cells and microglia are activated after light exposure. Third, a secondary consequence of photoreceptor and pigment epithelial degeneration with subsequent retinal remodeling. The review places the first two early and the third late. The mitochondrial route connects to Appendix C.69, where inhibition of a specific mitochondrial complex was measured, and the glial route connects to the study reported at second hand at Appendix C.67, whose proposed mechanism for a reduced electroretinogram b-wave was a change in Mueller cell conductance.

The statement the Foundation relies on, and it concerns susceptible populations. The review states that ganglion cell mitochondrial photosensitizers in a homeostatic state can counteract the effect of light, but that where that homeostatic state is compromised – the review names glaucoma, diabetic retinopathy, the aged retina and the genetic defect of Leber's hereditary optic neuropathy – then, in the authors' words, normal or even less than normal intensity of light may become one type of insult to these cells. The Foundation draws attention to the phrase. It is a statement from within the field that for an identified set of conditions the ordinary ambient level is not known to be safe. It corroborates the sensitive-population material at Part V.C.2.c and the observation of the predecessor European committee, recorded at Part V.K.9, that a low risk group classification should not be taken to imply adequate protection of the general population as a whole. The review adds that intraocular lens implantation or aphakia removes the filtering of the aged lens, which bears on the aphakic action spectrum discussed at Part V.C.2.c.

A second statement, on premature infants. The review reports a study in which neonatal mice had one eyelid incised to permit light exposure before the eyelids would naturally open, and in which the ganglion cells of the light-exposed retinas suffered considerable loss. The reviewers draw the inference that a relatively dark environment may be more beneficial for the development of the visual system in premature infants. The Foundation records it as a lead bearing on lighting in neonatal care settings, which Part VI.E addresses, and not as a finding about any human infant.

What it reports about exposure, which bears on Part V.J.4. The review characterizes the exposures of the studies it summarizes in illuminance only. Cell studies used 250 to 4,000 lux for durations from 3.5 minutes to five days, most longer than 24 hours. Animal studies used 500 to 20,000 lux for 1 to 48 hours, most under 12 hours. No irradiance, no radiance and no spectral power distribution appears anywhere in the paper. Two further statements by the reviewers are more useful to this comment than the ranges. The first is that different groups, and the same group in different experiments, used diverse conditions differing in spectrum, intensity and duration – which is the third independent statement of the standardization problem recorded at Part V.J.4, the others being at Appendix C.67 and in the systematic review discussed in that subsection. The second is that the light levels used in animal models are, in the reviewers' assessment, relatively excessive compared with what reaches the retina in everyday situations. That is the Foundation's own criticism of this literature, stated from within it, and the Foundation adopts it as such rather than treating these studies as descriptions of ordinary exposure.

A methodological detail with consequences for every stated illuminance. The review records that in the majority of the studies the animals' pupils were dilated with atropine or tropicamide in order to admit more light. A stated illuminance therefore understates the retinal dose delivered in those experiments by an amount that depends on the pupil area achieved and is not reported. This belongs in the Part V.J.4 treatment of what reported exposures do and do not permit, and it is an additional reason that an illuminance figure from this literature cannot be placed against an exposure limit.

The concentration of the literature, quantified. The review reports that among its sixteen animal studies at least nine come from a single group, and that among its twelve in vitro studies nine are from the team of one investigator. The Foundation has recorded in several entries that the literature in this field is concentrated in a small number of groups; this is the first quantified instance, and it is stated by reviewers with no interest in making the point. Part V.A.1 is the place for it.

What it does not establish, and two findings adverse to the Foundation. It is secondary throughout and establishes nothing about humans, about any product, or about any exposure level. Two statements in it run against the Foundation and are recorded for that reason. The first is the review's own premise, stated twice: that normal daily levels of light are believed to have no harmful effect on eyes in healthy conditions. The Foundation does not dispute it and notes that the entire force of the review lies in the qualification rather than the premise. The second is a reported beneficial effect: the review describes a study in which blue light pulsed at 5 and 20 hertz for one hour enhanced neurite outgrowth in postnatal retinas, acting through ganglion cells including the melanopsin-containing subset, without significantly increasing cell death. That effect was obtained in a preparation expressing an engineered light-sensitive channel, which limits what it shows about ordinary light, but it is a reported benefit of pulsed blue light and the comment should not omit it. The review also notes reported benefits of red light, consistent with Appendix C.63.

Disclosures. Funding is stated as provided by the National Health and Family Planning Commission of China (WKJ-ZJ-1820) and the Department of Science and Technology of Zhejiang Province (2018C03017). The Foundation located no competing-interests declaration in the copy it read, and records that as an absence rather than as a declaration of none. Indexing metadata attributes one of the two grants to a differently named provincial department, and the article text is preferred.

Where it bears. Part V.C.2.c and Part V.K.9, for the susceptible-population statement, which is its principal value. Part V.J.4, for the exposure characterization, the standardization problem and the pupil dilation point. Part V.A.1, for the quantified concentration of the literature. Part V.F, for the ganglion cell as the shared substrate of injury and of the non-image-forming responses. Part VI.E, for the neonatal lead.

C.72 Tao, Zhou and Zhu (2019) — the mitochondrial target named, and a confound in the cell-culture literature

Article type. A review. No search strategy, date range, inclusion criteria or appraisal instrument is stated in the text the Foundation read, so it is a narrative review and is cited in the category described at Part V.A.2, as evidence of the state of expert opinion and for the framework it supplies, not as primary evidence of any effect. Every figure in it is reported at one remove.

Citation. Tao J-X, Zhou W-C, Zhu X-G. "Mitochondria as Potential Targets and Initiators of the Blue Light Hazard to the Retina." Oxidative Medicine and Cellular Longevity 2019;2019:6435364. doi:10.1155/2019/6435364. PMID 31531186; PMCID PMC6721470. Published August 21, 2019. Open access under the Creative Commons Attribution license; full text read. Department of Neurosurgery, The Second Affiliated Hospital of Nanchang University, Nanchang. Tao and Zhou are stated to have contributed equally.

Provenance, disclosed because an agency reader may raise it. The journal was published by Hindawi when this article appeared and is now published by Wiley. Hindawi's portfolio, this journal included, was the subject of large-scale retractions in 2022 and 2023 arising from compromised special issues and organized submission of fabricated manuscripts, an episode widely reported in the research-integrity press. The Foundation records three things against that background. This article carries no retraction, correction or expression of concern. The National Library of Medicine catalog

records the journal as currently indexed for MEDLINE, with no ceased date. And a journal-level integrity episode is not evidence about a particular paper: this review is cited as reference 11 of the study at Appendix C.69, published in a Nature Portfolio journal three years later, which is some indication of its standing in the field. The Foundation raises the point so that the Department does not have to.

The identification the Foundation relies on, which is the principal value of the entry. The review names the mitochondrial chromophore and gives its absorption. Complex IV of the electron transport chain, also called cytochrome oxidase or cytochrome c oxidase, contains heme centers and has an absorption peak at approximately 420 nanometers in the oxidized form and approximately 440 nanometers in the reduced form. That is the same enzyme on which the deep red and near-infrared literature discussed at Part V.B.6 rests, and the coincidence of a blue absorption band and a long-wavelength one in a single enzyme is what connects the two halves of Part V.B. The review further reports that cytochrome oxidase expression in the rat retina was irreversibly inhibited by blue light at 404 nanometers; that a study testing the four respiratory complexes separately concluded at least two of the four are implicated in blue-light injury; that one group attributes adenosine triphosphate depletion to direct action on respiration and oxidative stress to indirect action; and that the injury was attenuated in fibroblasts whose respiratory chain function had been deliberately perturbed, which is the control that most directly implicates the chain itself.

The finding about visible change, which bears on what a limit measures. The review reports that cytochrome oxidase activity was significantly altered in different layers of the rat retina over time while no visible retinal morphological change was observed by ophthalmoscopy or by light microscopy. The Foundation relies on that sentence at Part V.B.6 and Part V.C.1.g. A measurable change in a respiratory enzyme with no lesion detectable on examination is the class of effect that a limit calibrated to threshold lesion formation is not constructed to detect.

The three injury mechanisms, which the comment adopts as a framework. The review states that at least three mechanisms operate between 400 and 1,400 nanometers. Photomechanical damage is produced by very high irradiance, of the order of megawatts to terawatts per square centimeter, over picoseconds to nanoseconds, and is, in the review's words, not determined by the wavelength of light; the energy is absorbed by melanin granules in the pigment epithelium and produces lethal microcavitation bubbles, a mechanism used deliberately in yttrium-aluminum-garnet laser iridotomy and capsulotomy. Photothermal damage is also governed by irradiance thresholds and requires microseconds to a few seconds to reach thermal equilibrium. Photochemical damage is the wavelength-dependent mechanism. Part V.B uses that division, because two of the three turn on delivered irradiance rather than on wavelength, which is the spatial characteristic, and all three turn on duration.

A confound in the cell-culture literature, reported against the Foundation's own evidence. The review warns that culture media themselves contain photosensitizers and that researchers should attend to medium-mediated effects. It reports that neurite outgrowth from retinal explants was inhibited when the medium was irradiated, and that unirradiated mammalian cells died when incubated in medium that had previously been irradiated near 365 nanometers, an effect attributed to riboflavin together with tryptophan or tyrosine present in the medium. The Foundation states the consequence plainly because it runs against several of its own entries. Appendices C.61, C.65, C.66, C.68 and C.70 all report effects in cultured cells in media of this kind. To the extent that irradiated medium generates injurious photoproducts, some part of what those studies attribute to light acting on cells may be light acting on the medium. None of them reports a medium-only irradiated control. That is a real limitation of the in vitro literature, it is identified from within the field, and the comment records it rather than waiting for the agency to.

Two further items. First, the review states that more than 65 percent of blue light at 460 nanometers is transmitted to the retina in children younger than nine, which independently corroborates the figure the comment takes from the 2012 Opinion of the predecessor European committee at Part V.C.2.g and supplies a further route to the underlying measurement through its own reference 43. Second, the review records a subdivision of the waveband into blue-violet light of approximately 400 to 440 nanometers and blue-turquoise light of approximately 440 to 500 nanometers, which is worth noting because the two subranges do not have the same relationship to either the hazard weighting of Part V.C.2.a or the melanopic sensitivity of Part V.F.

What it does not establish, and one statement not adopted. No primary data, no threshold, no exposure limit, and nothing about any product. The Foundation also does not adopt the abstract's characterization of blue light as having strong penetration. The phrase appears once, in the abstract, and is not developed in the body. Short wavelengths penetrate biological tissue less than long ones, and the reason blue light reaches the retina is ocular transmittance rather than penetrating power; the review's own careful treatment of wavelength-resolved absorption by the cornea, aqueous humor and lens makes that clear. The comment uses the transmittance account and not the penetration phrase.

Disclosures. Supported by the National Natural Science Foundation of China (81760446 and 81660420), the Natural Science Foundation of Jiangxi Province (20171ACB20035), the Construction Plan of the Superior Science and Technology Innovation Team of Jiangxi Province (20152BCB24009) and the Foreign Science and Technology Cooperation Plan of Jiangxi Province (20151BDH80009). The authors declare no conflict of interest.

Where it bears. Part V.B.6, as the identification of the mitochondrial chromophore and the bridge between the blue-light and long-wavelength material. Part V.B, for the three injury mechanisms that substantiate the three-characteristic frame. Part V.C.1.g, for the alteration of enzyme activity without visible change. Part V.C.2.g, corroborating the pediatric transmittance figure. Part V.A.2 and Part V.J.4, for the culture-medium confound.

C.73 Zhao, Zhou, Tan and Li (2018) — a 2018 review scored against the record assembled since

Article type and quality of the text. A five-page review with no stated search strategy, inclusion criteria or appraisal instrument, cited in the category described at Part V.A.2 as evidence of the state of expert opinion and not as primary evidence of any effect. The Foundation records a presentational matter because it affects quotation. The English of the published text is unreliable: it uses "Blu-ray" throughout as a term for blue light, which is a disc format and not a waveband; it renders the lipofuscin fluorophore A2E by a garbled chemical name; it refers to the lens as the crystal and to the vitreous as the glass cavity; and in one passage it appears to write skin cells where retinal pigment epithelial cells are meant. Nothing should be quoted from this source without checking the sense against the cited original, and the Foundation has paraphrased rather than quoted it except where noted.

Citation. Zhao Z-C, Zhou Y, Tan G, Li J. "Research progress about the effect and prevention of blue light on eyes." International Journal of Ophthalmology 2018;11(12):1999–2003. doi:10.18240/ijo.2018.12.20. PMID 30588436; PMCID PMC6288536. Published December 18, 2018. Department of Ophthalmology, Xi'an No. 4 Hospital, Xi'an, Shaanxi. The lead author is not the Zhao of Appendix C.71, which is a different investigator at a different institution.

Why the Foundation treats this entry differently from the other reviews. It is cited for its date. The determination the comment examines at Part I.C.7 issued on May 24, 2024. This review appeared in December 2018, five and a half years earlier, in a journal indexed in the National Library of Medicine. It therefore bears on what the ordinary literature

contained before the determination, which is the question line (3) of that subsection raises. Because a 2018 review can be assessed against what followed, the Foundation has scored its claims rather than merely summarizing them, and reports the result in both directions.

Claims borne out by the literature assembled since. Five, in descending order of how specifically they were later confirmed.

The blood-retinal barrier as a target. The review reported blue-light retinal edema in two mouse models on imaging and optical coherence tomography, barrier impairment mediated by inflammatory factors including tumor necrosis factor and interleukin-1, and the speculation that some cell death is caused indirectly by exuded blood components rather than directly by light. Appendix C.66, published in 2023, identified a molecular route to barrier failure: cleavage of the endothelial tight junction protein claudin-5 by the metalloprotease ADAM17. The phenomenon was correctly identified in 2018. The mechanism proposed in 2018 was inflammatory and secondary to photoreceptor death; the mechanism since identified is direct and proteolytic and does not require photoreceptor death first. Right about the target, partly wrong about the route.

Mitochondria as the principal target. The review stated that mitochondria are the main targets of blue-light-associated oxygen free radicals. Appendix C.72 subsequently named the chromophore and its two absorption peaks, Appendix C.69 measured inhibition of a specific respiratory complex in an intact animal, and Appendix C.71 gives direct mitochondrial action as the first of three injury routes to the ganglion cell. Vindicated, and since measured rather than inferred.

The retinal ganglion cell as a distinct target, with mitochondrial injury and programmed necrosis as the mechanism. Appendix C.71, published two years later, is a review devoted to that subject. Vindicated.

The ocular surface. The review attributed reactive oxygen species production, inflammatory signaling and dry eye to blue light acting on corneal and conjunctival epithelium. Appendix C.70 reported reactive oxygen species and interleukin-8 in human corneal and conjunctival epithelial cells and a lipid peroxidation marker on the ocular surface in mice, with no change visible on examination. A different cytokine, the same tissue and the same oxidative mechanism. Vindicated.

The waveband. The review placed the most injurious region between 415 and 455 nanometers. The peak of the weighting function in the governing guidelines is 445 nanometers, inside that range. Right, and more accurate than an earlier draft of this comment, which gave the peak as 435 to 440 nanometers before the error was corrected.

Claims not borne out. Two, and the Foundation states them because a scoring exercise that reported only the hits would be worthless. The review asserted that blue light can accelerate the occurrence and development of age-related macular degeneration, and that oxidative stress in lens epithelial cells may lead to cataract. Neither proposition has been established in humans. The 2023 review of the human clinical literature at Appendix C.67 concludes that it is difficult to state with certainty that blue light exerts a harmful effect on the human retina at all, and the comment does not advance either the macular degeneration claim or the cataract claim. The review's chain from blue light through sleep disruption to raised corticosteroids, reduced androgens, meibomian gland dysfunction and evaporative dry eye is the weakest reasoning in the paper, every link being at one remove, and the Foundation does not adopt it.

One body of claims pointing the other way, and unresolved. The review devotes a section to refractive development and reports the opposite valence from the rest of the paper: that short-wave light inhibits axial elongation, that monochromatic blue light produced relative hyperopia in guinea pigs, that myopia could be reversed toward hyperopia after blue light exposure, and that the richness of daylight in short wavelengths

may be why outdoor activity protects against myopia. If those findings hold, blue light is protective for one of the most prevalent ocular conditions in the world. The Foundation records this as unresolved rather than scoring it, because the comment contains no myopia material and the state of that literature in 2026 has not been established by the Foundation. It is recorded because an agency reader may know it, and because a comment that cited this review while omitting its refractive section would be selectively quoting a source it had read in full.

The sentence the Foundation relies on. Writing in 2018, the authors observed that research indicating minimal risk from ordinary digital displays, with most displays falling within the applicable standard, was a conclusion about short-term exposure only, and that measures addressed to long-term exposure remained necessary. That is the gap identified at Part V.C.2.c, where the framework ceases to accumulate dose at ten thousand seconds, and at Part V.K, where the limits are shown to have been calculated for a maximum of one eight-hour day. Practising ophthalmologists stated it in an indexed journal in 2018. The Foundation uses it at Part I.C.7 for that reason and for no other.

A caution the review states that the Foundation endorses. The review states that it is unscientific to treat all blue light as directly injurious, and sets against the injury material the benefits of blue light for circadian regulation and, on its account, for refractive development. That caution, offered in 2018 against the prevailing direction of concern, is the most creditable judgment in the paper and is consistent with the position the Foundation takes at Part V.C.2.e. It also anticipates the wavelength-specific findings at Appendix C.63, where green content drove white-light injury and red content mitigated it.

Disclosures. Supported by the National Natural Science Foundation of China (81400424), the Science and Technology Research and Development Project of Shaanxi Province (2014K11-03-07-04), the Innovative Talents Promotion Project of Shaanxi Province (2017KJXX-87) and the Hunan Province Education Department Outstanding Youth Science Foundation (15B210). Conflicts of interest are declared individually for each of the four authors, each as none, which is a more explicit form of declaration than most entries in this appendix carry.

Where it bears. Part I.C.7, for what the indexed literature contained before the determination of May 24, 2024, which is its principal use. Part V.C.2.c and Part V.K, for the short-term-only observation. Nowhere as evidence of any effect.

C.74 Nakamura and others (2018) — eleven times the illuminance from a fluorescent source did less damage

What the Foundation has read. The article is closed access and the publisher does not serve it to automated retrieval. The Foundation has read the abstract together with the introduction, the conclusion, the opening of the discussion and the section extracts the publisher exposes, supplied by Mr. Baker. That text contains the exposure levels and the principal results. It does not contain the complete methods. The specific omissions are recorded in the note at the end of this entry and the entry must be completed when the full text is obtained.

Citation. Nakamura M, Yako T, Kuse Y, Inoue Y, Nishinaka A, Nakamura S, Shimazawa M, Hara H. “Exposure to excessive blue LED light damages retinal pigment epithelium and photoreceptors of pigmented mice.” Experimental Eye Research 2018;177:1–11. doi:10.1016/j.exer.2018.07.022. PMID 30040948. Published online July 21, 2018. Molecular Pharmacology, Department of Biofunctional Evaluation, Gifu Pharmaceutical University, Gifu, Japan. Cite the publisher’s version.

Exposure conditions, which are the reason for the entry. Blue light-emitting diode illumination at 1,100 lux, for one day or for three days. The comparison arm was white fluorescent illumination at 12,000 lux for a comparable duration. Animals were male

C57BL/6J mice, eight weeks of age, obtained from Japan SLC, housed on a twelve-hour light and twelve-hour dark schedule. C57BL/6J is a pigmented strain. Approved by the Institutional Animal Care and Use Committee of Gifu Pharmaceutical University under the ARVO Statement for the Use of Animals in Ophthalmic and Vision Research. The peak wavelength of the diode source is not stated in the text available to the Foundation, nor is the source distance, nor whether the stated illuminance was continuous or delivered within the light phase of the housing cycle.

The finding the Foundation relies on. Blue diode light at 1,100 lux damaged the retinal pigment epithelium and the photoreceptors of pigmented mice. White fluorescent light at 12,000 lux did not produce severe retinal damage in the same strain. A source delivering approximately one eleventh of the photometric quantity produced the injury that the brighter source did not. The paper sets this against three earlier results in pigmented animals under fluorescent light, which the Foundation reproduces at Part V.B.3: no retinal damage at 1,200 to 1,600 lux for 24 hours in pigmented mice; no severe damage at 10,000 lux on a twelve-hour cycle for six consecutive days in pigmented rats; and the paper's own negative result at 12,000 lux. The authors state that no light-induced retinal damage model for pigmented mice had previously been established, and that their own earlier work in albino animals had already found blue diode light damaging at a lower intensity than fluorescent light.

Results in detail. Outer nuclear layer thickness was significantly reduced six days after exposure to blue diode light for either one or three days, with changes more severe and longer lasting after three days. Fundus appearance and optical coherence tomography were altered on days one, three and six; by day six the fundus showed white spots, and on days three and six the retinal layers were significantly thinner on tomography. Histology showed material accumulated at the junction of the inner and outer segments of the photoreceptors, staining for the macrophage marker Iba-1 and positive on periodic acid-Schiff staining. The area of the retinal pigment epithelium was enlarged immediately after exposure, particularly around the optic nerve, and photoreceptor degeneration followed as a secondary event. The authors describe the accumulated material as pseudodrusen-like and the changes as resembling those in eyes with non-exudative age-related macular degeneration.

A criticism of the field made by these authors, which the Foundation adopts. Reviewing the earlier literature, the authors describe a 2013 study that exposed mice to 7,000 lux of white fluorescent light for fifty hours and state that the exposure time may have been too long and the intensity too high for meaningful interpretation. That is the fourth independent statement in this appendix, from within the field, that the exposures used in this literature are too severe to support inference about ordinary conditions; the others are at Appendices C.63, C.67 and C.71. The Foundation notes that the criticism applies with some force to this study as well, whose own title describes its exposure as excessive.

What it does not establish, and the Foundation is emphatic about this one. It does not establish that light-emitting diode products cause age-related macular degeneration in humans, and the Foundation does not advance it for that purpose. Material described as pseudodrusen-like in a mouse is evidence that an exposure can produce a morphology resembling a human disease in an animal, and the authors' stated conclusion is that the model is useful for studying mechanisms, which is a statement about a research tool. The comment scores the contrary claim as unvindicated at Appendix C.73 and records at Appendix C.67 that the human clinical literature does not support it. Nothing here changes either assessment. Nor does the study establish a threshold: 1,100 lux of near-monochromatic blue light sustained for a day or more is far above the blue content of ordinary domestic illumination, and the comparison establishes a relationship between two sources rather than a safe level for either.

The narrower uses the Foundation makes of it. Four. First and principally, at Part V.B.3: that the photometric quantity in which lighting is specified and procured did not predict the outcome of this comparison and predicted it backwards, which is a demonstration of the defect that subsection identifies. Second, that the injury occurred in a pigmented animal, which answers the objection that this literature is an artifact of albino susceptibility and bears on the unresolved disagreement between Appendices C.63 and C.70. Third, that the retinal pigment epithelium was the primary target and photoreceptor loss secondary, consistent with the third injury route at Appendix C.71. Fourth, at Part V.C.1.a, that blue diode light is used by investigators as a method for producing retinal degeneration, this being the clearest instance because the phenotype resembles a named human condition.

Shared authorship, recorded for Part V.A.1. The last author and the departmental affiliation are shared with Appendix C.65: Molecular Pharmacology, Department of Biofunctional Evaluation at Gifu Pharmaceutical University appears in both, and Hara is an author of both. The two entries are not independent observations from separate groups. This is the third instance of author concentration identified in this appendix, with the laboratory shared between Appendices C.50 and C.69 and the figures reported within Appendix C.71.

Where it bears. Part V.B.3, as the second and stronger biological demonstration that illuminance does not determine the hazard. Part V.B, in the spectral leg of the three-characteristic frame. Part V.C.1.a, as a damage model. Part V.C.2.f, Appendix C.63 and Appendix C.70, on pigmented and albino animals. Part V.J.4, in the column of studies whose exposure cannot be placed against a numerical limit, the wavelength being unreported, with the qualification that the internal comparison between the two arms remains valid because both were measured in the same unit. Part V.A.1, for the shared authorship.

C.75 Jaadane and others (2017) — damage below the threshold the exposure limit was derived from, in the unit the limit is written in

Citation. Jaadane I, Villalpando Rodriguez GE, Boulenguez P, Chahory S, Carré S, Savoldelli M, Jonet L, Behar-Cohen F, Martinsons C, Torriglia A. "Effects of white light-emitting diode (LED) exposure on retinal pigment epithelium in vivo." Journal of Cellular and Molecular Medicine 2017;21(12):3453–3466. doi:10.1111/jcmm.13255. PMID 28661040; PMCID PMC5706508. Published online June 29, 2017. Open access; full text read. A correction was added on July 12, 2017 after first online publication, the author affiliations having been labeled incorrectly. Centre de Recherche des Cordeliers and Inserm; Ecole Nationale Vétérinaire d'Alfort; and the lighting and electromagnetism division of the Centre Scientifique et Technique du Bâtiment.

Why this entry matters more than most. Three reasons. The exposure was a commercially available warm white lamp of a named retail model, which the authors describe as widely used in residential lighting, rather than a monochromatic laboratory source. The exposure is reported as a retinal radiant exposure dose in joules per square centimeter, which is the unit in which the blue light hazard exposure limit is expressed, so the study can be placed directly against the limit; so far as the Foundation has found, no other entry in this appendix can. And the doses were, by the authors' express design, fixed below the damage threshold from which the exposure limit values were calculated.

Exposure conditions. A device built and characterized by the Centre Scientifique et Technique du Bâtiment containing ten Xanlite Evolution 5 watt white light-emitting diode lamps, fitted with a diffuser to improve uniformity and to suppress point-source effects. Resulting luminance 2,680 candelas per square meter and radiance 8.33 watts per square meter per steradian. Retinal radiant exposure dose computed with software developed by that laboratory, accounting for the cage, following the methods of Sliney and of van Norren and

taking the spectral transmittance of the rat ocular media into account. Posture coefficient 0.5, pupil diameter 5 millimeters, focal length 5.25 millimeters. Animals were male Wistar rats, albino, purchased at six weeks and described in the figure legend as seven weeks at exposure, four per condition, exposed to constant light for 4.75, 6, 12, 18 and 24 hours, giving computed retinal doses of 4.14, 5.23, 10.5, 15.7 and 20.9 joules per square centimeter. Pupils were neither dilated nor dark-adapted, the authors stating that this was to avoid introducing procedures that sensitize to photodamage. A fluorescent comparison arm used the same age and strain at 2,000 lux for 6 hours 25 minutes from bulbs 20 centimeters above the cages, which the authors compute as the same retinal dose of 4.14 joules per square centimeter.

The regulatory figures it reports, which corroborate Part V.C.2.f. The authors state that exposure limit values were calculated on the basis of a factor of ten to one hundred fold below the values that induce macroscopically observable retinal lesions; that for the retinal blue light hazard the limits were derived from a basic restriction of 2.2 joules per square centimeter of retinal exposure dose; and that this represents one fifth of the calculated damaging dose evaluated at 11 joules per square centimeter. Those are the same 2.2 and 11 figures the comment states at Part V.C.2.f from a different source, independently corroborated here. The Foundation notes one tension the authors do not address: the general margin they describe is a factor of ten to one hundred, while the specific blue light figures they give stand in a ratio of five.

Results. At 4.14 joules per square centimeter, after 4.75 hours, the actin cytoskeleton of the pigment epithelium was disorganized and protein kinase C zeta had translocated to the plasma membrane. At 5.23, after 6 hours, tight junctions were disrupted with changes in cell morphology and the appearance of stress fibers. At 10.5, after 12 hours, syncytia appeared. At 15.7, after 18 hours, actin became sparse with cytoplasmic aggregates, some cells losing the cytoskeleton almost entirely and showing vacuoles, and protein kinase C zeta had translocated to the nucleus following cleavage, which the authors treat as a death signal. Serum albumin leaked into the interphotoreceptor space and the leakage increased with exposure time, which is the direct evidence of outer blood-retinal barrier failure. Oxidative stress was inferred from cellular responses rather than measured directly, the authors stating that labeling oxidation of proteins and lipids in the pigment epithelium proved difficult. Basal autophagy was disturbed. Cell death was necrotic: staining for apoptosis was negative. The authors also report early formation of polynucleated cells and increased cell size, both features they associate with ageing of the pigment epithelium. An intravitreal protein kinase C zeta inhibitor was used as an interruption experiment.

The sub-limit figure, and the three qualifications the Foundation attaches to it. In the discussion the authors take the lowest damaging dose, 4.14 joules per square centimeter in total, observe that the blue part of the spectrum accounts for 14 percent of it, and give the blue retinal dose as 0.58 joules per square centimeter, which they describe as far below the 2.2 figure presumed completely safe. That is roughly one quarter of the limit. The Foundation relies on it subject to three qualifications, set out at Part V.C.2.f and summarized here: the 0.58 figure is a flat band fraction rather than a dose weighted by the hazard function the limit uses; the computed retinal dose rests on an assumed pupil diameter of 5 millimeters where the authors' own cited sources give values between 0.4 and 1.2 millimeters, an assumption that could overstate the delivered dose by a factor of seventeen to one hundred, erring in the direction that favors the finding but leaving the absolute values uncertain; and the dose was delivered over 17,100 seconds at the shortest, against a limit constructed for no more than 10,000 seconds.

An internal inconsistency, recorded. The discussion states that the dose of 4.14 joules per square centimeter was delivered not in 10,000 seconds but in 64,800 seconds. Sixty-four thousand eight hundred seconds is eighteen hours, which the figure legend assigns to a dose of 15.7 joules per square centimeter; 4.14 is assigned to 4.75 hours, or 17,100 seconds,

and the fluorescent arm delivering the same dose ran 6 hours 25 minutes, or 23,100 seconds. The pairing in that sentence therefore does not match the rest of the paper. The point the sentence makes survives the error, because every exposure in the study exceeded 10,000 seconds, by factors between 1.7 and 8.6. But the specific number should not be quoted until it is resolved.

What it does not establish. Nothing about humans. The animals were albino rats, and the comment records at Appendix C.63 and C.70 that whether albino rodents are more susceptible than pigmented ones is disputed. Four animals per condition. Nothing about age-related macular degeneration in people, notwithstanding that the pigment epithelial changes reported resemble features of that disease; the comment's position on that is at Appendix C.67, C.73 and C.74. And the exposures, though below the lesion threshold, were continuous illumination for between five and twenty-four hours, which is not a domestic exposure pattern.

Author overlap, which is substantial and belongs at Part V.A.1. This study shares Behar-Cohen, Martinsons and Torriglia with Appendix C.63, the 2024 threshold re-measurement. Behar-Cohen sat on the working group of the 2012 Opinion of the predecessor European committee recorded at Appendix D.1 and is an author of Appendix C.59. Martinsons is the author of the chapter at Appendix D.5, is an author of Appendix C.59, and his laboratory built the exposure apparatus both for this study and for the 2024 study. Torriglia held the French agency contract behind the 2024 study. The Foundation states this as a fact about the size of the field and not as a criticism of anyone: the same small group has produced the measurements, built the measuring apparatus and contributed to the expert assessments. That is a reason to weight the two studies as one sustained line of investigation rather than as independent confirmations, and it is also a reason the Department should fund work by groups outside it, which is a request Part IX.C can carry.

Funding and disclosures. Supported by Inserm, the Ecole Nationale Vétérinaire d'Alfort, the Centre Scientifique et Technique du Bâtiment, and a grant from the French environment and energy agency ADEME under the RETINALED and UV-LED projects; the first author held an ADEME fellowship. The Foundation records that the building science laboratory was both a funder of the study and the employer of the three authors who, by the stated contributions, designed, measured and mounted the lighting devices. The authors declare no conflict of interest, in a sentence whose wording is garbled in the published text.

Where it bears. Part V.C.2.f, as the identified instance behind the 2024 intergovernmental review's statement that independent teams have found retinal damage well below the exposure limit, and as the only entry whose exposure is reported in the unit of the limit. Part V.C.2.c, on the ten thousand second ceiling. Part V.C.1.g and Part V.C.2.h, as the outer blood-retinal barrier counterpart to the inner barrier study at Appendix C.66. Part V.J.4, in the audit of reported exposures. Part V.A.1, for the author overlap.

C.76 Shang, Wang, Sliney, Yang and Lee (2017) — three wavelengths at matched irradiance, and an author of the exposure limits among the authors

Citation. Shang Y-M, Wang G-S, Sliney DH, Yang C-H, Lee L-L. "Light-emitting-diode induced retinal damage and its wavelength dependency in vivo." International Journal of Ophthalmology 2017;10(2):191–202. doi:10.18240/ijo.2017.02.03. PMID 28251076; PMCID PMC5313540. Published February 18, 2017. Full text read. Institute of Environmental Health, National Taiwan University, Taipei. The journal is the same as that of Appendix C.73.

Why this entry carries unusual weight: the authorship. The third author is David H. Sliney, who is listed by the International Commission on Non-Ionizing Radiation Protection as a member of its Scientific Expert Group. The methods by which retinal radiant exposure dose is computed in Appendix C.75 are attributed in that paper to Sliney

and to van Norren. His stated contribution to this study is that he revised the study design and the manuscript and provided scientific collaboration, which is substantive involvement rather than courtesy authorship. The Foundation records this as a fact and draws from it only what follows: a study reporting wavelength-dependent retinal injury from light-emitting diode exposure in a mammal was designed with the participation of a person who contributed to the international framework by which such exposures are assessed. It is not an admission by anyone, and the Foundation makes no suggestion that it is. It does mean that this finding cannot be characterized as the work of investigators unfamiliar with the exposure limits.

Exposure conditions, which are the best characterized in this appendix. Three monochromatic light-emitting diode sources: blue peaking at 460 nanometers at 102.3 microwatts per square centimeter, green at 530 nanometers at 102.8, and red at 620 nanometers at 102.7. The arms were therefore matched on radiometric irradiance to within one percent, and wavelength was the only variable. Irradiance was measured at the level of the cornea, at 20 centimeters from each source, with the sources mounted at the top of shelves in a rack of six layers, each shelf curtained in black to separate the light conditions. The white light-emitting diode used for the spectral characterization is described as a yellow phosphor-converted source at a correlated color temperature of 6,500 kelvin, with a first peak at 460 nanometers at 0.028 watts per nanometer and a second broad yellow peak, and the paper plots the blue light hazard weighting function alongside it. Controls remained at 15.57 microwatts per square centimeter under cyclic compact fluorescent light at the same correlated color temperature. One author is credited specifically with coordinating the light source photometry and radiometry.

Design, and four features that distinguish it. In total 202 adult male eight-week-old Sprague-Dawley rats: 40 controls and 162 exposed. Ten days of environmental adaptation at the control light level, exposure beginning at 6 p.m. on day 11, and total exposure durations of 3, 9 or 28 days on a twelve-hour light and twelve-hour dark cycle. Temperature 22 to 23 degrees Celsius, humidity 50 to 70 percent, food and water without restriction. Four features are worth stating because they are uncommon in this literature: the comparison is matched on radiometric irradiance rather than on illuminance, so it isolates wavelength; the exposure is cyclic rather than continuous, which no other animal entry in this appendix can say except Appendix C.74; the investigators state that they were blinded to group allocation during the experiment and in assessing the outcome; and the sample is an order of magnitude larger than the four to eight animals typical elsewhere in this appendix, at 54 animals per exposure group for the electrophysiology.

Results. Electroretinography: the blue arm significantly weakened responses after three days, and after nine days the b-wave amplitude was significantly reduced in all three arms against control, with the blue arm showing the greatest loss. Histology after 28 days showed uneven alteration including absent photoreceptors and inner nuclear layer degeneration, with outer nuclear layer thickness significantly reduced in all exposure groups and most reduced under blue. Apoptosis and necrosis of photoreceptors and pigment epithelium were both found. Superoxide anion counts reached about 60,000 after three days of blue exposure against mostly under 20,000 for green and red. Hydrogen peroxide reached 0.13 nanomoles per retina under blue against 0.089 and 0.083 under green and red. Total retinal iron rose significantly under all three wavelengths, to about 2 nanomoles per retina under blue. Iron-handling proteins moved coherently as wavelength decreased: ceruloplasmin, ferritin and ferroportin up, transferrin and the transferrin receptor down, which the authors read as the cells detecting an increase in intracellular iron. Antioxidant defenses including heme oxygenase-1, superoxide dismutase 2 and glutathione peroxidase 1 were activated, the authors noting that heme oxygenase-1 can itself generate ferrous iron and carbon monoxide and so potentially worsen oxidative stress.

A result that runs against the simple account, stated for that reason. After nine days the b-wave was significantly reduced not only by blue but also by green and by red, and outer nuclear layer thinning after 28 days was significant in all three arms. At matched irradiance, red light at 620 nanometers produced a measurable functional and structural deficit. That is in tension with the long-wavelength material at Part V.B.6 and with the mitigating effect of red light reported at Appendix C.63, and the Foundation does not attempt to reconcile them here. The honest statement is that this study found a wavelength gradient with blue worst, not that it found blue harmful and the other wavelengths harmless. The gradient is the finding; the absence of a safe wavelength within the visible range, at this irradiance and duration, is also a finding and it is not one that favors the Foundation's emphasis on the short-wavelength peak alone.

A second tension, with Appendix C.63. The 2024 study at Appendix C.63 reports that within white light the green content drove phototoxicity, producing some eight times more macrophage invasion than blue, and that red mitigated injury. This study reports blue as the most injurious of three monochromatic arms. The designs differ: this comparison is monochromatic at matched irradiance assessed by electrophysiology and histology, while that one concerns the contribution of spectral components within a white source at high luminance assessed in part by macrophage invasion. They are not strictly contradictory. But the headline directions differ and the comment should not cite both as if they agreed.

What it does not establish. Nothing about humans, and the authors say so: they state that interpretation from the animal study to human applications should be carefully considered from a risk assessment perspective. The animals are albino, rod-dominant and without a macula. And although the irradiance of 102 microwatts per square centimeter is modest by the standards of this appendix, the paper does not convert it to a retinal dose and does not compare it against any exposure limit. The words ICNIRP, ACGIH and exposure limit do not appear in the paper. The Foundation notes that absence without drawing an inference from it, and does not attempt the conversion itself: corneal irradiance becomes a retinal dose only through the optical geometry of the eye, and Appendix C.75 shows how sensitive that computation is to the assumed pupil.

Disclosures. Supported by a grant of the Taiwan Ministry of Science and Technology, NSC 103-2314-B-002-076-MY3. Conflicts of interest are declared individually for each of the five authors, each as none.

Where it bears. Part V.B.3 and Part V.B, in the spectral leg of the three-characteristic frame, as the wavelength-resolved comparison at matched radiometric irradiance. Part V.J.4, at the head of the audit of reported exposures. Appendix C.68, which it independently supports. Part V.C.1 and Part V.C.2.f, on the authorship point. Part V.A.1, on the composition of the field.

C.77 Shang, Wang, Sliney, Yang and Lee (2014) — retinal injury at domestic levels, in this Department's own journal, a decade before the determination

Citation. Shang Y-M, Wang G-S, Sliney D, Yang C-H, Lee L-L. "White light-emitting diodes (LEDs) at domestic lighting levels and retinal injury in a rat model." Environmental Health Perspectives 2014;122(3):269–276. doi:10.1289/ehp.1307294. PMID 24362357; PMCID PMC3948037. Received June 30, 2013; accepted December 19, 2013; published online December 20, 2013; issue date March 2014. Institute of Environmental Health, National Taiwan University, Taipei. Full text read.

The publisher, which is why this entry is placed first among the pre-2024 material. Environmental Health Perspectives is published by the National Institute of Environmental Health Sciences, a component of the Department to which this comment is addressed. The journal states that publication in it lies in the public domain and is without copyright, and that its text may be reprinted freely with acknowledgment. The Foundation is therefore not constrained in the length of what it quotes, and has quoted the operative

sentences in full at Part I.C.7 rather than paraphrasing them. Part II.E.6 relies on a different article in the same journal, so the standing of the publication is already established in this comment.

Exposure conditions. Four light sources, each measured at 20 centimeters to deliver 750 lux at the animals, which the authors describe as the common domestic level. Single-wavelength blue diodes at 460 plus or minus 10 nanometers and phosphor-converted white diodes at a correlated color temperature of 6,500 kelvin, both custom made for the study; a white compact fluorescent lamp also at 6,500 kelvin; and a yellow compact fluorescent lamp at 3,000 kelvin. The white diode and the white fluorescent lamp were therefore matched both in illuminance and in correlated color temperature. Spectral power distributions and total intensities for every source were measured by the Industrial Technology Research Institute, a certification body testing laboratory, with each source programmed for forty measurements in an integrating sphere. The Foundation notes that this is independent accredited characterization of the exposure, which no other entry in this appendix reports.

Design. One hundred twenty adult male eight-week-old Sprague-Dawley rats. All held in darkness for fourteen days first, to clear the effect of prior lighting. Unexposed controls remained in darkness, three per time point; the remaining 108 were divided among the four sources, eight per source per time point. Exposure began at 1800 hours on day fifteen, for total durations of 3, 9 or 28 days on a twelve-hour light and twelve-hour dark cycle. A further thirty-two animals, eight from each exposure group, were exposed for 28 days and then returned to darkness for fourteen days of recovery, to allow for possible clearance of necrotic photoreceptor debris. Electroretinography before and after exposure with eighteen hours of dark adaptation before each measurement, then hematoxylin and eosin staining, terminal deoxynucleotidyl transferase labeling, immunohistochemistry, transmission electron microscopy and measurement of free radical production.

Results. Histology and electron microscopy showed apoptosis and necrosis of photoreceptors, which the authors read as photochemical injury. Free radical production in the retina was increased in the diode-exposed groups. Immunohistochemistry associated oxidative stress with the injury. The comparative finding is the one the Foundation relies on: the authors report serious retinal light injury in the diode groups and moderate to mild injury in the compact fluorescent groups.

The conclusion, quoted because it is a recommendation and because the text is in the public domain. The authors conclude that their results raise questions about adverse effects on the retina from chronic exposure to light-emitting diode light compared with other light sources having less blue light, and then: “we suggest a precautionary approach with regard to the use of blue-rich “white” LEDs for general lighting.” Earlier, in the introduction, they state that from an environmental health perspective retinal light injury and the potential risks of chronic exposure from using light-emitting diodes as a domestic light source require assessment before further development of the technology.

A finding about the product rather than the retina, which the comment now uses at Part V.B.1. The introduction records that a phosphor-converted diode progressively emits more short-wavelength light as lumen depreciation proceeds through phosphor degradation, and that light quality deteriorates past the 70 percent lumen maintenance level, for which the authors cite a 2009 publication of the United States Department of Energy. The Foundation had not previously identified this point and it has a consequence for a performance standard rather than for a person: the spectral distribution of the product drifts over its service life, in the direction of more blue, so a classification or a measurement performed on a new lamp is not a statement about the same lamp in service. Part V.B.1 develops it. The cited Department of Energy publication must be obtained and identified before the point is filed.

What it does not establish, including a limitation the authors state themselves. Nothing about humans. The authors say so: because albino rats were used, the exact risks for the pigmented human retina require further investigation. The exposure, though characterized as domestic in illuminance, was delivered for twelve hours a day for up to 28 days to caged animals that could not look away, which is not how a person encounters domestic lighting. Illuminance at 750 lux is a photometric quantity and the paper does not convert it to a retinal dose; as at Appendix C.76, the words ICNIRP, ACGIH and exposure limit do not appear, so the study makes no comparison with any limit and the Foundation does not attempt one. The injury descriptions are qualitative as between serious and moderate to mild rather than expressed as a measured ratio.

Disclosures. Supported by National Taiwan University Hospital grant UN101-036 and Taiwan National Science Council grant NSC 101-2314-B-002-073-MY2. The authors declare no actual or potential competing financial interests. Indexed as research support, non-United States government.

Relation to Appendix C.76. That 2017 study is this group's successor, with the same five authors. This one compares a diode source with the fluorescent source it displaced at matched illuminance and correlated color temperature; that one compares three monochromatic wavelengths at matched radiometric irradiance. Read together they are a single line of investigation and should be weighted as such, which Part V.A.1 must record. Where they differ in emphasis the later and better-characterized study should be preferred on exposure, and this one on the comparison with the displaced technology.

Where it bears. Part I.C.7, as the strongest item in the foreseeability argument, and the reason that argument is stated separately from the specialty-journal material. Part IX.B.4, which asks whether this study was considered. Part V.B.1, for the spectral drift with phosphor degradation. Part V.B.3, for the matched-correlated-color-temperature comparison against a fluorescent source, alongside Appendix C.70 and C.74. Part II.E.6, as the second article from this journal on which the comment relies. Part V.A.1, for the author overlap with Appendix C.76.

C.78 Jaadane and others (2015) — the regulatory endpoint negative, the injury extensive, and what the limits were built on

Citation. Jaadane I, Boulenguez P, Chahory S, Carré S, Savoldelli M, Jonet L, Behar-Cohen F, Martinsons C, Torriglia A. "Retinal damage induced by commercial light emitting diodes (LEDs)." Free Radical Biology and Medicine 2015;84:373–384. doi:10.1016/j.freeradbiomed.2015.03.034. PMID 25863264. The published article is closed access and the publisher does not serve it to automated retrieval; the Foundation read the author manuscript deposited in the French national open archive HAL under identifier hal-04674687, submitted August 21, 2024. Page citations must be taken from the published version. Cite the publisher's version.

Why this is the most important entry in the appendix for Part V.C.2.c. It states, in the authors' own words, the experimental basis of the exposure limit values: that they rest on fundus examination following a single eight-hour exposure, and that they define light as injurious when there is bleaching of the retina. The Foundation had previously inferred the first two of those three elements from the arithmetic of the standard and had taken the third at second hand. Here they are stated together by a group that includes the author of the handbook chapter at Appendix D.5 and the investigators of Appendices C.63 and C.75. Part V.C.2.c quotes the passage in full.

The result that follows from applying that endpoint. Dilated fundus examination was carried out immediately after exposure by a veterinary ophthalmologist with two assistants. No bleaching of the retina was detected in any animal, across exposures from twelve hours to three days and across all five sources used. The regulatory endpoint was therefore negative throughout. In the same animals the authors report interphotoreceptor

edema on semi-thin sections; activation of microglia and infiltration of macrophages on CD11b and Iba-1 staining after one and two days, which they read as retinal inflammation; oxidation of DNA and RNA by 8-hydroxyguanosine staining, most marked in the inner nuclear layer, and of proteins by nitrotyrosine staining; loss of photoreceptors; and the activation of caspase-independent apoptosis, necroptosis and necrosis. They also report marked chemosis, an edema of the ocular tissues, in almost all animals during the first twenty-four hours of exposure, resolving thereafter.

Sources and exposure. Commercially available white light-emitting diodes and four blue sources at 507, 473, 467 and 449 nanometers, on Wistar rats, which are albino. Exposures ran from twelve hours to three days. The authors report a corneal irradiance dose of approximately 0.0026 joules per square centimeter and state that this is about one thousandth of the flux used in the earlier experimental work they cite. The Foundation records, and Part V.C.2.c repeats, that this is a corneal quantity and must not be compared with the 2.2 joules per square centimeter retinal figure at Part V.C.2.f; the two differ by the optical gain of the eye. The luminance and radiance figures that Appendix C.75 attributes to its own apparatus, 2,680 candelas per square meter and 8.33 watts per square meter per steradian, are cited in that paper to this one and should be confirmed here. A wavelength dependence was observed, and the authors report that a named commercial royal blue diode produced a higher degree of protein oxidation than the other blue sources.

A detail that bears on the disagreement recorded at Appendix C.76. One of the four sources this paper calls blue has a peak at 507 nanometers. In the 2024 study at Appendix C.63, by three of the same authors and with apparatus from the same laboratory, a source at 507 nanometers is the green arm, and it is the arm that drove phototoxicity in white light. The same wavelength therefore appears in this group's 2015 work within a set described as blue and in its 2024 work as green. That is a matter of nomenclature rather than of measurement, but it bears on the apparent conflict between Appendix C.63 and Appendix C.76, where the green arm was at 530 nanometers. Part of the disagreement about whether blue or green drives injury may be a disagreement about where the boundary between them is drawn.

What it does not establish. Nothing about humans. The authors state the limitation themselves, writing that the pertinence of the albino rat model and the translation of the results to human beings is a matter of discussion, and that the model is useful for forming an idea of the kind of lesions these devices produce. No threshold and no safe level. The absence of bleaching does not establish that the exposures were below any limit, because the paper does not compute a retinal dose and makes no comparison with the numerical limit; what it establishes is that the endpoint on which the limit is defined was not reached while other injury was present.

Prior work it identifies, which the Foundation had not. Three leads. Dawson, 2001, reporting that a blue diode at 460 nanometers and an argon laser at 458 nanometers produced the same retinal lesions at a corneal irradiance of 10 joules per square centimeter. Ueda and colleagues, reporting retinal damage at the macula from blue diodes at 465 nanometers. And Mukai and colleagues, reporting that the retinas of monkeys exposed to light-emitting diode light for eight hours showed intracellular vacuoles in the photoreceptor outer segments together with reduced rod and cone responses on electroretinography, a mechanism these authors note was not analyzed there. The third is the most important: a primate study, at eight hours, with a functional deficit. The exposure limits were derived from primate thresholds, as Part V.C.2.f records, so a primate result bears on them more directly than any rodent study in this appendix.

Funding and disclosures. Indexing records the funders as Inserm, the Ecole Nationale Vétérinaire d'Alfort and the Centre Scientifique et Technique du Bâtiment, together with the French environment and energy agency ADEME and its RETINALED project, which are the same funders as Appendix C.75. The funding and competing-interest statements

must be confirmed from the published version; the Foundation has not located them in the deposited manuscript. The observation at Appendix C.75 applies here too: the building science laboratory was both a funder and the employer of authors who built the exposure apparatus.

Where it bears. Part V.C.2.c, as the primary statement of what the exposure limits were constructed to detect, which is the central proposition of that subsection. Part V.C.1.g and Part V.C.2.f, on injury without a visible lesion. Part V.B.3, on wavelength dependence. Appendix C.63, C.75 and D.5, as the earliest member of one line of investigation. Part V.A.1, on the concentration of that line in one group.

C.79 Kuse and others (2014) — the same radiant power at three wavelengths, and the same illuminance at three wavelengths

Citation. Kuse Y, Ogawa K, Tsuruma K, Shimazawa M, Hara H. "Damage of photoreceptor-derived cells in culture induced by light emitting diode-derived blue light." Scientific Reports 2014;4:5223. doi:10.1038/srep05223. Received January 24, 2014; accepted May 21, 2014; published June 9, 2014. Licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License; full text read. Molecular Pharmacology, Department of Biofunctional Evaluation, Gifu Pharmaceutical University, Gifu, Japan.

The design, which is why the entry is here. Cone photoreceptor-derived 661W cells were exposed from below the plate for twenty-four hours under two separate schemes. In the first, all three sources delivered the same radiometric irradiance of 0.38 milliwatts per square centimeter: blue at a peak of 464 nanometers, white with peaks at 456 and 553 nanometers, and green at 522 nanometers. In the second, all three delivered the same illuminance of 2,500 lux. The study therefore holds radiant power constant in one scheme and the photometric quantity constant in the other, which is the comparison this comment has been making by argument. Radiant power was measured with a handheld optical power meter, which the paper identifies by model. Control cells were incubated in the dark and drawn from the same stock, which the authors state was to eliminate pre-existing bias in light and temperature exposure, following a published protocol.

The figures the Foundation relies on, which are incidental to the paper and central to this comment. The authors record the illuminance equivalent of their single matched irradiance for each source: 0.38 milliwatts per square centimeter corresponds to 450 lux for the blue source, 1,600 lux for the white source and 2,500 lux for the green source. Three sources delivering identical radiant power to the same preparation therefore differed in measured illuminance by a factor of about five and a half, for the reason given at Part V.J.1. That is published confirmation, from a measurement rather than from the Foundation's arithmetic, that photometric and radiometric quantities are not interchangeable across spectra. Part V.B.3 relies on it.

Results. Blue light increased reactive oxygen species production, altered protein expression, and induced aggregation of short-wavelength opsin, with severe cell damage. In primary retinal cells the damage was photoreceptor specific. N-acetylcysteine, an antioxidant, protected against it. The conclusion the Foundation quotes is that the damage was, in the authors' words, wavelength- but not energy-dependent, and that blue light-emitting diode light may cause more severe photoreceptor damage than the other sources tested.

The mechanism, and its place in a lineage already in this appendix. The authors identify aggregation of short-wavelength opsin as the route. Their reasoning is that medium-wavelength opsin is readily degraded by the proteasome while short-wavelength opsin is not, so that the short-wavelength pigment accumulates in aggregates and causes rapid cone degeneration. They cite their own earlier work for the proposition that excessive light exposure aggregates short-wavelength opsin and leads to endoplasmic reticulum stress in this same cell line. That is the pathway developed nine years later at

Appendix C.65, by overlapping authors in the same department and in the same cell line. The two entries are one line of work.

What it does not establish. Anything about a retina, a human or a product. This is a monolayer of a transformed murine cell line in a ninety-six-well plate, illuminated from below continuously for twenty-four hours, with no retinal pigment epithelium, no choroidal circulation, no tissue architecture and no repair processes. The governing limitation recorded at Appendix C.65 applies with equal force here. It sets no threshold and makes no comparison with any exposure limit. The culture-medium confound identified at Appendix C.72 applies: no irradiated medium-only control is reported.

Shared authorship, now a pattern rather than an instance. This is the third entry in this appendix from Molecular Pharmacology, Department of Biofunctional Evaluation at Gifu Pharmaceutical University, with Hara an author of all three and Shimazawa of two. The others are Appendix C.65, which develops this paper's endoplasmic reticulum stress pathway in the same cell line, and Appendix C.74, the pigmented mouse study. The three are not independent observations.

Disclosures. The authors declare no competing financial interests. The Foundation has not located a funding statement in the article as read, and records that as an absence rather than as a declaration of no funding.

Where it bears. Part V.B.3, as the third and cleanest of the three biological demonstrations that the hazard follows the spectrum rather than the photometric quantity. Part V.J.1 and Part V.J.4, for the measured illuminance equivalents at constant radiant power. Part V.B, in the spectral leg of the three-characteristic frame. Appendix C.65, as its predecessor in mechanism. Part V.A.1, for the authorship pattern.

C.80 Youssef, Sheibani and Albert (2010) — the three-mechanism framework, from an American department, and the age of the question

Citation. Youssef PN, Sheibani N, Albert DM. "Retinal light toxicity." Eye (London) 2011;25(1):1–14. doi:10.1038/eye.2010.149. PMID 21178995; PMCID PMC3144654. Published online October 29, 2010. Department of Ophthalmology and Visual Sciences, University of Wisconsin School of Medicine and Public Health, Madison. Full text read. The journal is published for the Royal College of Ophthalmologists.

Article type and why the Foundation prefers it for the framework. A review, cited in the category described at Part V.A.2 as evidence of the state of expert opinion. Its value to this comment is that it is the framework source the comment needs and it comes from an American academic ophthalmology department in a journal of the Royal College of Ophthalmologists. Part V.B had rested its three-mechanism division on Appendix C.72 alone, a review whose journal was subject to the retraction episode recorded in that entry. This review states the same division independently, six years earlier, from a different continent, and the comment now relies on it in preference.

The three mechanisms as this review states them. Photothermal damage: radiant energy transferred to tissue where, at the longer visible and near-infrared wavelengths, vibrational and rotational states predominate over electronic excitation, so that mean kinetic energy and therefore temperature rise. The review notes that the capacity to raise kinetic energy is inversely proportional to wavelength, and that in a closed system thermal effect is proportional to exposure time while in an open system more energy is required for a given thermal effect as exposure lengthens. Photomechanical damage: compressive and tensile forces from the rapid introduction of energy into the melanosomes of the pigment epithelium, at irradiances of the order of megawatts to terawatts per square centimeter over nanoseconds to picoseconds, producing microcavitation bubbles lethal to those cells and sonic transients that can damage photoreceptors; the clinical application is the neodymium-doped yttrium aluminum garnet laser used for iridotomy and posterior

capsulotomy. Photochemical damage: the wavelength-dependent mechanism, which the review associates with both long exposure durations and shorter wavelengths, mediated by chromophores and the free radicals their excitation generates.

The chromophore list, which corrects a framing in this comment. The review gives the chromophores of the retina and pigment epithelium as including the photoreceptors, flavoproteins, heme proteins, melanosomes and lipofuscin. Part V.C.2.h had presented a convergence of four chromophore findings as a pattern the Foundation had noticed. Three of the four are members of classes on this list, published in 2010 before any of those four studies. The convergence is therefore the standard account rather than a discovery, and Part V.C.2.h has been amended to say so. The amendment strengthens the proposition and removes a claim to novelty that was not the Foundation's to make.

The age of the question, which bears on Part I.C.7. The review opens with a chronology the Foundation records because the determination it examines rests on a history. Socrates is quoted from Plato's Phaedo warning that people may injure the eye by gazing at an eclipse. Galileo lost vision studying sunspots. Newton described a scotoma and an afterimage persisting for days after observing the sun through a telescope. Solar retinal damage was first studied clinically in 1916. And in 1966 Noell and colleagues suggested that damage to the retina was possible with low-intensity light. That last citation is sixty years old and it is the origin of the proposition this comment is concerned with. The capacity of light to injure a retina has never been the open question. The open question has always been the level, which is what Part I.C.7 and Part IX.B.4 ask the Department to determine.

A body of human clinical evidence the Foundation had not identified. The review cites retinal phototoxicity from the operating microscope during cataract surgery, with nine references, and from endoillumination during vitreoretinal surgery, with four. It also cites histological study by Green and Robertson of human eyes exposed to various light levels before enucleation for choroidal melanoma. That is human evidence of retinal injury from artificial light sources, documented clinically over decades. It says nothing about domestic lighting levels and the Foundation does not offer it for that. It does establish that light-induced retinal injury in humans is an established clinical entity rather than an inference from animals, which is the premise Appendix C.64 supports with a single case and which this literature supports with a surgical subspecialty's accumulated experience.

Protective mechanisms, and what they are not. The review describes the eye's adaptations: photostasis, by which rhodopsin concentration is regulated so that relative photon absorption remains steady independent of ambient intensity; endogenous antioxidant generation, with rats raised in lighted environments producing protective enzymes; greater susceptibility in mice carrying a superoxide dismutase mutation; and the macular pigment formed by the dietary carotenoids zeaxanthin, meso-zeaxanthin and lutein, which neutralize singlet oxygen and free radicals. The Foundation notes what this material does not contain, because it had hoped otherwise.B.8 calls for literature on the aversion response, the blink reflex and glare to support or soften an inference made there. This review does not supply it: its protective mechanisms are biochemical and adaptive, not behavioral. That note remains outstanding.

What it does not establish. It is a review and contains no primary data. It is not about light-emitting diodes, which it mentions twice in fourteen pages; it predates the general lighting transition and should not be cited as addressing it. It sets no threshold and, notably for a review of retinal light injury by an academic ophthalmology department, it does not discuss exposure limits at all: the terms used by the standards bodies do not appear in it. The Foundation records that absence without inference, beyond observing that the clinical literature on retinal phototoxicity and the standards literature on optical radiation limits appear to have been written largely in isolation from one another.

Disclosures. The Foundation did not locate a funding statement or a competing-interests declaration in the text as read, and records that as an absence rather than as a declaration of none. Both must be checked against the published version.

Where it bears. Part V.B, as the preferred source for the three-mechanism framework that substantiates the three-characteristic division. Part V.C.2.h, for the chromophore list and the correction it requires. Part I.C.7, for the age of the question and the 1966 low-intensity citation. Part V.C.1, for the surgical phototoxicity literature, alongside Appendix C.64.

C.81 Jordan and Vanderheiden (2024) — flash thresholds that exist, in a domain that is not this one

The governing limitation, stated first. This article concerns flashing content presented on displays. It is not about light sources. The words display or screen appear in it more than two hundred times; lighting, luminaire, streetlight and lamp together fewer than ten; light-emitting diode twice; and vehicle, emergency and police not at all. Nothing in this entry is evidence that any lamp, luminaire, beacon or vehicle light triggers seizures, and the comment does not cite it for that. It is cited for the thresholds that exist in the display domain, for the epidemiology of the condition, and for the regulatory asymmetry those thresholds reveal.

Citation. Jordan JB, Vanderheiden GC. "International Guidelines for Photosensitive Epilepsy: Gap Analysis and Recommendations." ACM Transactions on Accessible Computing 2024;17(3):1–35. doi:10.1145/3694790. PMID 40026540; PMCID PMC11872230. Open access under a Creative Commons Attribution license; full text read. University of Maryland, College Park. The Foundation read the author manuscript served by PubMed Central; page citations must be taken from the published version.

Funding, which bears on Part I.C.7. Supported by the National Institute on Disability, Independent Living, and Rehabilitation Research under grants 90REGE0008 and 90REGE0024, by the Administration for Community Living of the Department of Health and Human Services, and by a gift from Meta. The first two are components of the Department to which this comment is addressed. The Foundation records, without drawing a conclusion about anyone's state of knowledge, that in the same year as the determination examined at Part I.C.7 this Department funded a thirty-five page analysis finding that the guidelines governing a known light-triggered neurological condition are not harmonized, that technology has outrun them, and that their thresholds should be revised. The gift from Meta is disclosed because that company has an interest in display content standards.

What it establishes. That flash thresholds for photosensitive epilepsy exist, are numerical, and are applied. A general flash in which the two states differ by more than 20 candelas per square meter is treated as potentially hazardous where the darker state is below 160 candelas per square meter; the more conservative of the two Web Content Accessibility Guidelines criteria prohibits any flashing more than three times per second; and the 20 candela figure was chosen because an estimated 7 percent of those who would respond to maximal black-to-white flashing may still respond at that level. Diagnostic photic stimulators, by comparison, flash at 400 to 10,000 candelas per square meter or more. It further establishes the epidemiology relied on at Part V.E.1, and the existence of automated compliance tools, including the commercial Harding Flash and Pattern Analyzer available since 2001 and the Photosensitive Epilepsy Analysis Tool of the Trace Research and Development Center, which is free for web content. The Foundation notes the tools because the existence of automated conformance testing answers the objection that a flash limit would be impractical to enforce.

The proposition the comment takes from it, which is regulatory rather than clinical. That the Web Content Accessibility Guidelines, including the photosensitive epilepsy success criteria, have been applied through Section 508 of the Rehabilitation Act to digital

documents and software purchased, procured or created by government, and in the European Union through EN 301 549. If that is right, a quantified federal flash limit for this condition exists in the United States for procured digital content and exists nowhere for physical light sources. Part V.E.1 develops the consequence. The proposition is load-bearing and is taken here from a secondary characterization.

Findings that complicate the comment's position. Two, recorded because they run the other way. The authors identify reduction of risk attributable to display technology as one of the risk factors that has changed: the inherent flicker of cathode ray tube screens, which contributed to the hazard historically, is absent from modern displays. And on ambient conditions they describe counteracting effects, bright surroundings reducing effective display contrast and constricting the pupil while prompting users to raise screen luminance, concluding that the exact relationship between these factors and photosensitive epilepsy is not fully understood. The Foundation does not assert that screens have become more hazardous over time, and this entry does not support that.

What it does not establish. Nothing about light sources, as stated above. Nothing about the light-emitting diode as a technology. It is an analysis of guidelines rather than an experimental study, so the thresholds it reports are reported at one remove from the work that established them. The comment does not presently cite that underlying work, and this entry is not a substitute for it. The authors propose working values for revised thresholds; those proposals are not adopted by this comment, which relies only on the thresholds presently in force.

Where it bears. Part V.E.1, which is built on it, and principally for the Section 508 asymmetry. Part V.D.3, where it partly answers the question whether the United States regulates temporal light modulation at all. Part V.B, as the first entry in this appendix addressed to the temporal characteristic. Part I.C.7, for the funding. Appendix D.2, which catalogues the five instruments it analyzes.

C.82 Soker-Elimaliah and others (2022) — the pupillary light reflex, measured in people who do not have the condition

The governing limitation, stated first. This study included no autistic participants. Its samples were described by its authors as non-autistic, and autistic traits were measured dimensionally with a trait questionnaire administered within those samples. It is a study of what its title calls the broader autism phenotype, meaning trait variation in a population without the diagnosis. The comment does not cite it for any proposition about autistic people, and Part V.E.3 states that expressly.

Citation. Soker-Elimaliah S, Lehrfield A, Scarano SR, Wagner JB. "Associations between the pupil light reflex and the broader autism phenotype in children and adults." Frontiers in Human Neuroscience 2022;16:1052604. doi:10.3389/fnhum.2022.1052604. PMID 36895201; PMCID PMC9990758. Open access under a Creative Commons Attribution license. Brief Research Report. Department of Psychology, College of Staten Island and the Graduate Center, City University of New York, with one author at the University of Southern California and one at the Albert Einstein College of Medicine.

Funding. National Institute of Mental Health, grant R15 MH112090, and the Professional Staff Congress of the City University of New York, awards 69677-00-47 and 64484-00-52. The authors declare no commercial or financial conflict of interest. The National Institute of Mental Health is a component of the Department to which this comment is addressed, which bears on Part I.C.7 in the same way as the funding recorded at Appendix C.81.

Participants. Fifty-nine children after exclusions, mean age 6.36 years, standard deviation 2.72, range 2 to 12; and sixty-six adults after exclusions, mean age 19.64 years, standard deviation 2.04, range 18 to 28, who were students in an introductory psychology course receiving course credit. Participants with fewer than four valid trials were excluded. No

participants aged 12 to 18 were included, which the authors identify as a limitation preventing analysis of age as a continuous variable.

Exposure conditions, which are not recoverable. The stimulus is described as a white flash of 120 milliseconds presented during a fixation animation on a black screen, viewed at 65 centimeters on a 22-inch monitor, with eye position sampled at 120 hertz. Nine trials per session, with inter-trial videos of 10 seconds for children and 15 seconds for adults included to encourage saccades and prevent retinal saturation. Wavelength is not stated. Luminance is not stated. The background adaptation level is not stated. Nothing in the report permits the retinal exposure to be reconstructed, and the entry is classified as not recoverable for the purposes of the audit at Part V.J.4.

What it establishes, and in which group. In the adult sample, and after correction for multiple comparisons at an alpha of 0.0125, two associations held. Higher scores on the restricted and repetitive behavior subscale were associated with smaller relative pupil constriction amplitude, r(64) = minus 0.36, p = 0.003; and with longer median constriction latency, r(64) = 0.32, p = 0.008. The authors state the finding as being that increased levels of restricted and repetitive behavior are associated with smaller relative pupil constriction and longer latency to respond to light. Relative constriction amplitude was defined as the fractional reduction in pupil area.

What it does not establish, including against the comment's interest. The total score on the trait questionnaire did not survive correction, at p = 0.024 against an alpha of 0.0125; only the one subscale did. In the child sample no association survived correction. Absolute constriction amplitude showed no group difference. The reported correlation of minus 0.36 corresponds to approximately thirteen percent of variance. Constriction latency is nowhere reported in milliseconds and pupil diameters are nowhere reported in millimeters, so no absolute quantity can be taken from this paper. Peak constriction velocity was used only as an inclusion criterion and not reported as an outcome. Redilation was not measured. The design is correlational and cross-sectional, and the adult sample was a single cohort of undergraduates.

The proposition the comment takes from it, which concerns the construction of a limit rather than autism. That pupillary response varies systematically with a measurable characteristic of a population. The relation at Part V.B.2 expresses retinal irradiance with pupil diameter as a term, and Part V.C.2.f sets out why the retinal dose computed at Appendix C.75 depends on an assumed pupil diameter of 5 millimeters where the sources cited for that assumption give smaller figures. Retinal irradiance scales with pupil area. It follows that an exposure limit computed from a single assumed pupil diameter does not describe the exposure of a person whose pupillary response departs from the assumption, and that the direction of the departure determines whether the limit is conservative or permissive for that person. This paper does not quantify any such departure and the comment does not claim that it does. It establishes that the parameter is not a constant of the population, which is enough to make its value a question a standard would have to answer.

Relation to Appendix C.83. The two entries are complements and should be read together. This study measures the response to light and lacks the population. Appendix C.83 has the population and measures nothing. Neither characterizes the light. Part V.E.3 is built on that relation rather than on either entry alone.

Where it bears. Part V.E.3, with Appendix C.83. Part V.B.2 and Part V.C.2.f, for the pupil term. Part V.J.4, as a study of the response to light which does not report the light. Part IX.C.6, for the research request. Part I.C.7, for the funding.

C.83 Nair and others (2022) — the population, and no measurement of the light

The governing limitation, stated first. This is a questionnaire survey. Its instrument is forty questions put to autistic children and their parents at a single autism center, answered on a suitability ranking. It contains no measurement of any light source, no controlled exposure, no comparison group, and no physiological or observed behavioral outcome. The Foundation cites it for the population it reached and for what its absence of measurement demonstrates about the state of this literature, and for nothing else.

Citation. Nair AS, Priya RS, Rajagopal P, Pradeepa C, Senthil R, Dhanalakshmi S, Lai KW, Wu X, Zuo X. "A case study on the effect of light and colors in the built environment on autistic children's behavior." Frontiers in Psychiatry 2022;13:1042641. doi:10.3389/fpsyt.2022.1042641. PMID 36532166; PMCID PMC9748440. Open access under a Creative Commons Attribution license; full text read. School of Architecture and Interior Design and three engineering departments of the SRM Institute of Science and Technology, Chennai, with co-authors at Universiti Malaya and at Xuzhou Medical University. Funded by the Xuzhou Science and Technology Program.

Participants, which are the reason for the entry. Eighty-seven autistic children aged between 6 and 16, 45 male and 42 female, mean age 8.7 years, standard deviation 2.3, identified by diagnosis. The survey was conducted at an autism center, and the paper states that it was administered among the children and their parents. This is the only study in this appendix whose participants are a diagnosed population identified by a sensory characteristic.

Exposure conditions. There are none reported, and the Foundation states how it established that. The Foundation searched the full text, of approximately 163,000 characters, for each of the following terms: lux, lumen, candela, candelas per square meter, illuminance, luminance, kelvin, correlated color temperature, spectral, nanometer and wavelength. None appears. The Foundation further searched for the common lamp technologies, and the paper does not identify whether the lighting it concerns was light-emitting diode, fluorescent or incandescent. A paper whose title is the effect of light on the behavior of autistic children therefore reports no photometric quantity, no radiometric quantity, no color temperature, no wavelength, no spectral power distribution, and no lamp type. For the audit at Part V.J.4 this is the limiting case in this appendix: not an exposure reported in the wrong units, but no exposure reported at all.

What the authors report. That the children expressed varying color preferences and responded differently to different shades; that neutral tones and mellow shades were found to be preferred, with a calming effect described; that bright, bold and intense colors were found stimulating; and, in the abstract, that "The stimulus of bright-lighting causes behavioral changes in autistic children prone to light sensitivity." The conclusions are addressed to designers and clinicians for the design of interior spaces.

Why the Foundation does not rely on the sentence just quoted. Because the method cannot support it, and because this comment holds other parties to that standard and must hold itself to it. A ranking of preferences collected from children and their parents can establish what was reported. It cannot establish that a stimulus causes a behavioral change, and the word causes is not available from this design. The Foundation records the same objection to the abstract's statement that certain shades were proven to be autistic-friendly; a preference ranking does not prove that either. The paper also describes itself as a case study while reporting a survey of eighty-seven respondents with a stated margin of error, and its limitations section consists of a single sentence calling for more participants, without reference to the absence of measurement, the absence of a comparison group, or the limits of self and proxy report. The Foundation makes these observations rather than omitting the paper, for the reason it gave in declining to rely on the consultancy report described at Part VI.E.3: a comment that cited only what suited it, without saying what each source can and cannot bear, would deserve to be discounted.

What it nonetheless establishes. Two things, and the second is the more important. First, that the question has occurred to investigators and that a diagnosed population can be reached and surveyed about lighting, so the obstacle to a proper study is not access to participants. Second, that in 2022 a paper could be published in an indexed journal on the effect of light on this population without stating a single physical property of the light. That is evidence about the state of the field rather than about the children, and it is the form in which this entry is used at Part V.E.3 and at Part V.J.4.

Relation to Appendix C.82. The two entries are complements and should be read together. This study has the population and no measurement. Appendix C.82 has the measurement and no autistic participants. Neither characterizes the light. Part V.E.3 draws the conclusion from the pair, which is that the deficiency in this literature is one of design rather than of volume, so that a further study of either kind would not remedy it.

Where it bears. Part V.E.3, with Appendix C.82. Part V.J.4, as the limiting case of unreported exposure. Part IX.C.6, for the research request.

C.84 Zhong and others (2023) — outdoor light at night and childhood leukemia, and what the authors say their exposure metric cannot do

Citation. Zhong C, Wang R, Morimoto LM, Longcore T, Franklin M, Rogne T, Metayer C, Wiemels JL, Ma X. "Outdoor artificial light at night, air pollution, and risk of childhood acute lymphoblastic leukemia in the California Linkage Study of Early-Onset Cancers." Scientific Reports 2023;13:583. doi:10.1038/s41598-022-23682-z. PMID 36631468; PMCID PMC9834257. Open access under a Creative Commons Attribution license; full text read. Keck School of Medicine of the University of Southern California, Yale School of Public Health, the School of Public Health of the University of California, Berkeley, and the Institute of the Environment and Sustainability of the University of California, Los Angeles. The digital object identifier carries 2022 and the article appeared in the 2023 volume; cite the volume and year as given.

Funding, which bears on Part I.C.7. National Cancer Institute of the National Institutes of Health, under contracts HHSN261201800032C and 32I, HHSN261201800015C and 15I, and HHSN261201800009C and 09I; the National Center for Chronic Disease Prevention and Health Promotion of the Centers for Disease Control and Prevention, under NU58DP006344; and the National Institute of Environmental Health Sciences, under T32 ES013678 and P30 ES007048. Three components of the Department to which this comment is addressed. The Foundation records the funding without inference, as it does at Appendix C.11 and Appendix C.81.

Design and population. Population-based case-control study using the California Linkage Study of Early-Onset Cancers, which links diagnoses in the California Cancer Registry, a Surveillance, Epidemiology and End Results program registry, to birth records. Two thousand seven hundred and eighty-two cases of acute lymphoblastic leukemia and one hundred thirty-nine thousand one hundred controls, identified during 2000 to 2015, with fifty controls per case matched on year of birth. No case or control was contacted, which the authors identify as minimizing selection bias.

Exposure, as assigned, and the limits of the assignment. Outdoor light at night was assigned from the New World Atlas of Artificial Night Sky Brightness, which supplies, on a 750-meter grid, a modeled estimate of luminance at the zenith expressed in millicandela per square meter. The Atlas was constructed from National Oceanic and Atmospheric Administration Visible Infrared Imaging Radiometer Suite observations taken between May and December 2014, together with handheld sky-meter measurements. Median assigned value 3.27 millicandela per square meter, interquartile range 1.83 to 5.92. Fine particulate matter was assigned from an ensemble-based prediction model. Both exposures were assigned to the maternal residential address recorded at delivery. The Foundation asks the Department to hold three features of that assignment in view: the

quantity is the brightness of the sky overhead and not the light reaching any person; a single six-month average from 2014 is assigned to births spanning 2000 to 2015; and no residential history was available for controls.

Results, stated in full rather than as the abstract states them. The association reported in the abstract is confined to one stratum: in Hispanic children, the highest tertile of light at night against the lowest gave an adjusted odds ratio of 1.15, 95 percent confidence interval 1.01 to 1.32. The lower bound excludes unity by 0.01. For fine particulate matter the unadjusted association with leukemia, odds ratio 1.11 (1.01 to 1.22), did not survive adjustment, falling to 1.08 (0.96 to 1.20); the borderline figure of 1.24 (0.98 to 1.56) reported in the abstract for non-Hispanic White children does not exclude unity. In age-stratified analysis the light association rose from 1.00 (0.84 to 1.19) in the 0 to 2 year group to 1.22 (0.88 to 1.69) in the oldest group, and was not significant in any stratum. The model adjusted for census block group poverty in tertiles, sex, race and ethnicity, birthweight, mode of delivery, maternal age, maternal education, mother's place of birth, and complications during pregnancy.

The finding the comment principally relies on, which is a statement by the investigators about their own method. In the limitations of the published paper the authors write: "Another limitation is that the measure of outdoor ALAN that we used was based on observations from 2014 and consisted of an estimate of luminance at the zenith. It did not characterize light at various wavelengths, which may be an important distinction. Animal studies show that shorter, blue spectrum wavelength light (450–500 nm) was more detrimental to sleep, which could be an issue as cities are moving away from amber lights towards more shorter wavelength LED (light emitting diode) streetlights." They add that their work "can inspire investigators of future studies to expand the scope of exposure assessment to include all types of ALAN."

Why that passage matters more to this comment than the odds ratio does. Because it is the argument of Part V.J, stated by investigators funded by three components of this Department, about the method they themselves employed. The exposure metric on which this literature rests is spectrally blind. It records how much light is in the sky and not what kind. The transition this comment is about is a change in the kind. The authors identify that limitation, identify the conversion to shorter-wavelength light-emitting diode street lighting as the reason it matters, and state that their metric cannot address it. The Foundation does not need the odds ratio to make the point that follows: a body of epidemiology that cannot distinguish amber from blue-rich light cannot answer the question whether the conversion to light-emitting diode sources has changed the risk, in either direction. That is a reason for the measurement program requested at Part IX.C.1, not a reason to discount the epidemiology.

What it does not establish. Causation, which the design cannot deliver. Any dose-response relation, since the only significant estimate is a single tertile contrast within one stratum and the age-stratified estimates are not significant. Anything about light-emitting diode products specifically, since the exposure metric does not identify source technology and the authors say so. And anything about indoor exposure, bedroom light, or light reaching the eye, none of which was measured. The Foundation notes additionally, against its own interest, that Hispanic ethnicity was independently associated with higher leukemia risk in this study (adjusted odds ratio 1.29, 1.16 to 1.43), so the single stratum in which the light association appears is also the stratum with the higher baseline risk, which leaves residual confounding as a live explanation that the paper does not exclude.

Relation to Appendix C.11, which is not an independent replication. Appendix C.11 is a study of pediatric papillary thyroid cancer by substantially the same investigators, using the same California birth-record linkage, the same two exposures, and the same New World Atlas product. Six authors are common to both: Wang, Zhong, Wiemels, Morimoto, Metayer and Ma. The two entries should therefore not be read as two independent findings

about light at night. They are two outcomes examined by one group using one exposure assignment, and any defect in that assignment is inherited by both. The Foundation records one substantive difference between them: the thyroid study reported no significant differences by race or ethnicity, while the light association here appears only within one ethnic stratum. A subgroup pattern that differs between two outcomes examined with the same exposure product is more readily explained by chance or by residual confounding than by a consistent biological effect, and the Foundation states that rather than presenting the two as mutually supporting.

Bearing on the statutory question. Part V.J.1 and Part IX.C.1, for which this entry is now the clearest illustration in the appendix of a spectrally blind exposure metric identified as such by its own users. Part V.F, with Appendix C.11, for the light-at-night literature. Part I.C.7 and Part II.E.6, for the funding and for the position of this research relative to the determination of May 24, 2024. Part VII, for the affected population, these being children. As evidence of risk from light-emitting diode products the Foundation relies on it for nothing.

C.85 Hering and others (2024) — off-axis light-emitting diode exposure, measured loss of central visual field sensitivity in humans, and an exposure that neither radiometry nor photometry alone predicts

Citation. Hering D, Jakobs FM, Ritt G, Henrichsen M, Hohberger B. "Impact and visualization of scotomatic glare in central visual field perception." Vision Research 2024;222:108457. doi:10.1016/j.visres.2024.108457. PMID 39029384. Published online 18 July 2024. Open access under a Creative Commons Attribution license; full text read. Designed in collaboration between the Fraunhofer Institute of Optronics, System Technologies and Image Exploitation at Ettlingen and the Department of Ophthalmology of the German Air Force Centre of Aerospace Medicine at Cologne and Fuerstenfeldbruck. Ethical approval by the Bavarian State Medical Association, Munich, reference 19032, 5 November 2019. The work was performed in fulfillment of the requirements for the first author's doctorate in medicine.

Funding, which is unusual in this appendix. The authors state that the perimeter was provided on temporary loan by Fraunhofer and that "this research has not been funded by any scientific, industrial, or governmental institution." They declare no competing financial interests or personal relationships. Of the entries in this appendix bearing on glare, this is the only one with no funder at all.

Design and participants. Prospective, with exposure sequences randomized and blinded as to level. Forty-eight volunteers recruited, thirty-one completed, sixteen female and fifteen male, mean age 32.2 years, median 31, range 18 to 58, in three age strata of 18 to 29 (n=13), 30 to 40 (n=13) and over 50 (n=5). All ophthalmologically healthy: best corrected acuity 20/20 or better, intraocular pressure below 22 millimeters of mercury, clear media, intact visual field, with glaucoma, disc drusen, opacities and high refractive error excluded. Right eyes only, the fellow eye occluded. Four hundred thirty-four completed visual fields and 32,984 data points.

Apparatus and exposure geometry. An Octopus 900 automated perimeter modified by mounting an interchangeable light-emitting diode on an adjustable carrier along the inner horopter, driven by a four-channel Thorlabs DC4100 driver at bounded intervals of 25, 50, 75 and 100 percent of nominal output. Incoherent diodes were used in place of coherent laser light for safety. The source was placed 15 degrees inferior and 10 degrees left of center, deliberately avoiding direct irradiation of the fovea. Standard 30-2 white-on-white perimetry on a 6-degree grid, 76 points per field. The perimeter's background illumination was switched off, giving a background luminance of 0.255 candelas per square meter, which the authors describe as comparable with mesopic conditions and which is a fortieth of the 10 candelas per square meter at which photopic perimetry is conventionally run.

Device ceiling 40 decibels; threshold defined as the stimulus luminance seen with 50 percent probability.

Exposure, measured and reported in both systems of units. This is the best-characterized human exposure in this appendix, and the Foundation reproduces the authors' table because the comparison between its two halves is the reason the entry matters. Irradiance was measured at eye level; illuminance was computed from the radiometric measurements following the published photometric principles of the International Bureau of Weights and Measures; retinal illuminance was calculated from source luminance and mean pupil area.

Quantity and wavelength	25%	50%	75%	100%
Irradiance at eye, 470 nm (µW/cm²)	4.91	9.21	13.12	16.68
Irradiance at eye, 530 nm	5.74	9.73	13.01	15.83
Irradiance at eye, 625 nm	6.84	13.24	19.19	24.52
Illuminance at eye, 470 nm (lux)	1.62	2.92	4.31	5.34
Illuminance at eye, 530 nm	26.80	44.60	57.33	68.03
Illuminance at eye, 625 nm	12.35	24.02	34.30	41.57

Results on disability glare. Unexposed fields gave mean sensitivities of 34.1 to 39.7 decibels, mean 37.8 with standard deviation 1.5. Under glare, mean sensitivity fell as intensity rose, at every wavelength, with the inferonasal quadrant significantly worse than the others (p less than 0.001) where unexposed subjects showed no inter-quadrant difference at all. Loss was greatest at 530 nanometers, then 470, least at 625, at every intensity (p at most 0.001). Reconstructed fields placed the deepest scotomas around 15 degrees in the lower left quadrant and 10 to 15 degrees off center. The inferonasal quadrant carried 71 absolute scotomas, comparable with the 70 found in the blind spot itself, and 15 absolute scotomas appeared out at the 30-degree limit of measurement. Adjusted coefficients of determination for the intensity model were 0.125 at 625 nanometers, 0.224 at 470 and 0.252 at 530.

The finding the comment relies on, which is about units. The ordering of functional impairment was 530, then 470, then 625 nanometers, at every intensity. The ordering of irradiance was 625 highest at every intensity. The ordering of illuminance was 530, then 625, then 470 at every intensity. The impairment ordering therefore matches neither. At full power the red source delivered about 1.5 times the irradiance of the blue and about 7.8 times its illuminance, and produced the least impairment of the three; the green source delivered slightly less irradiance than the blue and about 12.7 times its illuminance, and produced the most. The authors state the puzzle themselves, that the result "was unexpected" given illuminances about eight times higher at 625 nanometers and up to fifteen times higher at 530 than at 470, and they resolve it by the adaptation state: the mesopic background shifted the spectral luminous efficiency function toward the blue, so that neither the photopic weighting nor the unweighted radiometric total described what the eye did.

Why that is the most useful thing in this entry. Because it is a measured demonstration of the proposition Part V.J.1 asks the Department to adopt. A single number did not predict the effect, and this is true of both single numbers. Photometric reporting failed because it weights by a photopic observer who was not present. Radiometric reporting failed on its own because an unweighted total discards the spectral distribution. What predicted the response was the spectral composition read against the adaptation state of the eye. That is why Part V.J.1 requests spectral power distribution with photometric quantities given in

addition rather than instead, and why Part V.B treats the spectral characteristic as independent of the others. The Foundation knows of no cleaner instance in the literature it has examined.

Results on discomfort glare, and the dissociation from disability. Discomfort was rated on the de Boer scale, which the authors describe as still the most common perception scale in automotive and public lighting and which runs unbearable (1), disturbing (3), just admissible (5), satisfactory (7), unnoticeable (9). Ratings worsened stepwise with intensity at every wavelength, from about just admissible at 25 percent to nearly disturbing at 100 percent, significant at full power against lower levels for all three wavelengths except red at 100 against 75 percent. But the two measures came apart. Perceived discomfort was highest at 470 nanometers while measured field loss was greatest at 530, so that blue was the most annoying and green the most disabling. Relative to baseline, measured field defects moved 1 to 25 percent while subjective ratings moved up to 60 percent, and the coefficients of determination for discomfort were very low, 0.066 at 625 nanometers, 0.094 at 470 and 0.007 at 530. The Foundation draws the conclusion that bears on Part V.C.4: what a person reports about glare and what glare does to that person's vision are different quantities, and neither substitutes for the other.

Age. No difference by sex in measured sensitivity at any wavelength or intensity. Participants aged 50 and over were significantly more affected than the rest (p less than 0.001), with no difference between the 18 to 29 and 30 to 49 groups. Including age raised the explained variance substantially, to 0.385 at 625 nanometers, 0.433 at 470 and 0.561 at 530. The authors attribute it to the known increase of straylight with age-related opacity of the refractive media. The comment should read that alongside the age-resolved transmittance figures at Part V.C.2.g, which run the other way for children, and should not merge the two: one concerns short-wavelength transmittance in the young, the other scatter in the old, and both describe departures from the single assumed observer on which limits are built. Discomfort ratings showed no age or sex effect.

What it establishes for Part V.C.1. That measurable functional impairment occurs at exposures the authors describe as subthreshold. Their conclusion opens: "our results indicate that LED dazzling with subthreshold amounts of monochromatic light tends to affect the complete central visual field of exposed individuals with relative and absolute scotomas scattered around the source of glare, even when exposure is decentered and the light is not precisely focused by physiological accommodation." Their introduction states the consequence for the products this comment concerns: that because the remote risk of retinal injury from distant illumination is considered generally low, "glare-induced visual impairment has to be regarded the main hazard for mobility-related tasks i.e., road and air traffic." A framework that asks only whether a source produces a lesion does not reach that hazard.

Mechanism, as the authors describe it. They distinguish veiling glare, the generalized flooding of the eye by forward scatter, from what they call scotomatic glare, in which the loss is spatially tied to the retinal location corresponding to the external source. They attribute their result mainly to the latter and suggest photoreceptor saturation rather than inter-reflection as the key mechanism for a point source. They report a paradoxical central sparing and offer two explanations, the high cone density at the center and a Stiles-Crawford-like directional effect arising because the eccentric source did not enter through the center of the pupil. They state the mechanism is probably multifactorial and unresolved.

Limitations, including two that run against the comment and one that runs for it. Against: light-emitting diodes were substituted for lasers, so the study does not describe laser exposure, and the authors judge that it probably understates what a laser pointer would do; the source was moved off axis to protect the fovea, which the authors say introduced additional variables and biometric confounding; the exposures were

monochromatic where the products this comment concerns are broadband; the subjects were thirty-one healthy volunteers in a clinical setting, not drivers or pedestrians; and the framing throughout is deliberate dazzling and its misuse, not illumination. For: the three wavelengths were not isoluminant, and the blue channel in particular "had to be technically lowered on behalf of the ethics comittee" to avoid excess dose. The blue source was therefore run at the lowest illuminance of the three by a wide margin, and still produced more impairment than the red. The authors recommend isoluminant sources in future work.

The authors on the de Boer scale, which bears on Part V.C.4. They conclude that de Boer's scale, "although representing the most widely used rating scale for glare environments, might be less useful in small-study populations and real-life applications," and call for larger samples and more detailed rating scales. The Foundation records that the Federal Highway Administration study described at Part V.D.4 used a three-category scale of its own devising and named no established scale at all. The most widely used instrument for discomfort glare is criticized by its users as unsuitable for real-life application, and the federal research on the subject did not use it.

The inference the Foundation draws, and whose it is. Part V.D.4 records that the research arm of the Federal Highway Administration hypothesized in 2015 that a driver who looks away from an unbearable glare source "might miss the identification of conflicts or hazards located near the glare source," and did not test it. This study supplies the step that hypothesis needs, that impairment does not require the observer to be looking at the source, and its authors reach the adjacent conclusion that "glare-induced visual field reduction might be a stronger predictor of driver or pilot incapacitation than visual impairment only." Joining those to the devices at Part VI.C is the Foundation's inference and is advanced by neither set of authors.

Where it bears. Part V.C.3, which should be written on it. Part V.C.1, for functional impairment below the injury threshold. Part V.C.4, for the two findings on rating scales. Part V.J.1 and Part V.J.4, for the units. Part V.B, for the spectral characteristic in humans. Part V.D.4 and Part VI.C, for the roadway inference. Part IX.C.1, for the measurement request.

C.86 Khan (2019) — closed-form derivation of the near-field intensity distribution of a finite flat light-emitting diode, and why Lambert's law supplies the shape of the emission and not its magnitude

Citation. Khan MN. "Derivation and Experimental Verification of the Near-field 2D and 3D Optical Intensities From a Finite-size Light Emitting Diode (LED)." IEEE Photonics Journal 2019;11(6), article 8201219, pages 1 to 19. doi:10.1109/JPHOT.2019.2948816. Received 20 September 2019, accepted 18 October 2019, published online 22 October 2019. Open access under a Creative Commons Attribution 4.0 license; full text read. Sole author, affiliated to IEM LED Lighting Technologies, Red Bank, New Jersey, and the author of a monograph on light-emitting diode illumination published by CRC Press in 2013 which the paper cites. The near-field goniometric measurements reproduced in the paper were supplied by TechnoTeam Bildverarbeitung GmbH and are acknowledged as such.

What kind of paper this is. A theoretical derivation with partial experimental verification, published in a peer-reviewed journal of the Institute of Electrical and Electronics Engineers. It is not a health or safety study and makes no claim about either. The Foundation relies on it for the physics of how light leaves a light-emitting diode, which is a question the comment must answer before any exposure quantity can be stated, and for four explicit statements by the author which bear on the adequacy of the quantities in which the product is presently described.

The author on the quantity at issue. The paper opens on the question Part V.B.2 and Part V.B.8 address. "These applications require high-quality color properties of light that

depend on the brightness of the light source, which is technically known as luminance. Luminance is equal to luminous intensity per square area, and for LEDs and lasers, it depends on the viewing angle rather significantly." The conclusions identify the derived surface distribution in the same terms: "This surface distribution, known as luminance in the lighting and display industry, is a paraboloid, which resembles a Gaussian over a substantial part of the transverse domains where the transient effects only play a small role."

The derivation, in outline. For an infinitesimal flat element the author integrates the generalized solid angle in spherical coordinates and recovers Lambert's Cosine Law, I = I(max) cos φ. She then sums the elements over a finite emitting rectangle of dimensions X(L) by Y(L) containing m by n radiative electron-hole pairs, each contributing an inherent luminance L(avg), and obtains a luminous intensity distribution of the same Lambertian form whose constant of proportionality scales with the product of the emitting area, the number of pairs and L(avg). Projecting that three-dimensional distribution onto the emitting surface yields the surface intensity profile, which is a paraboloid of the form $z = C(max) - r^2$. The author notes that the Lambertian result is widely used and its condition widely forgotten: "it appears that many overlook as to why it is only valid for a 'differential-area' source, i.e., an infinitesimally small, flat source."

First finding relied on: the law gives the shape and not the peak. The author states the limitation of the Lambertian description expressly. "Although Lambert's Law holds for a differential area element in both near and far fields, it is only useful for a far-field luminous intensity pattern generated by a flat source that can be treated as an infinitesimal, flat source from very far away. From this law, one cannot calculate or predict I max in near or far field. In order to use Lambert's law, I max must be measured and then I can be calculated for any φ, provided the flat source is a square." The consequence for this comment is direct. The Lambertian assumption that runs through lighting design and photometric reporting fixes how intensity falls away from the axis. It is silent on how large the on-axis value is. That value must be measured, and Part V.J records that for the products at issue it is not.

Second finding relied on: what the peak scales with. The author states the scaling of the peak in terms, and the Foundation quotes it rather than paraphrasing because the word is hers. "the peak of the parabola shown in Fig. 11 would become enormous when L avg for the LED is very high due to very high inherent quantum efficiency, high light extraction efficiency form the LED chip, and driven by a large current. The peak of the parabola would also become very large when the size of the LED chip is very large." The word form in that passage appears in the original. Four quantities therefore govern the peak: the area of the emitting surface, the number of radiative pairs within it, the inherent luminance of each, and the drive current. None of the four is reported on a component data sheet, required by any standard examined in this comment, or recoverable from the lumen rating by which the product is sold. The author describes the practical use of the result as design control: "Our derived formula for surface intensity distribution provides a unique way to calculate the peak intensity generated by an LED which occurs in the middle of the diode surface."

Third finding relied on: directivity follows from the flat geometry. The author contrasts the emission of a finite flat diode with that of a point source. "Fig. 17 also shows the directivity of the beam generated by a finite, flat LED and such a behavior is never observed from a point radiant source that generates intensity distribution omni-directionally over the full solid angle range spanning from 0 to 4π steradians." She further reports that the transverse confinement depends on the shape of the emitting surface: it is circular on planes perpendicular to the optical axis where X(L) and Y(L) are equal, and where $X(L) \neq Y(L)$ the confinement is elliptical. This is the mechanism underlying the difference between a square and a round emitter recorded at Appendix D.3. The

significance for the comment is that the beam is a consequence of the shape of the emitter, present before any lens or reflector is fitted, and not a property conferred by the optic.

Fourth finding relied on: the comparison with a fluorescent lamp. The author photographed a G12 corn lamp carrying seventy surface-mount light-emitting diode modules, operating at 10 watts on 100 to 240 volts alternating current and producing 1,080 lumens, and observed the weighted Lambertian pattern from each flat face. She then states the comparison: "such patterns are never observed for fluorescent G12 lamp counterparts because their emitting surfaces are not flat." A lamp of the same fitting and comparable output does not produce the pattern, and the difference is attributed to one property of the newer source, namely that its emitting surface is flat.

The array measurement, which bears on Part V.J.3. Near-field goniometric measurement was performed on a task lamp carrying twenty-one discrete light-emitting diode modules mounted on flat surfaces, using a RiGO-801 near-field goniometer and plotted in candelas per kilolumen. The measured distribution was not that of a single emitter enlarged. The author reports a weighted Lambertian, attributes the departure to the number of elements, their coarser spacing and the greater size of the emitting plane, concludes that "the Lambertian LIDs are indeed weighted according to the x and y dimensions of the flat LED sources", and notes that the data would show more asymmetry at higher angular resolution.

What was verified experimentally, and what was not. The angular shape was verified against measured goniometric data. The magnitudes were not, and the author says so: "The magnitudes of the measured LIDs are not associated with our analytic solution in this study because one would have to measure the 'L avg' equivalent luminance values for the individual LED modules in the experimental samples. These will be included in our future studies." The surface-profile comparison was made against Philips LXHL data distributed for ray-tracing software rather than against a direct measurement of surface luminance, and the author records the limitation: the simulated plot "does not strictly represent the source surface intensity, i.e., exactly at z = 0. Instead, it is approximated via simulation at the detector plane." She identifies four sources of error in that comparison. The predicted dependence of the peak on emitter size is likewise stated as future work: "Our future work will also include measurements and calculations of LEDs of various sizes and shapes for the light emitting surface showing the increase of peak intensities as the surface size increases while keeping the drive current constant." No part of this comment may state that this paper measured a peak luminance for any product.

A statement in this paper that runs against the comment. The author states that "LEDs in general have random polarization and they are incoherent light sources because of the spontaneous emission process; therefore, random polarization, birefringence, and random phase all get averaged in the intensity that is generated by the surface normal LED." That is the opposite of the proposition for which Part V.C.2 relies on the measured spatial coherence lengths reported in the optics literature. The two statements concern different quantities, as Part V.C.2 now records, and neither author addresses the other. The Foundation does not cite this paper in support of the coherence argument and has placed the conflict in the body text rather than leaving it to be found.

A technical reservation, and its consequence for how the paper is used. Equation 5 of the paper carries the cube of the viewing-distance magnitude, so that luminous intensity appears to scale with distance, while the discussion later states correctly that luminous intensity in a given direction "is unchanged regardless of the distance of the viewer or detector by definition." The author reconciles the two by treating the distance term as absorbed into a constant evaluated at a chosen viewing distance. The cosine dependence, which is the result the Foundation relies on, is unaffected. The comment accordingly cites the proportionalities and the Lambertian result and does not reproduce the paper's equations as quantitative formulas.

Two further matters of quality, recorded rather than concealed. The paper cites an encyclopedia article accessible on the public internet as its authority for Lambert's Cosine Law, which is a textbook result available in the standard references the paper cites elsewhere; the comment does not rely on this paper for the statement of that law. The published text carries several uncorrected typographic errors. Twenty-eight days elapsed between submission and acceptance for a paper of nineteen pages. None of this bears on the four findings above, each of which is either direct quotation or an immediate consequence of the author's algebra, but it is the reason the comment cites the paper for its derivation and its express statements rather than treating it as settled authority.

Where it bears. Part V.B.8, which is written on it, for the geometry that produces the emission pattern and for the scaling of the peak. Part V.B.2, for the identification of luminance as the governing quantity and for the fourth consequence now recorded at subsection e. Part V.J.3, for the array measurement. Part V.C.2, for the contrary statement on coherence. Appendix D.3, whose square and round emitter figures this paper explains.

C.87 Williamson and McLin (2018) — quantitative exposure limits for visual impairment without injury, derived for coherent sources and proposed for international safety standards

Citation. Williamson CA, McLin LN. "Determination of a laser eye dazzle safety framework." Journal of Laser Applications 2018;30(3):032010. doi:10.2351/1.5029384. Published 18 July 2018 by the Laser Institute of America; designated an Editor's Pick. Open access under a Creative Commons Attribution 4.0 license; full text read. Williamson is at the Defence Science and Technology Laboratory, Porton Down, United Kingdom. McLin is at the Optical Radiation Bioeffects Branch, Bioeffects Division, Airman Systems Directorate, 711th Human Performance Wing, Joint Base San Antonio Fort Sam Houston, Texas. Crown copyright 2018, Dstl, reference DSTL/JA101326, licensed additionally under the Open Government Licence. The acknowledgment thanks colleagues across the United Kingdom Ministry of Defence and the United States Department of Defense.

Why this entry is in an appendix otherwise concerned with light-emitting diodes. It is not about light-emitting diodes and the Foundation does not present it as evidence about them. It is in this appendix because it is a worked instance, in the peer-reviewed literature and with United States federal authorship, of the thing this comment says has never been done for incoherent sources: the derivation of quantitative exposure limits for impairment of vision that produces no injury. What it supplies is a method and a demonstration of feasibility, not a number that may be carried across.

The gap the authors identify, in their own words. The introduction states the asymmetry this comment makes for a different emitting technology. "Cases of permanent eye damage caused by lasers are still relatively rare, with the risks of eye damage from laser systems being well understood and comprehensively documented in international laser safety standards. However, despite the significantly greater frequency of laser eye dazzle events, there is an absence of equivalent guidance for laser eye dazzle effects in these standards." The standards referred to are ANSI Z136.1-2014 and EN 60825-1:2014. The authors characterize the need as urgent and the paper as the scientific background to a framework proposed for adoption, the full text of which is an annex to the paper.

The quantity defined, and the limit it is built against. Dazzle is defined at the opening as "the temporary impairment of human performance caused by visible wavelength laser light." The limit is the Maximum Dazzle Exposure: "The MDE is the laser irradiance at the eye above which an object cannot be visually detected through this dazzle field." The authors then state the structural point this comment takes from the paper: "MDE is analogous to the established concept of Maximum Permissible Exposure (MPE) which sets the laser irradiance limit above which there is a risk of permanent eye damage." The field therefore has two limits in the same units for the same radiation, one for injury and one for

functional impairment, and the second was constructed because the first did not describe what was actually happening to people.

How the limit is resolved, which is the part that matters for method. Three variables, each of which the Foundation argues at Part V.J must enter any adequate specification. Extent of impairment, through a defined dazzle level: very low is a 2-degree full-angle obscured field centered on the source, low is 10 degrees, medium 20 degrees and high 40 degrees. State of adaptation, through three ambient luminances approximating night at 0.1, dusk or dawn at 10, and day at 1,000 candelas per square meter, with the authors noting that dazzle is "more readily achieved as the ambient light level decreases from day to night." And wavelength, by dividing every tabulated value by the photopic luminous efficiency V(λ) at the wavelength concerned, the authors giving V(450) = 0.0647, V(550) = 0.9890 and V(650) = 0.1193.

The proposed limits. Table VI of the paper, offered by the authors as "the proposed table of MDE values to be used in laser safety standards." Values are irradiance at the eye in microwatts per square centimeter, each to be divided by V(λ).

Acceptable dazzle level	Night (0.1 cd/m²)	Dusk or dawn (10 cd/m²)	Day (1,000 cd/m²)
Very low – 2° obscured	0.001	0.6	40
Low – 10° obscured	0.04	30	2,000
Medium – 20° obscured	0.16	120	8,000
High – 40° obscured	0.6	450	30,000

What was measured and what was modeled, which the entry separates because the authors do. The experimental basis is a human-subject letter-orientation task reported in the authors' earlier work: a tumbling-E character of 0.4 degrees with a 0.08-degree bar width at 60 percent contrast, viewed monocularly in negative contrast, across up to eight laser wavelengths. The table above is not that measurement. It is modeled output, computed for binocular viewing after the model had been validated against the monocular experimental data, then rounded. Three qualifications follow and all are the authors'. Night values for the standard object were not measured at all, because the target "was too near threshold and could not be reliably discriminated by many of the subjects"; measured night values exist only for a larger and higher-contrast target. Many of the daylight values were extrapolated beyond the irradiances actually used, the experiment having never exceeded 1,000 microwatts per square centimeter. And the model assumes a single observer profile, age 40 with dark eye pigmentation. The authors state the status of the result plainly: "The final MDE table should be taken only as an approximate guide to the laser irradiances required to cause the stated dazzle levels at the given ambient light levels."

The first finding the comment takes from the table, and the arithmetic is the Foundation's. The paper states that the Maximum Permissible Exposure for a 10-second visible exposure is 1,000 microwatts per square centimeter, and that for a quarter-second exposure it is 2,546. Set the injury limit against the impairment limits above. At night, the irradiance that obscures 40 degrees of the visual field is 0.6 microwatts per square centimeter, which is about one thousand seven hundred times below the injury limit for a 10-second exposure. The irradiance producing the least dazzle the framework recognizes is 0.001, about one millionth of it. Even at 450 nanometers, where the division by V(λ) raises the limit by a factor of about fifteen, a high dazzle level at night arrives at roughly 9 microwatts per square centimeter, still about one hundred times below the injury limit. The Foundation states the consequence and no more: for this radiation, in darkness, compliance with the injury limit leaves between two and six orders of magnitude of headroom above the exposure that destroys the usability of the visual field. The ratios

are the Foundation's arithmetic on the authors' published values; the authors do not state them in that form.

The second finding, likewise the Foundation's arithmetic. The same table quantifies the dependence on adaptation that Part V.B.2 and Part V.C.3 argue for. Holding the dazzle level constant, the irradiance required in daylight exceeds that required at night by a factor of 40,000 at the very low level and 50,000 at each of the other three. From night to dusk the factor is 600 at the very low level and 750 at the others. The authors note the direction of the effect; the factors are the Foundation's computation from the tabulated values.

The daylight collision between the two limits, which the authors do state. In daylight the relationship inverts, and the authors say so: "During the day, a Very Low DL can be achieved with around 40 μW cm−2, but greater levels of dazzle require irradiances that exceed the visible wavelength MPE–i.e., the observer would be at risk of eye damage if exposed to these levels of dazzle." Three of the four daylight values in the table carry a footnote recording that they exceed the injury limit. So the injury limit binds first in daylight and is almost irrelevant at night. A limit addressed to injury is therefore not a conservative proxy for impairment; whether it protects against impairment at all depends entirely on the ambient condition, and in the condition where these products are most used it does not.

The object the limit is defined against, which bears on Part VI.C. A limit of this kind requires a defined visual task, and the authors chose one: an object of 0.08 degrees at 60 percent contrast. They give the everyday equivalents, and the second is the one this comment should notice. Detecting an object of that size is "approximately equivalent to detecting a 5 m long car at a range of 3.5 km or a 0.5 m human torso at 350 m." The limits above are therefore limits on the irradiance at which a human torso at 350 meters ceases to be detectable. Part V.D.4 records the research arm of the Federal Highway Administration measuring pedestrian detection distances averaging 116 feet at night, and hypothesizing without measuring that a driver who looks away from an unbearable glare source might miss a hazard near it. The laser safety literature has built the quantity that hypothesis requires, for its own emitting technology.

A tension with Appendix C.85 that the Foundation records rather than resolves. The framework scales by photopic luminous efficiency, so it predicts that equal dazzle follows equal photopic illuminance regardless of wavelength. The study at Appendix C.85, which applied dazzle methodology to light-emitting diodes at a mesopic background of 0.255 candelas per square meter, reports a result that does not follow that rule. At full intensity its three sources delivered 5.34, 68.03 and 41.57 lux at 470, 530 and 625 nanometers. Photopic scaling predicts impairment ordered 530, then 625, then 470. The measured impairment was ordered 530, then 470, then 625: the blue source impaired vision more than the red while delivering about one eighth of its photopic illuminance. The Foundation does not call this a refutation and the comparison is its own arithmetic across two papers. The endpoints differ, one being detection of a defined object through a dazzle field and the other perimetric sensitivity across the central field, and the sources differ in coherence. What it indicates is that a photopic weighting is the element of this framework least likely to transfer to incoherent sources, and that it would err in the direction of understating the short wavelengths, which are the wavelengths at issue in this comment.

The practice of the field, offered as a comparison. The authors published the complete data and analysis for both this paper and the underlying experiment as citable datasets, together with a spreadsheet calculator for computing limits, protection requirements and the Nominal Ocular Dazzle Distance, which they define as the distance beyond which a source delivers less than the Maximum Dazzle Exposure and which stands to the dazzle limit as the Nominal Ocular Hazard Distance stands to the injury limit. Their stated purpose was "to encourage independent verification of the methodology." The Foundation records this because Part V.J reports the opposite condition for the products at issue,

where neither the emission characteristics nor the measurement protocols are published in a form permitting verification.

What it establishes. That exposure limits for impairment of vision without injury can be derived from human subject data; that they can be resolved by severity of impairment, by state of adaptation and by wavelength; that a limit so derived can be expressed in the same irradiance units as the injury limit and used in the same safety calculations; that the derivation was carried out with the participation of a United States federal research organization and published in the peer-reviewed literature; and that the field undertaking it regarded the absence of such guidance from its safety standards as urgent.

What it does not establish. Nothing about light-emitting diode products. The values depend on a monochromatic collimated beam producing a particular retinal irradiance distribution, and the comment's position at Part II.C.3, that diodes and lasers differ in coherence and collimation and that the difference is real, is unchanged. No value in this entry may be applied to an incoherent or extended source. The table is modeled rather than measured, is extrapolated at the upper end, assumes one observer profile, and is offered by its authors as an approximate guide. The framework is proposed for adoption into standards; this entry does not establish that it has been adopted.

Where it bears. Part V.C.3, which is written on it and whose outstanding request for Williamson it answers. Part V.K.3, for the margin between the injury limit and the impairment threshold, which bears directly on a safety conclusion conditioned on compliance with an injury limit. Part V.C.1, for the distinction between lesion and impairment. Part II.E, for the asymmetry between the agency's treatment of coherent and incoherent optical radiation, which this paper extends from standards recognition to the hazard science itself. Part V.J.1 and Part V.J.4, for the units. Part VI.C, for the object standard.

C.88 Babadi and others (2017) — why a street lighting luminaire needs a secondary optic, the threshold at which an emitter stops behaving as a point, and the dependence of the designed distribution on the source

Citation. Babadi S, Ramirez-Iniguez R, Boutaleb T, Mallick T. "Performance Comparison of a Freeform Lens and a CDTIRO When Combined With an LED." IEEE Photonics Journal 2017;9(5), article 6501008, pages 1 to 8. doi:10.1109/JPHOT.2017.2728701. Received 21 March 2017, revised 13 July 2017, accepted 14 July 2017, published online 18 July 2017. Open access; full text read. Marked an invited paper. The first three authors are at the School of Engineering and Built Environment, Glasgow Caledonian University; the fourth at the Environment and Sustainability Institute, University of Exeter. Supported in part by the Energy Technology Partnership of Scotland, by Optical Antenna Solution, and by Glasgow Caledonian University.

How the Foundation came to this paper, which bears on how it is cited. The work was first presented as a conference paper, Analysis of uniformity of illumination of a freeform lens when combined with different optical sources, SPIE Proceedings volume 9744, article 974417, 2016. A conference paper is not an article in a peer-reviewed scholarly journal and is therefore outside the criterion stated in the preamble to this appendix. The present entry is of the journal paper, which reports the same program of work and cites the conference paper as its own authority for the threshold described below. The same four authors published two further journal papers on this work, in Applied Optics in 2018 and in Optical Engineering in 2020, neither of which has been read.

What the paper is. An optical engineering study comparing two secondary optics, a single refractive freeform lens and a circular dielectric totally internally reflecting optic of the authors' own design, each combined with the same light-emitting diode and each intended to convert its output into uniform illumination of a defined area. Both were designed by energy mapping, fabricated in polymethyl methacrylate by computer numerical control to

a precision of 5 to 30 micrometers, simulated by ray tracing in Zemax, and then measured. It is not a health study and reports no biological endpoint. The Foundation relies on it for four propositions about the emission of these sources and about what an optic can and cannot do with it.

Apparatus and dimensions. The emitter was a Cree XLamp 1507 with an active area 0.89 centimeters in diameter. The freeform lens was 2.5 centimeters high and 4 centimeters wide and was designed to illuminate a circle of 50 centimeters radius at a distance of 1 meter. The alternative optic had an entrance aperture 1.7 centimeters high and 0.9 centimeters in radius and was designed for a circle of 35 centimeters radius at the same distance. Uniformity is defined by the authors as "the ratio of the minimal illuminance over the area weighted average illuminace", the misspelling being theirs, and both optics achieved over 95 percent on that measure in both simulation and measurement.

First proposition: these sources cannot be used for street lighting as they emit. The authors state the reason a secondary optic is required at all, and the Foundation quotes it because it is the application-side counterpart of the derivation at Appendix C.86. "In spite of the advantages of LEDs, it is impractical in many cases to use them in street light luminaires directly without a suitable secondary optic due to their lambertian radiation pattern. Normally, the LED produces high light intensity at the centre and low light intensity at the edge of its circular illumination footprint." The spelling centre is the authors'. Two things follow that this comment uses. The distribution is Lambertian, which is what Khan derives from the geometry of a flat emitter and what the manufacturer at Appendix D.3 states it designs for. And the intensity is concentrated at the center of the footprint, which is the peak the whole of Part V.B.2 concerns.

Second proposition: the threshold at which an emitter stops behaving as a point. The design method assumes a point source. The authors state where that assumption fails: "A point light source (small LED) has been assumed in Fig. 1. However, high power LEDs (extended light sources) are required in application such as street lighting. Using an extended light source reduces uniformity on the target plane. To keep uniformity the size of the light source and the optic have to be taken into account. An extended light source acts as an approximate point light source when the size of the optic is five times larger than the light source." That is a stated numerical threshold for the failure of the point-source approximation, and it is the third independent statement of such a threshold the Foundation has collected: Khan derives at Appendix C.86 why a finite flat emitter is not a point, the metrology reference work described at Appendix D.5 gives a photometric distance of five to fifteen times the source extent, and these authors give five times the source size as the condition on the optic. The authors attribute the threshold to their own earlier conference paper.

Third proposition, and the one with the most consequence: the designed distribution depends on the source. The finding stated in the abstract is that the two optics differ in robustness rather than in peak performance. "Both optics can produce over 95% uniformity within an illuminated area. However, the uniformity produced by the freeform lens reduces abruptly compared with the CDTIRO when some parameters such as size and the position of the light source are changed." In the comparison section the authors put it as a property of their own design: because its footprint is the sum of two illuminations, the alternative optic "reduces the effects of changing the light source or the size of the optic in the uniformity of illumination." The consequence the Foundation draws is that the illumination a luminaire actually produces is a property of the source and the optic together and not of the optic's design, and that it is not robust to a change in the size or position of the emitter.

Fourth proposition: optics in an array interfere. On the freeform lens in a multiple-element installation: "it is necessary to provide a gap between them in order to keep uniformity of illumination. Otherwise the lenses act like obstacles and uniformity

deteriorates." The emission of an array is therefore not the sum of the emissions of its elements on the optical side either, which is the proposition Part V.J.3 advances on other grounds.

What it does not establish, and a limit the Foundation states against itself. It establishes nothing about health, exposure or injury and the Foundation does not offer it for any such purpose. On its own central finding it is qualitative: the degradation of uniformity is described as abrupt and is nowhere quantified, no figure is given for how much uniformity is lost for a given change in source size or position, and no part of this comment may imply a magnitude. The work concerns illumination of a target plane and not exposure of an eye. And the uniformity measured is uniformity of the illuminated surface, which is a different quantity from the uniformity of the emitting surface discussed at Part V.B.2.

An attempted inference the Foundation abandoned, recorded because the abandonment is informative. The Foundation attempted to explain the difference in robustness by the authors' own five-times threshold and could not. The freeform lens is 4 centimeters across against an emitter of 0.89 centimeters, a ratio of about 4.5 and so just below the stated threshold, which would account for its fragility. But the alternative optic has an entrance aperture about 1.8 centimeters across, a ratio of about 2 and so further from the threshold, and it is the more robust of the two. Either the threshold does not govern robustness or the relevant dimension is not the one used here. The authors attribute the robustness to the summing of two illumination components and not to size. The arithmetic is the Foundation's, it does not support the inference, and no part of this comment advances it.

Considerations bearing on confidence. In favor: both optics were fabricated and measured rather than only simulated; the simulation and the experiment used the same optic size, source size, refractive index and source radiation pattern, which the authors state expressly; the emitter is a named commercial component and the manufacturer's own simulation data were used; and the central finding runs against the authors' interest in neither direction, since both optics are reported to reach the same peak uniformity. Against: the paper is an invited paper accepted one day after revision; the study compares the authors' own novel optic favorably with an established alternative, which is an interest; the measurement of uniformity is described only as taken with a light sensor at marked intervals, with no instrument named and no uncertainty stated; and the scholarly apparatus is careless in several respects. The Foundation accordingly cites this paper for the authors' own measurements and their own stated design rules and not as authority for anything they attribute to others.

Where it bears. Part V.B.8, for the Lambertian and center-peaked emission and for the point-source threshold. Part V.J.1, for the dependence of the delivered distribution on the source. Part V.J.3, for the interference between optics in an array. Part VI.D, Roadway, Area and Parking Lighting, which is presently unwritten and for which this is one of the sources.

C.89 Moreno and Sun (2008) — the radiation pattern of real light-emitting diodes, why the chip and the package differ, and a published recommendation that manufacturers disclose what the half angle does not

Citation. Moreno I, Sun C-C. "Modeling the radiation pattern of LEDs." Optics Express 2008;16(3):1808 to 1819. doi:10.1364/OE.16.001808. Published by the Optical Society of America, now Optica Publishing Group. Open access under the publisher's version-of-record open access license; full text read. The first author is at the Universidad Autónoma de Zacatecas, Mexico, and the second at National Central University, Taiwan. Supported by the Ministry of Economic Affairs of the Republic of China under contract 94-EC-17-A-

07-S1-043. The publisher records 297 citing works, which makes it the most cited item in this appendix so far as the Foundation is aware.

Article type. A modeling paper in a peer-reviewed optics journal. It proposes an analytic representation of the angular intensity distribution of a light-emitting diode, fits it to the published distributions of named commercial devices from several manufacturers, and reports the accuracy of the fit. It is not a health study and reports no biological endpoint. It is in this appendix because the appendix admits peer-reviewed articles whatever their subject matter, and because four propositions in it bear on Part V.B.

First proposition: the chip is Lambertian and the finished device is not. The authors locate the Lambertian form precisely, and the location is the emitting region rather than the product. "In LEDs, light is produced by spontaneous emission from the light-emitting region of chip. Therefore, the generated light is incoherent and its superposition is a linear combination in intensity terms. From the radiometric point of view, the emitting region is a Lambertian light source." And of the chip faces: "The radiation pattern emitted by every chip face will generally be Lambertian, although in some LEDs, this pattern is modified by special microstructures on the chip and by wave guide effects inside the chip." The emitted pattern of the finished device is then the sum of three contributions, from the chip, from the reflecting cup and from the encapsulating lens, and the authors identify the three structural factors that modify it: the roughness of the chip faces, the geometry and roughness of the reflective cup, and the geometry of the encapsulant lens.

Second proposition: the lens is what narrows the beam. The authors state the direction of the effect: "In most cases, the lens angularly narrows the radiation pattern (due to the chip and the mirror), though sometimes it enlarges the pattern." That supplies the mechanism for the measurement at Part V.B.8 in which four packaged devices were found to depart from the Lambertian form in the narrowing direction, and it is the explanation the Foundation preferred there over coherence. The authors also supply the term the literature uses for that departure, calling a cosine-power distribution with an exponent above unity an imperfect Lambertian.

Third proposition: the point-source approximation fails further out for these devices than the standard rule predicts. The authors set out the conventional rule and then correct it for this technology. The rule is that a source may be treated as a point beyond about five times its largest dimension. Of that rule they write: "this rule of thumb is not so easily applied to LEDs because of the radiance complexity and wave effects", and they record that a separate concept, the mid field, had to be proposed for these sources. Then the figure: "Using the radiometric definition, a high-power LED with a 1mm2 chip should have a 5-mm near field, but in practice up to 20-mm mid fields are found." Their own laboratory measurements place the onset of the far field at about 20 millimeters from the tip for some power devices and "a little longer in multi-chip LEDs." The rule therefore under-predicts, for this technology, by up to a factor of four.

Fourth proposition, and the one the comment principally relies on: a published recommendation that the data sheet disclose more. The authors state what manufacturers publish and why it is not enough, and then make a recommendation. "Most manufacturers use $\theta 1/2$ (the view angle when radiant intensity is half of the value at 0°) to characterize the angular distribution of LEDs with a single intensity peak." They note a second published attribute, the total included angle within which ninety percent of the flux is radiated, and then: "However, additional parameters are needed to render the shape of the radiation pattern. Therefore, we propose that the manufacturer should include a simple formula (like those reported here) with its coefficients in their technical data sheets." That is a recommendation, published in a peer-reviewed optics journal in 2008 and since cited several hundred times, that the information this comment asks for at Part IX.F be disclosed on the data sheet.

What was modeled, and against what. The model is a sum of at most two or three Gaussian or cosine-power terms, the number corresponding to the three optical elements. It was fitted to the published distributions of named devices from Nichia, Cree, Lumileds Philips, Edison, Osram and Seoul Semiconductor, including the Nichia NSPW345CS, the Cree XLamp XR-E, the Lumileds Luxeon Rebel, K2, Side Emitter and Batwing, the Edison EdiPower 3-RD-01-H0001, the Osram Firefly Hyper-Bright LB-V19G and the Seoul Semiconductor Z-Power Side Emitter. The authors set their own acceptance criteria at a root mean square error below 5 percent and a normalized cross correlation above 99 percent, and report that both were satisfied in every case.

Three incidental findings the Foundation records, because each bears on the reliability of a published figure. That not even the device best described as Lambertian is well described by a simple cosine: of the Edison part the authors write that it "fits well as a perfect Lambertian emitter, and a first order analysis can be performed by using a simple cosine function, but with a 5.1% RMS error", which exceeds their own five percent threshold. That the published pattern of a device is an envelope rather than a curve: several manufacturers publish an upper and a lower bound, and the authors attribute the difference between them to "manufacturing errors related to the emission, reflection and transmission of the optical flux." And that a published pattern may be misaligned: to fit one manufacturer's data the authors had to displace the entire distribution by 2.55 degrees, which they attribute to "a misalignment of the optical axis of the LEDs tested by the manufacturer."

What it establishes. That the angular distribution of a finished light-emitting diode is the product of a Lambertian emitting region modified by a reflector and a lens, and is not itself Lambertian; that the lens generally narrows it; that for this technology the distance beyond which the device may be treated as a point is up to four times the conventional rule; that the half angle published on a data sheet is insufficient to render the shape of the distribution; and that the specialists who established this proposed in 2008 that manufacturers publish the coefficients that would render it.

What it does not establish. Nothing about health, exposure, injury or any biological endpoint, and the paper addresses none of those. It models intensity and irradiance and no other quantity. The devices modeled are those of 2008 and the fits are to manufacturers' published distributions rather than to the authors' own measurements of the parts, a distinction the entry preserves. The authors' statement that the generated light is incoherent is an assertion in passing and not a measurement, and Part V.C.2 treats the coherence question on the sources that measured it.

Where it bears. Part V.B.8, which is written on it. Part V.J.1, for what a single published figure does not determine. Part IX.F, for which it supplies a peer-reviewed precedent dating from 2008. Part V.C.2, for the incoherence assertion, recorded there as an assertion.

C.90 Miller, Irvin, Royer and Strachan (2024) — the phantom array effect remains visible to 7,000 hertz, is seen and resented more by people with a history of migraine, and is not described by the function in the governing international document

Citation. Miller N. J., Irvin L., Royer M., Strachan C. "Visibility and annoyance of the phantom array effect varies with age and history of migraine." Lighting Research and Technology 2024. doi:10.1177/14771535241288783. Received 16 July 2024, revised and accepted 16 September 2024. Published by SAGE for the Chartered Institution of Building Services Engineers. The copy read carries the article-in-press pagination 1 to 31 and no volume number. The first, second and fourth authors are at Pacific Northwest National Laboratory, Portland, Oregon; the third is also at the School of Civil and Construction Engineering, Oregon State University.

Funding, which is the first thing the Foundation asks the Department to notice. The funding statement reads that the work "was supported by the U.S. Department of Energy's Lighting R&D Program, part of the Building Technologies Office within the Office of Energy Efficiency and Renewable Energy (EERE)." The authors declared no conflicts of interest. This is accordingly federally funded research, performed at a national laboratory, finding that an artifact of light-emitting diode modulation is more visible and more resented by an identifiable group of people. It is not the work of an affected party and the Department need not weigh it as such.

Design. A within-subjects psychophysical experiment. Fifty-five participants, 25 with migraine and 30 without, 27 under 40 years and 28 aged 40 or over, median age 39 and mean age 45 in both groups, evaluated 85 unique temporal light modulation waveforms for visibility of the phantom array, and a subset of 51 for annoyance. Migraine history was established by a pre-participation questionnaire reviewed by a medical professional, and the paper states that no person in the migraine group was excluded on account of symptoms. Sessions ran about 90 minutes. An exit questionnaire was administered at the end of the session and a follow-up questionnaire one to three days later.

The effect studied, in the authors' definition. The phantom array effect is "a series of repeated images that may be perceived when a person moves their eyes in large saccades across a light source (or a specular reflection of that light source) that is modulating in output over time." It is therefore distinct from the stroboscopic effect, which concerns a moving object under a modulating source, and from directly visible flicker.

Apparatus and stimulus, with two figures that bear on Part V.B. The source was a ThorLabs MWWHLP1 blue-pump phosphor-coated light-emitting diode of 2871 kelvin, emitter 3.5 millimeters in diameter by 1.6 millimeters high, driven through an arbitrary waveform generator. The participant sat about 3.0 meters away at an eye height of 1.2 meters, with fixation targets 22.5 degrees to each side and the wall around the source draped in matte black cloth. Saccades were paced by a metronome at 126 beats per minute, giving an average saccade velocity of 95 degrees per second and a peak near 500. Vertical illuminance at the eye was about 8.8 lux from the ambient lighting and 1.9 plus or minus 0.2 lux from the source. The overhead luminaires were driven at a nominal 32 kilohertz, so the ambient lighting was not itself a source of low-frequency modulation. Two figures are recorded for use elsewhere in this comment. The source subtended a visual angle of 0.06 degrees across the scan dimension, which is about 1.05 milliradians and therefore below the 1.5 milliradian minimum angular subtense of the instrument described at Appendix D.1. And the target luminance was 52,400 candelas per square meter, which is about 5.2 times the luminance above which that instrument states a hazard assessment is normally required. The conversion and the ratio are the Foundation's arithmetic.

The waveforms. Fifty sinusoidal conditions at 120, 400, 800, 1,200, 2,400 and 4,800 hertz with seven or eight modulation depths each from 100 percent down to 5 percent, plus single conditions at 7,000 hertz and 100 percent and at 10,000 hertz at 55 and 100 percent. Twenty-eight rectangular conditions across seven frequencies from 120 to 10,000 hertz, each at two modulation depths of 100 and 55 percent crossed with two duty cycles of 10 and 50 percent. Six complex waveforms measured from commercial lighting products. One nominally direct-current condition, which served as the control against which visibility was tested. Measured luminous output was within 10 percent of the mean for all waveforms.

First finding: the frequency extent. Peak sensitivity fell between 400 and 800 hertz, with the individual peak having a median and mode of 800 hertz and a mean of 831, which the authors qualify by noting that the frequency resolution was not designed to locate the true average peak. Stimuli up to 7,000 hertz were statistically more visible than the direct-current control across all participants. Sine waves at 100 percent modulation were "still problematic – and more visible than DC at 7000 Hz." At 10,000 hertz the effect was not

statistically more visible than the control on sample averages, although five reliable participants reported visibility above threshold there. The control figures are given and the Foundation reproduces them because they establish that the 10,000 hertz result is a true null rather than a weak signal: for the rectangular waveform at 100 percent modulation and 10 percent duty cycle, detection at 4,800 hertz was accurate for 84 percent of reliable observers and 73 percent of all observers, while at 10,000 hertz it was 13 percent of reliable observers and 16 percent of all observers against a false-positive rate of 15 percent of all observers on the direct-current waveforms.

Second finding: history of migraine. The authors state that this question had not been examined before: "no research has investigated if or how PAE sensitivity varies between people with and without migraine. Likewise, there has been no research on physiological symptoms following exposure to the PAE – for either migraine or non-migraine groups." In the mixed-effects binary logistic model of visibility, migraine status gave an odds ratio of 3.31 with a 95 percent confidence interval of 1.22 to 8.94 at p equal to 0.019, and the interaction of migraine status with frequency was significant at p below 0.001, the migraine group being relatively more sensitive at the higher frequencies. Rectangular waveforms were more visible than sinusoidal ones at an odds ratio of 1.41.

Third finding: age. Younger participants found more stimuli visible, at p below 0.001 and an odds ratio of 0.94 for each year of age. The Foundation states the effect size with the qualification the authors give it. Excluding the least sensitive participants, the decline in the proportion of visible stimuli was about 2.8 percent per ten years of age, and "a linear regression between age and number of stimuli visible above threshold had R2 = 0.08." The direction of the age effect is therefore well established and its magnitude is not. Unlike migraine status, the interaction of age with frequency was not statistically significant.

Fourth finding: the questionnaires, and what the annoyance data do and do not show. The Foundation separates these because the paper reports two different kinds of annoyance result and a comment that merged them would overstate. On the questionnaires, the migraine group reported being bothered by the effect more than rarely at 72 percent against 40 percent, physical symptoms attributed to it at 84 against 47 percent, headache at 64 against 10 percent, eye fatigue or strain at 60 against 17 percent, distraction or disorientation at 64 against 34 percent, and having changed a behavior such as leaving a restaurant at 60 against 17 percent. In the four hours after the session, 64 percent of the migraine group against 19 percent reported discomfort or an adverse reaction, and 41 against 8 percent a headache. Younger participants reported more headache and more visual fatigue, each 36 against 9 percent. Whether participants see the effect in everyday life at all did not differ significantly, at 84 against 73 percent and p equal to 0.328. In the model of annoyance ratings recorded during the experiment, by contrast, migraine status was not significant as a main effect, at p equal to 0.062, while its interaction with frequency was, at p equal to 0.001; age was not significant as a main effect at p equal to 0.182 although its interactions were. The accurate statement is therefore that the migraine group reported substantially more annoyance and more symptoms outside the experiment, and that within the experiment their greater annoyance was concentrated at the higher frequencies rather than present across the board.

Fifth finding: the range of individual sensitivity. Six participants saw fewer than 10 percent of stimuli above threshold, three of them saw none and two never saw the effect at all, while seven saw at least 75 percent of the unique stimuli. "A small number of reliable observers were able to detect the PAE above threshold even at only 5% modulation." Of the predictive measure the authors write that "it cannot predict any individual's ability to see the phantom array, as there is extreme variation in sensitivity to the PAE."

Sixth finding, and the one that bears on standards: the function in the international document is not supported. The provisional phantom-array function of CIE 249:2022 was based principally on a study using a 0.02 degree target at 250 or 500 lux and

frequencies of 100, 600 and 1,200 hertz only. The authors state the resulting limitation of both available functions: "The CIE 249 function was developed using data up to 1200 Hz, and the PAVM threshold function was developed using data up to 2000 Hz." Against measurement, "CIE 249 suggests threshold visibility at 76% modulation for 2400 Hz sine waves, but threshold visibility was 49% in this experiment." Saturation at full modulation would occur at 2,700 hertz on the Commission model and 5,100 hertz on the phantom array visibility measure, against approximately 6,000 hertz on this experiment's own model. The authors conclude: "This experiment does not support the use of the PAE threshold modulation function published in CIE 249." They endorse the alternative: the phantom array visibility measure and the performance levels of IES TM-39 "were effective at differentiating stimuli" at the two ends of the range.

The qualification that runs the other way, which the Foundation states because the paper does. The failure of the Commission function is a failure about the shape of the frequency dependence and not a uniform permissiveness. The authors write: "Aside from relative differences, both the CIE 249 function and PAVM function predict lower absolute threshold modulation." In absolute terms, that is, both functions predict visibility at lower modulation than this experiment measured, and the authors note that another recent experiment found lower thresholds still at the peak. They also list the application and individual factors on which absolute thresholds depend: background and contrast, ambient illumination, stimulus size and shape, the size of the scanning angle, saccade speed and personal sensitivity. A comment that presented this paper as showing the standards to be generally too permissive would misdescribe it. What it shows is that the Commission function understates sensitivity at the frequencies above its evidence base.

The authors' own statements of consequence. Three, quoted because they are the authors' and not the Foundation's. On the weight of the evidence: "this is strong evidence that TLM is a major problem in lighting and should be remedied, even if it requires trade-offs with other performance attributes." On the choice of population against which any metric is normalized: "if a general population is used to model threshold visibility, and individuals with migraine and other sensitive individuals were excluded as subjects, then the average values may not be protective for some at the more sensitive end of the normal distribution. In that case, more strict performance criteria can be set to account for more sensitive observers." And on what should happen: "We advocate for rapid uptake of metrics and specifications to mitigate the PAE – and other responses to TLM – such as those proposed in IES TM-39."

The frequency recommendation, and the conditions the authors attach to it. The recommendation and its limits are in one sentence and the Foundation quotes the whole of it, because the exclusions are what make it relevant to Part VI: at 10,000 hertz the pulse-width-modulation waveform "was not statistically more visible or more annoying than DC, making this a reasonable target minimum frequency if PWM is utilized in lighted environments similar to those in the experiment space (i.e. not areas with larger eye movements, darker finishes or very low ambient light conditions)." The excluded conditions are those of the nighttime outdoor environment. The authors record what is known about them: "Others have examined higher frequencies using luminous targets in very dark surrounds, in which case some observers can reliably see the PAE above 10 000 Hz."

What it establishes. That the phantom array effect is visible well above the frequencies at which modulation is commonly assumed to become imperceptible, to 7,000 hertz on these averages and reliably above 10,000 hertz in dark surrounds on the literature the authors cite; that pulse-width modulation at full depth is the most visible and most annoying waveform class tested; that sensitivity varies with history of migraine and with age; that the range of individual sensitivity is wide enough that some observers detect the effect at 5 percent modulation; that the provisional function in CIE 249:2022 does not describe

measured sensitivity at frequencies above its evidence base; and that the authors, funded by the Department of Energy, consider the evidence strong enough to call for remediation accepting trade-offs.

What it does not establish. That the phantom array effect causes the symptoms reported. The authors are explicit, and the Foundation adopts their statement rather than softening it: because the task was visually demanding, requiring an hour or more of repeated saccades, "the negative outcomes (for the migraine group in particular) cannot be explicitly linked to the TLM itself." Nor does it establish the prevalence of anything in the general population, the sample being 55 volunteers recruited in one city. Nor does it establish effects of ordinary duration: exposure to each stimulus was momentary, and the authors note that "Longer durations of exposure may increase the annoyance level or the prevalence of adverse physiological responses." A specific caution attaches to the symptom figures, which the authors raise themselves: all participants were told during recruitment that symptoms were possible and the migraine group received an additional history questionnaire, so "It is possible the migraine group inferred a higher likelihood of headaches afterward, which could have increased the number of post-experiment headaches reported." The study was also not designed to identify which stimuli produce adverse reactions, and whether visibility is necessary for symptoms at all is left open as a question for future work.

Where it bears. Part V.D.2, which is written on it. Part V.D.1, for the standing of pulse-width modulation at full depth. Part V.D.3, for the relation between this material and IEEE Std 1789-2015, which addresses frequencies far below those at issue here. Part V.D.4 and Part VI, for the nighttime and high-contrast conditions the authors expressly exclude from their frequency recommendation. Part V.E, for the migraine findings, which belong with the neurological material rather than with the photochemical. Part VII, for the population-normalization passage. Part V.B.8, for the two incidental figures recorded above.

C.91 Martinsons and others (2024) — the authors of the governing recommended practice state that no measurement method exists for the phantom array effect, that the model in the international report has never been validated, and that there is insufficient data to set safe levels for sensitive people

Citation. Martinsons C., Gaines J., Vollers J., Nachtrieb R., Wolfman H., Zissis G. "A Review of Contemporary Issues with Temporal Light Modulation of Lighting Systems." IEEE Transactions on Industry Applications, early access 12 July 2024. doi:10.1109/TIA.2024.3425821. Print ISSN 0093-9994, online ISSN 1939-9367. The copy read is the early-access version and carries no volume, issue or page numbers. An author copy is deposited in the open archive HAL as hal-04659609. The paper states that it is an augmented and updated version of a paper presented at the eleventh International Conference on Energy Efficiency in Domestic Appliances and Lighting and seventeenth International Symposium on the Science and Technology of Lighting, Toulouse, 1 to 3 June 2022.

The authors, which the Foundation sets out in full because the authorship is the reason this paper carries the weight it does. Christophe Martinsons, Centre Scientifique et Technique du Bâtiment, a French public research institute. James Gaines, Standards and Regulations, Signify, Burlington, Massachusetts. Jonathan Vollers, Director of Engineering Services, Cree Lighting, Ideal Industries, Racine, Wisconsin. Robert Nachtrieb, Lead Scientist, Lutron Electronics, Coopersburg, Pennsylvania. Howard Wolfman, University of Illinois at Chicago and Lumispec Consulting, Northbrook, Illinois. Georges Zissis, LAPLACE, Université Toulouse 3, France. Four of the six are of the lighting industry, including the standards and regulations function of one of the largest lighting manufacturers in the world and the engineering services director of a second manufacturer whose products are described at Part VI.

Their standing, which they state themselves. The paper records that the joint working group of the IEEE Industrial Applications Society and the Illuminating Engineering Society was created to review the existing knowledge on temporal light modulation, that the group's survey was incorporated into the IEEE 3001.9 and IES RP-48-2023 Recommended Practice published in May 2023, and then: "This paper is authored by members of the joint IES / IEEE working group." The acknowledgment thanks the chair and the secretary of that working group by name. The statements recorded below are therefore the statements of the people who wrote the American recommended practice on the design of power systems supplying lighting, and of the manufacturers whose products that practice governs. They are not the statements of a critic of the industry.

Article type. A review. It presents no new experiment and reports no biological endpoint of its own. It surveys the origins of temporal light modulation in lighting products, the visual, neurophysiological, health and psychological effects, the metrics, the measurement methods, and the standards and regulations, and closes with an application of modulation as an optical signature for remote sensing. It is in this appendix because the publication is peer reviewed.

First matter: what the paper says is not known about sensitive people. This is the proposition for which the Foundation principally relies on the paper. Introducing the health material the authors write that "The case of sensitive people is worth considering because a significant fraction of the general population is known to suffer from symptoms associated with the exposure to TLM." Their section on sensitive populations then states: "An unknown fraction of the general population is particularly sensitive to temporal light modulation. This population is not well understood but includes migraineurs and people suffering from headaches induced by flickering lights, those suffering from pre-existing conditions such as photosensitive epilepsy, and some people who have suffered head injuries such as traumatic brain injuries." And then the sentence on which Part V.D.1 rests: "Safe TLM levels were defined for photosensitive epilepsy, but there is insufficient data to define safe levels for other categories of sensitive people." In the conclusions the same point is made as a recommendation: the symptoms "seem to occur more frequently and more intensely for a fraction of the general population which is yet to be rigorously identified. For these well-known effects, more research should be done to provide dose-response relationships to be able to improve health and safety requirements for sensitive people." The conclusions add that "Other conditions, such as traumatic brain injuries, require specific protective measures against exposure to modulated light sources."

Second matter: the health effects are described as confirmed. The paper states that "The known health effects of TLM are eyestrain (asthenopia), headaches, migraine, and photosensitive epilepsy", and in the conclusions that "Headaches, migraines, and eyestrain have been commonly reported, studied, and confirmed in the scientific literature." It also supplies the reason such effects are difficult to attribute, which bears on Part VIII: "Eyestrain, headaches, and migraine happen during, or after, prolonged exposures to TLM, typically of one or several hours. The delay in the onset of these effects makes it difficult to identify TLM as a critical factor of lighting systems." On neurophysiological effects it reports that modulation at 100 or 120 hertz "can disrupt eye movements and reduce visual performance compared to higher modulation frequencies, or to constant light", and that work using electroencephalography and pupillometry found that tasks performed under modulation near 100 hertz lead to "greater physiological arousal" and "a general increase in brain activity, particularly in the right hemisphere", in each case by comparison with higher modulation frequencies or with constant light.

Third matter: that exposure has changed and the response to it is unknown. The paper states that the standard on which the American framework rests was built on the literature of its time, and that the circumstances have since changed: "the ubiquity of solid-state lighting and solid-state display technologies profoundly changed the characteristics

of human exposure to TLM. Longer exposures to an increasing number of modulated light sources are becoming the norm. The human response to these repeated stimuli is still unclear but some recently published results are now available." That bears directly on the limitation the authors of the experiment at Appendix C.90 placed on their own work, which examined momentary exposure only.

Fourth matter: the frequency range, stated by the standards writers. The conclusions give the ranges within which the three common artifacts may appear: "from about 1 Hz to about 60 Hz for flicker (maximum visibility at about 8 Hz), 60 Hz to about 2 kHz for the stroboscopic effect associated with hand motion (maximum visibility at 80 Hz), and from about 100 Hz to about 10 kHz for the phantom array effect (maximum visibility at 600 Hz)." The consequence the authors draw is addressed to design: "The electrical design of power supplies, drivers and dimmers should minimize the occurrence of undesired effects of temporal light modulation in this wide frequency range." The paper's summary table of effects against modulation frequency runs from 1 hertz to 10 kilohertz and marks the upper extent of both the neurophysiological and the health effects as an "Unknown boundary."

Fifth matter: that the model in the international report has never been experimentally validated. Of the phantom array effect the paper states flatly that "There is currently no metric to quantify the visibility threshold or the sensitivity function to the phantom array effect." Of the governing international report it states that CIE 249:2022 "informs that the phantom array effect is more visible with small light sources in high contrast with their background (dark environments) at modulation frequencies from about 100 Hz to 10 kHz" and that "This report contains a tentative visibility model which has not been experimentally validated yet." The Foundation asks the Department to read that beside Appendix C.90, where a federally funded experiment tested that model against measurement and concluded that its threshold function is not supported. An industry and standards review and a Department of Energy experiment, published in the same year and by different people, say respectively that the model was never validated and that it fails when tested.

Sixth matter: the thresholds reported for the effect, which are very low. The paper reports, from experimental studies of 2023 which it cites and the Foundation has not obtained, that the phantom array was most visible at 600 hertz "with a visibility threshold, expressed in terms of modulation depth for a pure sine wave, of 7% for a white-light stimulus observed in dark conditions. For a red-light stimulus under dark conditions, the visibility threshold was about 3% at 600 Hz." Further: "The visibility of the phantom array was found to be significant at modulation frequencies as low as 80 Hz. At such frequencies, the phantom array was visible at a threshold of 10% for red light, but only at a threshold of 35% for white lights." The paper also records a dependence of the effect on the color of the modulated source, including at the upper frequency limit of visibility.

Seventh matter: where the authors say the effect is encountered. "In real-life application, the phantom array is best seen in indoor and outdoor luminaires (and displays) using PWM dimming at low illuminance levels. It is also noticeable in automotive headlights and rear lights." And on waveform, corroborating Appendix C.90: "The effect is more visible under rectangular versus sinusoidal TLM and when duty cycles are low (typically 10% or 30%, versus 50%)".

Eighth matter: the metrics, their stated domains, and the limits. Of flicker: "The PstLM value of 1 is now consensually accepted as a limit value below which flicker is acceptable. It is specified in most standards and regulations as the upper limit for flicker, throughout the world." But the response function underlying it "was originally derived using a small size luminous stimulus with sharp edges, seen in central vision in well-lit conditions. However, PstLM can be assessed, and is now used, outside its original range of lighting conditions, included in dim environments (mesopic conditions)." Of the stroboscopic measure: its "upper frequency limit is 2000 Hz"; it applies where motion is of the order of human

motion and illuminance exceeds 100 lux; "It is not applicable in dark environments, nor with outdoor lighting"; and "SVM is not adapted to assess the stroboscopic effects observed on high-speed rotating or reciprocating machinery under modulated light, where motion may be considerably faster than 4 m/s." On its limit value: "Unlike the flicker metric PstLM, there is currently no consensus on an acceptable upper limit for SVM. The European eco-design regulation EU 2019/2020 defined the limit at 0.4, following an interim two-year period during which the accepted limit had first been set at 0.9. The NEMA specifies a maximum SVM of 1.6, which is considerably higher than the EU limit." On displays: "There is currently no standard metric associated with TLAs observed on electronic devices."

Ninth matter: the measurement methods, and the range they cover. The joint American national standard for laboratory measurement of the luminous waveform, ANSI and IES LM-90-20 of 2020, is described as "covering modulation frequencies 1 Hz and 3 kHz". The Foundation observes, and the observation is its own, that the paper's own stated range for the phantom array effect extends to 10 kilohertz, so the laboratory measurement standard covers less than a third of the frequency range in which the authors say the effect occurs. For field measurement: "Portable instruments are now available to perform on site TLM waveform measurements and return TLM and TLA metrics. However, there is no standard covering the field measurement of these parameters." And the conditions the paper specifies for valid measurement exclude the ordinary environment: "Temporal light modulation parameters should be measured without daylight, without any unwanted light from another lighting/display installation nearby and without any moving objects or people in the field of view of the measurement device." The paper's summary table records the measurement method as nonexistent for the phantom array effect, for stroboscopic effects with machines and tools, and for eyestrain, migraine, headache and other neurophysiological effects.

The statement that runs against the Foundation's position, recorded because the paper makes it. "The temporal light modulation in a real-world application, consisting of multiple light sources is generally lower than the TLM performance of a single light source due to the averaging out of the light modulation from the different light sources." In an interior lit by many luminaires, therefore, measured modulation is expected to be lower than any one product's rating. The Foundation accepts that and states the limit of it: the averaging requires multiple independent sources in the field of view, and it does not apply to a single dominant source viewed against a dark field, which is the case of the headlamp, the warning beacon, the message sign and the single luminaire overhead at night. The paper also notes that combination of waveforms "could, in principle, lead to beat frequencies if the frequencies slightly differ between luminaires".

What the paper says about the adequacy of existing requirements. The authors characterize the present position with three qualifiers, and the Foundation reproduces the sentence whole rather than paraphrasing it: "International standards and regional regulations now include requirements providing a certain degree of protection against undesired visual effects of temporal light modulation that may occur at high levels." A certain degree of protection; against visual effects; at high levels. The paper nowhere states that existing requirements are sufficient, and on health effects and sensitive people it states the opposite.

What it does not establish. It is a review and establishes no new fact of its own. The thresholds at the sixth matter and the neurophysiological findings at the second are reported at second hand from studies the Foundation has not obtained, and are attributed to this paper accordingly. The paper reports no exposure of any person, no dose-response relationship, and no measurement of any named product. Its treatment of health is brief, occupying a small part of a paper whose main subject is metrology and whose final section concerns an application of modulation to remote sensing. The Foundation does not

suggest that the authors call for regulation of these products; they call for research, for improved design, and for improved requirements.

Where it bears. Part V.D.1, which is written on it. Part V.D.2, for the corroboration of the frequency range and for the non-validation of the international model. Part V.D.3, for what IEEE Std 1789-2015 was built on and what has changed since. Part V.D.4 and Part VI, for automotive headlights and rear lights and for the inapplicability of the stroboscopic measure to outdoor lighting. Part V.E, for the sensitive populations and the traumatic brain injury statement. Part VII, for the absence of safe levels for sensitive people. Part VIII.D, for the divergence between the European limit and the American recommendation. Part IX, for the measurement gaps.

C.92 Wald, Erwin, Annon-Eberharter and Werther (2023) — light from an examination lamp drove a pulse oximeter to report 85 percent saturation, the manufacturers could not explain it, and medical lamps are excluded from the regulation that would have prohibited the flicker

Citation. Wald M., Erwin P., Annon-Eberharter N., Werther T. "LED light can falsify pulse oximetry readings via the stroboscopic effect." Physical and Engineering Sciences in Medicine 2023;46(4):1667 to 1675. doi:10.1007/s13246-023-01328-2. Published 19 September 2023 by Springer. PubMed Central PMC10703953; PubMed 37725312. Open access, funding for open access provided by Paracelsus Medical University. Full text read from the PubMed Central deposit. The published article gives the authors' affiliations by superscript and the Foundation has not recorded them in full.

Independence. The declarations state that the study "was not supported by any grants. None of the companies mentioned in the study were involved in the study", and that "None of the authors made financial disclosures or had a conflict of interest." The companies named in the article are the manufacturers of the monitor, the oximetry module, the closed-loop oxygen controller and the examination lamp.

Design, and what is observation as against what is model. The Foundation separates these at the outset because the paper does two different things and their evidentiary weight differs. The first is a clinical observation in a neonatal intensive care unit, reported as a single event with an informal reproduction. The second is a mathematical model, built in MATLAB, of a pulse oximeter and its light-cancellation algorithm, used to show that the observed behavior follows from the stroboscopic interaction between the lamp's modulation and the instrument's sampling. The model is the paper's contribution; the event is the reason it was built. No measurement of a pulse oximeter under controlled light was performed, and the paper does not claim one. The ethical statement records that "No animals or humans were involved in the experiments, and no ethical review was required."

The clinical event. An infant, after intubation and with ventilation well established, did not according to the monitor achieve saturation above 90 percent despite increasing the fraction of inspired oxygen through a closed-loop controller. The devices are named in the paper: a Philips IntelliVue X3 monitor with Nellcor pulse oximetry and OxiMax technology of Medtronic, a closed-loop oxygen controller of Fritz Stephan GmbH, and an examination lamp, the Dräger Variolux. Then: "Surprisingly, an abrupt increase in the recorded saturation occurred when the examination LED (light-emitting diode) lamp … was switched off. Within seconds, the monitor indicated 100% saturation, and the FiO_2 was reduced to ambient air. Each time the lamp illuminated the infant, a similar drop in oxygen saturation (SpO_2) could be observed." The paper adds that "The saturation sensor was never in the central light cone but was only illuminated by the scattered light of the lamp."

That the interference was optical and not electromagnetic, which the authors established and stated. The event was reproduced by placing another person's finger, with the sensor attached, in the lamp's stray light. "The effect disappeared when an opaque

shield was placed over the sensor. This indicated that the interference was caused by light and not electromagnetic interference." The Foundation records this sentence with particular care. The paper identifies visible light as the interfering agent and expressly excludes electromagnetic interference, by the simplest available test, which is to block the light.

That the manufacturers could not explain it. "For clarification, the occurrence was brought to the attention of all manufacturers involved. Neither the manufacturers, nor a review of scientific literature could provide an explanation for this phenomenon."

What was measured in the lamp. The lamp was characterized by the compact flicker degree method. It operates by pulse-width modulation at 207 hertz. The compact flicker degree was 63.9 percent undimmed and 80.1 percent fully dimmed, and the paper states that this "resulted in light emission only 37% of the time in the non-dimmed mode and 13% of the time in the fully dimmed mode." The Foundation notes the direction of the dimming effect, which is the opposite of what a reader might assume: dimming the lamp increased its flicker and reduced its duty cycle to about one part in eight.

The mechanism the model demonstrates. A pulse oximeter emits red and infrared light in turn and measures in a dark phase between each, subtracting the dark measurement to cancel ambient light. The paper states the assumption on which that works and why modulated light defeats it: "Assuming the ambient light to be constant at least during the measurement cycle, this will eliminate the disturbance of the ambient light in the measurements of the red (infrared) signal. Ambient LED light, on the other hand, is not constant and therefore will not be eliminated by subtraction of the dark measurements, and can subsequently induce a stroboscopic effect." The instrument's red-dark-infrared-dark cycle repeats 311.25 times per second. The authors observe that this "is almost exactly 1.5 times the frequency of the PWM signals output by the LED, and this may be significant."

The magnitude of the error the model produces. With a distortion factor of one tenth of the constant component of the signal, the computed ratio gave a saturation of 85 percent, which then remained at that value as distortion increased further. The computed pulse rate plateaued at 108 beats per minute against a true rate of 140. The paper also shows that the error depends on the frequency relationship rather than on the light alone: at a sampling rate of 300 hertz instead of 311.25, the same distortion gave 96 percent rather than 85, and the resulting waveform was irregular enough that "a medical doctor would suspect an artefact". The authors report more regular output at 414 hertz, twice the lamp frequency, and at 500 hertz.

The finding the Foundation regards as the most important in the paper. That the false reading does not announce itself. Of the erroneous pulse rate the authors write that it "corresponds to a plausible heart rate for neonatal patients. This pulse curve can be interpreted by the pulse oximeter as a valid measurement, particularly when the interference already existed at the beginning of each measurement. The incorrect pulse frequency therefore does not represent a warning signal for an incorrect measurement." A saturation of 85 percent and a pulse of 108 are both physiologically plausible in a newborn. There is no artifact flag, and in the originating event the value was being acted upon automatically by a closed-loop controller.

The consequence the authors identify. From the abstract: "The stroboscopic effect leads to low saturation values, which can lead to the risk of blindness in premature infants due to excessive oxygenation." And from the conclusion: "Erroneously low saturation levels can lead to unnecessary increases in oxygen administration, which increases the risk of retinopathy in preterm infants." The recommendations are two: "To minimize inaccuracies in pulse oximeter readings, flicker-free LED lamps should be used in medical settings. On

the other hand, manufacturers should be quite capable of producing pulse oximeters that can detect artifacts caused by PWM LEDs."

The regulatory finding, which is why this paper bears beyond its own subject. "There are EU regulations in place for the use of indoor lighting, which prohibit strong flickering light at the frequency of the lamps we tested. However, medical lamps, with their specific requirements such as spot brightness and color fidelity as essential diagnostic features, are excluded from these regulations. This should be fundamentally questioned, as the technical effort to produce flicker-free LED lamps seems manageable." The regulation cited for that proposition is Commission Regulation (EU) 2019/2020, which is the same instrument the review at Appendix C.91 identifies as setting the European limit on the stroboscopic visibility measure. So the lamp in a neonatal intensive care unit flickers at a degree that the European instrument would prohibit in an office, because medical lamps are carved out of it.

What the authors say about flicker frequency and perception, recorded as reported rather than as established. The discussion states that seizures from flickering light occur "usually … only at low frequencies around 15 Hz", that "Frequencies above 80 Hz cause stress", and that "Above a frequency of 200 Hz, the phantom array effect occurs." Of their own lamp: it "flickers at 207 Hz, which corresponds to a frequency that can not only cause stress but also multiple perceptions." The authority cited for the phantom array proposition is the preliminary Opinion of the Scientific Committee on Health, Environmental and Emerging Risks, which this comment holds at Appendix D.1. The Foundation does not adopt the bare statement that frequencies above 80 hertz cause stress; it is asserted in a discussion section without a figure or a citation to a study, and Part V.D.2 rests on the measurement literature instead. The authors also state that "It is not yet known how flicker affects the immature brains of premature babies."

What runs against the Foundation's position, stated because the authors state it. The paper does not claim the effect is peculiar to light-emitting diodes. "In theory, LED light does not necessarily cause the interference described here. The phenomenon of a saturation measurement displaying on the monitor, although the pulse oximeter is not attached to a patient, occurs even when no LED light source is present. It can therefore be assumed that such phantom signals can be caused by any flickering light source. Both incandescent bulbs and fluorescent tubes flicker during standard operation with alternating current. Consequently, these light sources can also cause the interference signal we have shown." The Foundation accordingly does not advance this paper for the proposition that the interference is unique to this technology, and Part V.D.5 says so. What the paper does establish about this technology is specific and sufficient: the lamp that produced the observed event is a light-emitting diode lamp operating by pulse-width modulation at 207 hertz with emission for 37 percent of the time, and the authors attribute the interference to that modulation.

Stated limitations. The authors identify three. The model is simplified, and they did not test different versions of the red-dark-infrared-dark cycle. They did not use the calibration curve of the instrument in question, which was not accessible to them, but constructed one from a published curve for a different manufacturer's oximeter, "although the measurement is based on a Nellcor algorithm." And the underlying pulse waveform was not a measurement of the patient but a publicly available arterial pressure signal, compressed and inverted to represent a premature infant. To these the Foundation adds the obvious ones: one lamp, one oximeter model, one clinical event, and a reproduction on one adult.

What it establishes. That a light-emitting diode examination lamp in clinical use was measured to operate by pulse-width modulation at 207 hertz with a compact flicker degree of 63.9 percent undimmed and 80.1 percent dimmed; that illumination of a pulse oximeter sensor by that lamp's scattered light was repeatedly associated with depressed saturation

readings and that the readings recovered within seconds when the lamp was switched off or the sensor shielded; that the interfering agent was light and not electromagnetic interference; that the manufacturers of the devices involved could not explain the effect; that a model of the instrument reproduces an error of the observed magnitude by the stroboscopic interaction of the lamp's modulation with the instrument's sampling; that the resulting values are physiologically plausible and carry no artifact warning; and that medical lamps are excluded from the European regulation that would otherwise prohibit the measured flicker.

What it does not establish. That any infant was harmed; the paper reports none, and the Foundation asserts none. That the effect occurs with other lamps, other oximeters or other frequency combinations; the paper shows the error depends on the frequency relationship and expressly leaves those cases to further research. That the effect is peculiar to this technology; the authors say it is not. And nothing about prevalence: the paper gives no indication how often this combination of lamp and instrument occurs in clinical use anywhere.

Where it bears. Part V.D.5, which is written on it. Part V.D.1, for the measured modulation depth and duty cycle of a lamp in service and for the finding that dimming increased the flicker. Part V.D.2, for the frequency at which the authors place the phantom array effect. Part VIII.D, for the fact that the manufacturers could not explain an effect reported to them. Part IX, for the exclusion of a product class from a flicker limit on the ground of its clinical function.

C.93 Bartossek, Kemmerer and Schmidt (2021) — flashing light at 3 and 10 hertz measurably alters visual perception in screened healthy adults, and the protocol required to expose them discloses what such exposure is understood to warrant

Citation. Bartossek M. T., Kemmerer J., Schmidt T. T. "Altered states phenomena induced by visual flicker light stimulation". PLoS ONE 2021;16(7):e0253779. doi:10.1371/journal.pone.0253779. Published 1 July 2021. PubMed Central PMC8248711; PubMed 34197510. Open access. Full text read from the PubMed Central deposit. Work conducted at the Center for Cognitive Neuroscience Berlin at the Free University of Berlin; approved by the ethics committee of Charité Berlin.

Why the Foundation records the mismatch before anything else. This study used flicker at 3 and 10 hertz. The modulation addressed at Part V.D is that produced by the drive electronics of light-emitting diode products, which the sources there place between about 100 hertz and 10 kilohertz. These are different phenomena at different frequencies, and the comment does not cite this paper for any proposition about the modulation of lighting products. The exposure conditions are likewise not comparable to encountering a lamp: participants sat in a reclined chair at about 50 centimeters from a purpose-built stroboscope, with the room lights off, wearing earplugs, with their eyes closed, for twenty minutes. The Foundation states all of this at the head of the entry so that no reader of the comment mistakes its reliance for a wider one. The paper is cited for two things only: the frequencies at which flashing light is known to alter perception, and what was required before a university would permit the exposure.

Design. A within-subjects study of 24 volunteers, mean age 24.0 plus or minus 6.4, 19 female and 5 male, German native speakers without a history of neurological or psychiatric disorder, recruited through social media and student mailing lists. Each attended three sessions of twenty minutes: constant halogen light, then 3 hertz and 10 hertz flicker in randomized order, at least four days apart. Outcomes were measured by the Altered States of Consciousness Rating Scale in its five-dimension and eleven-factor forms, the Phenomenology of Consciousness Inventory, the Positive and Negative Affect Schedule, time-estimation ratings, and an alternative-uses task for divergent thinking, with

personality assessed by the NEO Five-Factor Inventory-2 and the Tellegen Absorption Scale. None of the participants had prior experience of flicker light stimulation.

The stimulus. The device was the Lucia N°03 stroboscope of Light Attendance GmbH, Innsbruck, which the paper describes as having been "developed to evoke hypnagogic visual impressions by intermittent light stimulation" and as "used in various recreational contexts". It carries one halogen lamp for constant light and eight light-emitting diodes for the flicker, each at 700 lumens and a light color of 6300 kelvin. The flicker conditions were 3 and 10 hertz at a 50 percent on-off duty cycle.

What the screening required, which is the Foundation's principal reason for citing the paper. Before any participant was exposed, the protocol required the following. "To minimize the risk of any aversive effects of FLS, all participants underwent a semi-structured video interview with a psychologist previous to the experiment to ensure that they were not affected by an acute mental or neurological disorder, were not currently or regularly taking any psychotropic medication or drugs and were not pregnant". Then an instrumented screen: the initial assessment included "a screening for indications of photosensitive epilepsy based on electroencephalography (EEG)", comprising a resting record, four-second flicker episodes at 1, 3, 10, 20, 30 and 40 hertz each presented twice, and about two minutes of hyperventilation, the whole reviewed by a trained expert. Participants were informed of the risks and gave written consent, and a familiarization session with constant light preceded the flicker sessions. Notwithstanding all of that, "One participant dropped out of the study due to self-reported migraine symptoms after the first experimental session with FLS of 10 Hz". That participant was replaced.

What was found, stated as the Results state it rather than as the abstract states it. On the eleven-factor scale, Elementary Imagery, which records basic visual impressions such as colors and patterns, scored 48.44 plus or minus 27.59 at 3 hertz and 63.05 plus or minus 27.90 at 10 hertz on a scale of 0 to 100. Vigilance Reduction, reflecting drowsiness and clouded consciousness, was the highest of the five dimensions at about 32 in both conditions. The global altered-state score was 12.04 and 14.20. The Foundation then records the qualification the figure caption supplies, because the abstract does not: "None of the differences between the dimension scores of 3 Hz and 10 Hz conditions were significant after Bonferroni-correction of the α-threshold for multiple comparisons". The abstract's statement that effects were "strongest in the 10 Hz condition" therefore describes a trend and not a significant difference, and the comment should not report it as a frequency-dependence result.

The comparison that gives the paper its public profile, and its status. The abstract states that the technique is "capable of inducing visual effects with an intensity rated to be similar in strength to effects induced by psychedelic substances". The basis is a descriptive comparison of this study's ratings against published values for other agents, not a within-study test. On Elementary Imagery the 10 hertz figure of 63.05 is set beside 64.01 plus or minus 32.03 reported for 100 micrograms of lysergic acid diethylamide, and about 61.1 expected for psilocybin at 300 micrograms per kilogram; Vigilance Reduction is set beside 28.93 for low-dose ketamine. The authors immediately confine the claim: "the visual effects appear limited to elementary imagery (i.e., colorful, dynamically changing fractal structures), while complex, hallucination-like visions of meaningful objects were rarely reported in the study at hand". The resemblance is to the colors-and-patterns component only.

The frequency range the wider literature identifies, which is the second reason for citing the paper. The discussion collects the frequencies at which flashing light has been found to alter visual perception. One study reported "most radial illusory percepts at ~10 Hz and spiral percepts to be most pronounced at the slightly higher frequency of ~15Hz". Another found visual phenomena "most strongly pronounced between 10–25 Hz". Two further reports indicate "the strongest illusory percepts in the range of 15 to 30 Hz". Taken

with the present study, the band in which the effect is established runs from about 3 to about 30 hertz. The authors also record what has not been done: "With respect to future research, it will be informative to assess the effects of higher flicker frequencies with standardized questionnaire tools, as well".

Personality, reported precisely because the abstract compresses it. The trait of Absorption correlated with the global altered-state score in both conditions, at r equal to 0.61 and p equal to 0.002 at 3 hertz and r equal to 0.68 and p below 0.001 at 10 hertz. It did not correlate with Elementary Imagery in either condition, and its correlation with Complex Imagery did not survive correction. The abstract's statement that Absorption "highly correlated with the experienced alterations in consciousness" is accurate of the global score and not of the imagery subscales.

What it establishes. That twenty minutes of flashing light at 3 or 10 hertz, delivered to the closed eyes of screened healthy adults in a dark room, produced measurable alterations of visual perception and of vigilance on standardized instruments; that on the colors-and-patterns dimension the ratings fall in the range published for substantial doses of psychedelic drugs; that the effect is established across the literature in a band from about 3 to about 30 hertz; and that a university ethics committee required psychological interview, exclusion of pregnancy and psychotropic medication, and electroencephalographic screening for photosensitive epilepsy before such exposure was permitted.

What it does not establish. Nothing about light-emitting diode lighting products or their drive modulation, which operate at frequencies an order of magnitude and more above those used here. Nothing about exposure with the eyes open, which is the only exposure at issue in this comment, and the difference is not a detail: the closed eyelid both attenuates and diffuses the stimulus and the paper does not address what an open-eyed observer would experience. Nothing about brief exposure, the sessions being twenty minutes. Nothing about frequency dependence, the two conditions not differing significantly. Nothing about vigilance specifically, because there was no condition without light and the authors say so: "the study at hand did not include a control condition without light stimulation", so twenty minutes seated with the eyes closed in a dark room is not excluded as the cause of the drowsiness scores. And nothing about the general population, the sample being 24 young adults, mostly women, recruited from a university and screened to exclude the people most likely to be affected.

Where it bears. Part V.E.6, which is written on it. Part V.D.4, for the frequency band in which the beacon counted there operates. Part V.E.1, for the frequencies at which the screening in this protocol was conducted. Part VII, for the asymmetry between what is required before a volunteer may be exposed and what is required before a member of the public is.

C.94 Inger, Bennie, Davies and Gaston (2014) — the largest collation of critical fusion frequencies finds species able to resolve flicker far above the frequencies of mains-driven lamps, and states candidly that the evidence of actual effect is thin

Citation. Inger R., Bennie J., Davies T. W., Gaston K. J. "Potential Biological and Ecological Effects of Flickering Artificial Light". PLoS ONE 2014;9(5):e98631. doi:10.1371/journal.pone.0098631. Published 29 May 2014. PubMed Central PMC4038456; PubMed 24874801. Open access. Full text read from the PubMed Central deposit. The authors were at the University of Exeter.

Design. A systematic collation with statistical analysis. The authors searched Web of Science, Google Scholar and Google in September 2012 for reported critical fusion frequencies in non-human animals, took the mean photopic value where a range of intensities was reported, extracted values from figures where only figures were given, and admitted only peer-reviewed papers containing a full description of method. They then fitted linear mixed-effects models with taxonomic class, natural light exposure, light source type and measurement method as fixed factors and species as a random factor. The critical fusion

frequency is defined as the threshold at which an animal ceases to perceive a flickering source as a series of flashes and perceives it instead as a continuous stream.

The collation, which is the paper's own work and the part the comment relies on. Fifty-six studies yielding 93 measurements, 19 behavioral and 74 by electroretinography, for 81 species in 66 genera and 9 classes. The range found was wide: the lowest value was 6.7 hertz for the cane toad and the highest 400 hertz for a fire beetle. The proportion exceeding the doubled mains frequency is given four ways: "In a considerable number of cases (16.1% of measurements, 13.5% of species, 16.6% of genera and 44.4% of classes), CFFmean values were above the flicker frequency of fluorescent lamps on a 50 Hz electrical supply; i.e. 100 Hz". The authors add the point that matters for a comment addressed to a United States agency: "It should be noted that a number of countries utilise a 60 Hz electrical supply and hence the flicker frequency with be higher at 120 Hz".

The two taxa the authors treat as most exposed, with their figures. Of insects, values have been characterized for only nine diurnal and three nocturnal species, "producing a wide range of values (42.5–400 Hz)", and the authors state that "Given the vital role insects play in ecosystem functioning (e.g. pollination, decomposition), and as nutrition for other organisms, this depauperate knowledge base should give cause for concern". Of birds, values exist for five species only, ranging from 40 to 143 hertz, with direct measurement for just two diurnal species. One is the domestic chicken. The other is the pigeon, which the authors describe as "a very common urban bird that is likely to encounter high levels of artificial light" and which has "the highest CFF values recorded (143 Hz) of any vertebrate species and will easily be able to perceive flicker from artificial lights". Values above 100 hertz have been inferred for starlings. The authors reason from this that "it is likely that other birds capable of rapid flight have high CFFs, and are able to detect flickering artificial light".

What the paper says about the technology. "Light emitting diode (LED) technology is also increasing in popularity particularly for street lighting and these lamps also have a high flicker index. Indeed the perceived brightness of many LED lamps is controlled by regulating the flicker frequency". The Foundation records that the last clause is imprecise, and says so rather than quoting it approvingly: pulse-width modulation controls output by varying the duty cycle at a fixed frequency, as Part V.D.1 establishes from the sources there, not by regulating the frequency. The error does not affect the paper's analysis, which turns on frequency of flicker rather than on how dimming is achieved.

The concession the Foundation places at the center of its use of this paper. The authors state the weight of their own evidence, and the comment would be worth less if the Department had to find the sentence itself. "The evidence presented here suggests that impacts from the perception of the flicker of artificial light may be rather limited for most species studied thus far. There remains, however, a scarcity of data on CFFs for many taxa that are most likely to be affected, hence we suggest that the potential ecological effects should not be wholly dismissed". The title of the paper says potential, and the authors mean it.

The limits the authors place on perceptibility, which are substantial. Three. First, taxonomic: "all animals able to detect artificial flicker are naturally diurnal hence only species for which artificial light serves effectively to increase day length, or which are facultatively nocturnal, are likely to be affected". Second, intensity, because "CFF decreases with light intensity, which itself decays with distance from the light source". Third, and as a consequence, distance: tsetse flies retain high values at low intensity and "will still be able to perceive flickering street lamps at 3 lux, which is approximately the lowest intensity light found at ground level between neighbouring metal halide lamps", whereas for honeybees and domestic chickens "a subject would need to be closer than three metres to the light source in order to perceive the flicker". Of chickens the authors go further: they "will only be able to perceive flicker at light intensities exceeding the range likely to be

produced by artificial lamps". The figure in which this is plotted identifies the perceptible region for 50 hertz supply lamps as lying within 0 to 40 lux.

What the authors say about evidence of actual effect. "Explicit studies of the biological effects of light flicker on animals remain scarce, and have focused on the efficacy of trapping devices for insects and on welfare issues for captive vertebrates". The paper's table of documented effects lists sixteen entries across eleven species, predominantly insects and the European starling, with effects classified as behavioral, physiological, physiological stress or visual, and the authors note that such effects "can be produced by flicker that may or may not be perceivable by the animal". The groups the authors flag for further work are nocturnal animals that move fast in dark conditions, naming hawkmoths, certain nocturnal flying birds and bats, and observing that some bats "often utilise artificially lit areas as they act to concentrate their food resources".

Their conclusion. "Given the precautionary principle and that it is likely that in the future an increasing level of artificial light will come from lamps with a high flicker index, as incandescent bulbs are phased out, and replaced with fluorescent (including compact fluorescent bulbs, generally referred to as 'low energy bulbs') and LED lamps, we suggest the impacts of flickering light on natural systems are given urgent attention".

The paper's table of human effects, which the Foundation examined and does not rely on. The paper opens with a table of fifteen documented effects of flickering light on humans, with frequencies and references, four rows of which are labeled unperceived. The table is attractive to this comment and the Foundation traced three of its rows to their sources before deciding not to use it. The row reading unperceived neurological effects, light-emitting diode, up to 200 hertz is referenced to Burns, Elsner and Kreitz, Analysis of nonlinearities in the flicker ERG, Optometry and Vision Science 1992;69:95 to 105. That is a 1992 methodological study of retinal electrophysiology in which light-emitting diodes were the laboratory stimulator, and an electroretinographic response is evidence that the retina responds to a stimulus rather than evidence of a neurological effect in any ordinary sense. The row materially overstates its source. Two other rows are better founded: unperceived retinal effects at 76 to 162 hertz is referenced to Berman, Greenhouse, Bailey, Clear and Raasch, Human electroretinogram responses to video displays, fluorescent lighting and other high frequency sources, Optometry and Vision Science 1991;68:645 to 662, which is directly about that question; and unperceived neurological effects from a computer monitor at 42.5 to 75 hertz is referenced to Lu, Cai, Shen, Zhou and Han, Alerting and orienting of attention without visual awareness, Consciousness and Cognition 2012;21:928 to 938, whose title states the proposition. The Foundation therefore treats this table as a bibliography rather than as authority, cites nothing to it.

What it establishes. That across 81 species in 9 classes the measured temporal resolution of vision ranges from about 7 to 400 hertz; that 16.1 percent of measurements and 44.4 percent of classes exceed 100 hertz, with the relevant comparison in a 60 hertz country being 120 hertz; that the pigeon, a common urban bird, has the highest recorded vertebrate value at 143 hertz; that insect values span 42.5 to 400 hertz on a base of twelve species; that flicker has been overlooked relative to the intensity, duration and spectrum of artificial light; and that the authors, on the precautionary principle, call for urgent attention to the question.

What it does not establish. That any animal is harmed by the flicker of any lamp. The paper is a collation of temporal resolution and not a study of effect, its own authors state that the impacts may be rather limited for the species studied so far, and the explicit effect studies it tabulates are about insect traps and captive animal welfare. It does not establish that resolving a flicker is adverse: perceiving a light as flashing rather than steady is a perceptual fact, not an injury. Its perceptibility findings are heavily conditioned on intensity and therefore on distance, to the point that two of the three species modeled would need to be within three meters of the lamp. The collation mixes electroretinographic

and behavioral determinations, which the authors expected to differ and included as a factor, although they report finding no effect of method. And it reports no measurement of any lamp: the frequencies it compares against are the nominal doubled mains frequencies, not measured product output.

Where it bears. Part V.I, which is written on it. Part V.D.1, for the proposition that perceptibility of modulation falls with illuminance, which is the same relation the instrument maker at Appendix D.3 states from the measurement side. Part VI.D, for street lighting.

C.95 Oliveira, Ferreira and Martinez-Perez (2024) — a survey of festival attendees finds self-reported sensitivity to stage lighting differing by refractive condition, and measures no light

Citation. Oliveira A. P., Ferreira G. and Martinez-Perez C. "Effects of Stage Lighting on Visual Comfort at Summer Festivals: A Study in Portugal". Healthcare (Basel) 2024;12(23):2441. doi:10.3390/healthcare12232441. Published 4 December 2024. Open access; full text read. The authors are of the Instituto Superior de Educacao e Ciencias de Lisboa and are optometrists rather than neurologists or lighting engineers, which bears on what the paper is evidence of.

Design. A cross-sectional self-report survey. An instrument of eighteen questions in five sections was built in Google Forms and distributed through Facebook, Instagram and Twitter, through festival-related groups and pages, through targeted paid advertisements, through the authors' personal networks and their institution's databases, and by some festival organizers at summer 2024 events. It was open from June to September 2024. Participants were not compensated and there were no inclusion or exclusion criteria. Ethics approval was given by the institution's ethics committee under code CE/2024/09/01 on 22 May 2024. The authors declare no conflicts of interest. Analysis in IBM SPSS v.27.

Sample. Two hundred and six participants.

What was measured, stated first because it governs everything else. Nothing was measured. No luminance, illuminance, spectral content, flash rate, modulation depth or duty cycle of any light source at any festival is reported, and no instrument is described. No clinical examination was performed and no biological endpoint was recorded. The paper is a record of what two hundred and six people said about their experience of lighting at events they attended.

The findings the comment relies on. Sensitivity to stage lighting: 14.3 percent of participants reported high sensitivity and 23.4 percent moderate sensitivity. Women reported significantly higher sensitivity to stage lighting than men (3.29 ± 1.28 against 2.68 ± 1.31; p = 0.0070; Cohen's D = 0.47). Sensitivity varied significantly by age (p = 0.0472), highest in the 66 to 75 group at 4.00 and lowest in the 19 to 25 group at 3.08 ± 1.28. Sensitivity to light varied significantly by refractive condition (p = 0.0375): astigmatism 3.51 ± 1.42, hyperopia 3.62 ± 1.19 and presbyopia 3.88 ± 0.99, against emmetropes at 2.75 ± 1.28 and myopes at 3.08 ± 1.36. The conclusion reports that 33.1 percent of festivalgoers with refractive errors experienced heightened sensitivity to artificial and stage lighting.

What the participants asked for, which is the part that bears on Part IX. Asked what would improve visual comfort, 44.81 percent favored high-quality light-emitting diode systems, 37.66 percent designated low-light areas for visual rest, 37.01 percent more shaded areas, and 31.82 percent minimizing the use of intermittent lighting. Of the aesthetic perception of the stage lights, 43.51 percent found them pleasing, 36.36 percent were indifferent and 20.13 percent found them uncomfortable.

What the paper is NOT evidence of, and the Foundation states it plainly because the paper is easily misread. It is not evidence that strobe lights provoke seizures. The paper contains a sentence in its introduction to the effect that strobe lights are known to trigger disorientation or discomfort and that for individuals predisposed to photosensitive epilepsy they can trigger seizures. That sentence is background narrative and not a finding. It carries three citations, to Harding and Harding, Applied Ergonomics 2010;41:504 to 508; to Silva and Leal, Seizure 2017;50:209 to 218; and to Fisher R. S., Acharya J. N., Baumer F. M., French J. A., Parisi P., Solodar J. H., Szaflarski J. P., Thio L. L., Tolchin B., Wilkins A. J. and Kasteleijn-Nolst Trenite D., Visually sensitive seizures: an updated review by the Epilepsy Foundation, Epilepsia 2022;63(4):739 to 768, doi:10.1111/epi.17175. The study itself did not examine seizures, photosensitivity, flash frequency or any person with epilepsy. The comment cites the source of the proposition and not this paper, and no part of this comment relies on this paper for any neurological claim.

Limitations the authors state, reproduced because they are unusually candid. Four. That the sample of 206, while sufficient for exploratory analysis with an estimated margin of error of 6.8 percent, does not achieve the 5 percent margin typically desired for population-wide estimates, which the authors address by "focusing on identifying trends and relationships rather than drawing generalized conclusions". That the study relies on self-reported data and may carry recall and social desirability bias. That the cross-sectional design limits the ability "to infer causal relationships between stage lighting and reported symptoms". And that the geographic scope, Portugal only, may affect generalizability.

Two internal inconsistencies the Foundation found and does not reproduce. The abstract states that cooler stage lighting was associated with a higher incidence of glare "with male participants reporting greater discomfort than females", while the results report women as significantly more sensitive to stage lighting than men. These are different measures, and any use of either must say which. More seriously, the abstract states that "participants aged 19–25 experienced more frequent tearing under stage lighting" and presents it as notable, while the conclusion states of the same comparison that "these differences were not statistically significant". The comment does not use the tearing finding.

Where it bears. Part V.C.5, for the differential by refractive condition. Part VI.K, for entertainment and event lighting as a product class. Part IX.F, for what the surveyed population asked for. It does not bear on Part V.D or Part V.E and is not cited there.

C.96 Mankowska, Grzywinska, Winklewski and Marcinkowska (2022) — a neurophysiological review finds that whether modulation is seen depends on eight variables, and that colored flashes carry their greatest seizure risk at fifteen hertz

Citation. Mankowska N. D., Grzywinska M., Winklewski P. J. and Marcinkowska A. B. "Neuropsychological and Neurophysiological Mechanisms behind Flickering Light Stimulus Processing". Biology (Basel) 2022;11(12):1720. doi:10.3390/biology11121720. Published 28 November 2022. Open access; full text read.

Design, and the limits that follow from it. A narrative review. It states no search strategy, no database query, no date range and no inclusion or exclusion criteria, and it does not describe itself as systematic. It should be read as a subject-matter summary by its authors rather than as a reproducible synthesis, and the Foundation cites it accordingly.

What it is about, which is not what this comment is about. Its subject is flickering light as a research and diagnostic stimulus: the flicker test, critical flicker fusion, steady-state visual evoked potentials, electroencephalography and functional magnetic resonance imaging, and their possible clinical uses. It is not a review of environmental exposure to light-emitting diode products, and it states of its own field that the clinical applications of

flickering light "are still not well understood". The comment uses it for specific statements of fact within it and not as an assessment of the subject of this comment.

The eight determinants, which is the principal reason it is cited. The review states that distinguishing flickering from steady light depends on the frequency of modulation, the amplitude of modulation, the average illumination intensity, the position on the retina at which the stimulus occurs, the wavelength or color of the light-emitting diode, the intensity of ambient light, the viewing distance, and the size of the stimulus. The measurement standards and the recommended practice treated at Appendix D.2 address the first two. Relied on at Part V.D.1 and Part V.J.

Color and flash rate in the induction of photoparoxysmal responses. The review reports that white light requires frequencies above 20 hertz to induce seizures while for colored stimuli such as blue and red the risk is greatest around 15 hertz; gives a summary table in which color exceeds white at 10 to 15 hertz, the 15 hertz entry is red-blue alternating stimulation, and color and white are equivalent at 20 to 30 hertz; and reports that blue with green elicited the fewest epileptiform responses. It attributes the identification to a documented broadcast incident in which children had seizures while watching a sequence it describes as an intense blue-red light flashing at 15 hertz. Its abstract states that because flicker testing carries a risk of inducing seizures, every effort must be made to avoid high-risk combinations including red-blue light flashing at 15 hertz. Relied on at Part VI.C.1 and Part II.H.6.

Three further statements the comment uses, each with the review's own qualification attached. That the critical fusion threshold in humans is estimated at 50 to 90 hertz, with a report of discrimination at 500 hertz attributed to saccadic eye movement, and with the review recording that the studies are not consistent with one another. That reports exist of a stroboscopic effect above 1000 hertz where objects elsewhere in the visual field are moving. And that there is limited evidence of a visual cortical response to modulation perceived as steady, which the review bases on a functional imaging study it describes as having few participants. The Foundation has read none of the underlying studies and cites each as reported by this review.

A caution the review supplies against a measure this comment uses elsewhere. It reports a conclusion that critical flicker fusion has limited value as a clinical measurement because the threshold depends on both the gain of the visual system and its processing speed without separating them. Carried to Part V.D.2 and applicable at Part V.I.

What it does not establish. That any light-emitting diode product in commerce harms anyone. It reports no exposure to any commercial product, measures no lamp, and contains no photometry. Every stimulus it discusses is a laboratory or clinical stimulus, and its orientation throughout is toward the diagnostic and therapeutic use of flicker rather than toward its avoidance.

C.97 Hall and Madsen (2022) — a roadside safety message designed to capture attention increased crashes, and the authors conclude that an intervention can be too salient

Citation. Hall J. D. and Madsen J. M. "Can behavioral interventions be too salient? Evidence from traffic safety messages". Science 2022;376(6591), article abm3427. doi:10.1126/science.abm3427. Published 22 April 2022.

What the Foundation read, stated first. The structured abstract, the abstract and the editor's summary as published. The full text was not read. The publisher's site was not accessible to the Foundation, and the Foundation declined to rely on a copy of the article hosted by a third party. Every figure and every quotation used in this comment is from the structured abstract. This is a limitation on the use of the source and it is recorded wherever the source is used.

Design. A natural experiment with difference-in-differences and instrumental variable estimation. The Texas Department of Transportation displayed the year-to-date statewide count of road fatalities on its dynamic message signs for one week each month, the week before its monthly board meeting, from August 2012. The authors used data on 880 signs and all crashes in Texas from 1 January 2010 to 31 December 2017, holding fixed road segment, year, month, day of week and time of day. Placebo tests used weeks before the campaign began and road upstream of the signs. The authors state that they consider seven alternative hypotheses and give evidence inconsistent with each.

Results as the authors state them. A 1.52 percent increase in crashes within 5 kilometers of a sign during campaign weeks, diminishing to 1.35 percent over the 10 kilometers after a sign; an instrumental-variable estimate of a 4.5 percent increase over 10 kilometers for the effect of displaying a message; statewide on-highway crashes higher during campaign weeks; the effect comparable to raising the speed limit by 3 to 5 miles per hour or reducing highway troopers by 6 to 14 percent; and, on a calculation the authors themselves describe as back-of-the-envelope, an additional 2,600 crashes and 16 fatalities a year in Texas with a social cost of $377 million a year.

The mechanism the authors propose, and the pattern supporting it. That negatively framed messages seize too much attention and interfere with drivers' ability to respond to changes in traffic conditions. In support: a higher displayed count causes more crashes than a lower one; the effect is larger on more complex road segments; the effect is largest near the sign and falls with distance; and the messages increase multi-vehicle but not single-vehicle crashes.

Scope of the practice studied. The authors state that the campaign has been implemented in 28 United States. It is therefore a national practice on devices governed by the Manual on Uniform Traffic Control Devices and not a single State's experiment.

What it does not establish, and the Foundation puts this in its own field because the paper is easily misdescribed. It does not establish that the emission of an electronic sign causes crashes. The signs were previously installed and operating in both conditions. Luminance, spectral content, modulation and physical presence were identical during campaign and non-campaign weeks; only the displayed message differed. The study holds emission fixed and varies content, and nothing in it bears on the optical quantities this comment is concerned with. No part of this comment cites it for any proposition about emission.

What it is used for. For the proposition that the premise underlying every conspicuity device in Part VI, that greater attention capture is better, is an empirical claim capable of being tested; that it has been tested once, rigorously, on real crash data; and that it failed. Also for two findings that answer standing objections: that individuals did not habituate to the stimulus over five years, and that the effect did not persist after the practice stopped. And for the authors' conclusion that it is important to measure an intervention's effect because good intentions do not necessarily imply good outcomes.

Where it bears. Part VI.J.7, which is written on it. Part VI.C.1, for the premise beneath warning lamps. Part II.H.6, for what it shows about evaluation of devices governed by the Manual on Uniform Traffic Control Devices. Part IX.C, for the research request.

C.98 Fisher and others (2022) — the Epilepsy Foundation's updated review states the four conditions under which a flash is a hazard, says that the effect of light-emitting diodes on people with epilepsy is unstudied, and says that flashing police lights only rarely provoke seizures

Citation. Fisher R. S., Acharya J. N., Baumer F. M., French J. A., Parisi P., Solodar J. H., Szaflarski J. P., Thio L. L., Tolchin B., Wilkins A. J. and Kasteleijn-Nolst Trenite D.

"Visually sensitive seizures: An updated review by the Epilepsy Foundation". Epilepsia 2022;63(4):739 to 768. doi:10.1111/epi.17175. Full text read.

What it is, and the limit its authors place on it. A review by a working group of the Epilepsy Foundation, updating the same body's 2005 review. It is expressly not systematic: the authors state that the literature summary derives from a nonsystematic review via PubMed using the terms photosensitive and epilepsy, that the prior reviews were not systematic and neither is this one, and that a paucity of controlled studies in the field would make a systematic review difficult. The Foundation cites it as the considered statement of the leading expert body and not as a systematic synthesis.

The four criteria, which are the reason the comment needed this document rather than the sources that quote it. Section 9.2: a flash is a potential hazard if it is brighter than 20 candelas per square meter, occupies at least 10 percent of the visual field, flashes or changes color at a frequency between 3 and 60 hertz, and endures for at least half a second. The conditions are conjunctive. Avoidance of these characteristics is estimated by the review to be protective for at least two-thirds of people with epilepsy. A pattern criterion is stated separately: at least five clearly discernible oscillating stripes, eight if drifting smoothly, brighter than 50 candelas per square meter and enduring for over one-half second.

A discrepancy between the abstract and the body, recorded because the comment quotes the body. The abstract renders the spatial condition as occupying "at least 10 to 25% of the visual field". Section 9.2 gives it as at least 10 percent of the visual field, and section 9.3 explains that more than 10 percent of the visual field is "typically about one-fourth of the screen area at typical viewing distances". These are one quantity in two expressions rather than a range, and the comment uses the body text.

What it says about this comment's product classes, stated in its own field because it is adverse. Section 3.1: "Flashing police car lights only rarely provoke seizures, perhaps because the image rarely occupies a large part of the visual field." The sentence carries one citation, is qualified by the word perhaps, and appears in a passage on syndromes imitating photosensitivity rather than in the review's treatment of stimulus characteristics. It is quoted in full and answered at Part VI.C.1 and referred to at Part VI.I. No part of this comment cites this review while omitting it.

Section 8.6, on light-emitting diodes, which is the most directly relevant passage in the document. It states that modern light-emitting diodes have significantly increased luminance; that photostimulators in electroencephalography laboratories now use them to generate bright lights, so that it is clear flashes from them can provoke photoparoxysmal responses; and that what is not known is whether they have provocative properties distinct from the known responses to bright flashes. It records a dated literature search: PubMed, 25 January 2021, terms light emitting diode and seizures, five results, none indicating provocation and two animal studies showing suppression. It states that frequencies up to 11 kilohertz generate a visible pattern on the retina when a saccade is made across a flickering diode, more visible to individuals who complain of eye strain. And it concludes that the effect of these devices on people with epilepsy is a subject that would benefit from additional research.

Regulatory content. Section 9.1 states that prevention "can take place at the level of government regulation, industry, families, and individual patients". Section 9.3 lists eight commercial or academic tools for detecting provocative flashing, including the Harding Flash and Pattern Analyzer and the Photosensitive Epilepsy Analysis Tool, which supports the abstract's statement that equipment to assay for these characteristics is probably underutilized. It names the United Kingdom, Japan, Russia and Italy as having implemented regulations for broadcast material, and the United States is not among them. It records that British guidelines prohibit flashes greater than 3 hertz, brightness above 20

candelas per square meter, or red flashes occupying more than 25 percent of the screen; and, separately from broadcast, that "In the UK, devices that flash in public are limited to frequencies no higher than 4 Hz, and they should not be visible from stairways". It states that "Frequency, brightness, binocularity, and large area are all key factors in contributing to seizure provocation".

Prevalence and population. Light, pattern or color stimuli can provoke seizures in up to 1 in 4,000 persons, with the review noting that prevalence may be higher because of selection bias. A photoparoxysmal response is reported in 0.3 to 8 percent of the normal population and 0.6 to 30 percent of people with epilepsy. Females are approximately twice as likely as males. About half of individuals with electroencephalographic photosensitivity are unaware of the trait, and most children affected in the broadcast incident of 1997 were unaware of it. That last figure bears on Part VIII and Part IX.F: a person who does not know they are susceptible cannot avoid a stimulus that is not disclosed.

The sentence the comment relies on at Part IX. The abstract concludes that visually-induced seizures remain significant public health hazards so they warrant ongoing scientific and regulatory efforts and public education. That is the expert body of the field calling for regulatory effort, in a peer-reviewed review, and the Foundation asks the Department to weigh it as such.

What it does not establish. That any light-emitting diode product in commerce has provoked a seizure in anyone. Its section 8.6 says the opposite: that the literature is close to empty and the question unstudied. It measures no product, reports no exposure to any commercial lamp, and its criteria were developed for broadcast and display content rather than for luminaires.

Where it bears. Part VI.C.1, for the criteria, the adverse sentence and the British four-hertz rule. Part VI.I, for the criteria applied to a measured lamp. Part V.D.1 and Part V.D.2, for section 8.6. Part V.B.8, for increased luminance. Part V.J, for the measurement tools. Part V.L and Part IX.C, for the research gap. Part VIII and Part IX.F, for unawareness of susceptibility. Part IX, for the call for regulatory effort. It supersedes the secondhand renderings at Appendix C.95, Appendix C.96 and Appendix D.2 wherever those quote it.

C.99 Salet, Visser, Stam and Smulders (2018) — a cohort of 400,343 people finds the seizure rate at stroboscopically lit events more than three times higher when the event takes place in darkness

Citation. Salet N., Visser M., Stam C. and Smulders Y. M. "Stroboscopic light effects during electronic dance music festivals and photosensitive epilepsy: a cohort study and case report". BMJ Open 2018. doi:10.1136/bmjopen-2018-023442. Open access under Creative Commons Attribution Non Commercial 4.0. Not commissioned; externally peer reviewed. No specific grant declared and no competing interests declared. Full text read.

Design. A retrospective cohort study reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology statement, together with a case report. The domain was visitors to electronic dance music festivals in the Netherlands between 1 January and 31 December 2015. All such festivals use stroboscopic lighting and those without it were excluded; the presence of the effects was verified from publicly available video. The cohort was divided by whether the event took place in darkness, indoors or at night, or in daylight. Data came from the source files of a company providing medical assistance to more than 90 percent of such events in the Netherlands. Approved by the hospital's medical ethics committee. Power to detect a twofold difference exceeded 90 percent.

Cohort. Twenty-eight festivals and 400,343 visitors, representing 4,556,556 person hours. Exposed: 241,543 people and 2,222,196 person hours. Unexposed: 158,800 people and

2,334,360 person hours. Medical assistance was provided 2,776 times, and its incidence density was equally divided between the two groups.

Result. Thirty-nine seizures identified as epileptic, thirty in the exposed group and nine in the unexposed. Incidence density ratio 3.5, 95 percent confidence interval 1.7 to 7.8, p less than 0.0005. The authors conclude that stroboscopic light effects at events occurring in darkness probably more than triple the risk of epileptic seizures.

The accompanying case. A twenty-year-old man collapsed at an indoor festival with features of a tonic-clonic seizure witnessed by bystanders, having reported an urge to turn his eyes away from the stroboscopic effects beforehand. He denied drugs and alcohol and had no seizure history. At later examination after overnight sleep deprivation his electroencephalogram was normal at baseline, while stroboscopic stimulation throughout the 14 to 25 hertz range elicited generalized epileptiform discharges; the same discharges and sensations occurred when he was shown cell-phone video of the concert he had attended, recorded by one of the authors who was present.

Why the comment relies on it, which is not for the reason a reader might assume. Not for anything about intensity. The exposure variable is darkness. The same kind of event, with the same kind of lighting and a similar audience, produced three and a half times the seizure incidence when held against a dark background rather than in daylight. It is the only population evidence the Foundation has that the state of adaptation of the viewer, which the measurement literature treats as a condition under which instruments perform poorly, is a variable capable of moving a clinical outcome. Relied on at Part VI.K and Part V.D.1, and bearing on Part V.C.3.

What it does not contain. Any photometry. No luminance, no measured flash rate, no modulation depth, no spectral content, and no measurement of any fixture at any venue. No part of this comment cites it for a proposition about any of those quantities.

Limitations, as the authors state them. That the individual epileptogenic components could not be fully disentangled, the authors writing that stroboscopic light effects are prime suspects but probably not solely responsible, with sleep deprivation, physical exertion and stimulant use also present and more likely at night-time events. That the database is anonymous and aggregate, so unique persons could not be identified and ecstasy use could not be formally adjusted for, though the proportion of seizure cases involving ecstasy was similar in the two groups at 27 and 33 percent. That seizures were identified by on-site medical staff from witness reports and physical findings rather than by confirmed diagnosis, permitting both under and over diagnosis, with the authors judging their figures an underestimate. That people with known photosensitivity may have taken precautions or avoided medical staff. And that the results "may be less applicable to other types of concerts or festivals, which use less stroboscopic lights and attract a different audience". The data were not shared.

What the authors recommend. That organizers and audiences warn of the risk and promote precautionary measures, the authors noting that organizers do not routinely warn visitors. That bears on Part IX.F.

C.100 Minamisawa, Funayama, Matsumoto, Matsuki and Ikegaya (2017) — a brief flash evokes cortical activity outlasting it by seconds, and repeated pairing suppresses perception for hours in mice

Citation. Minamisawa G., Funayama K., Matsumoto N., Matsuki N. and Ikegaya Y. "Flashing Lights Induce Prolonged Distortions in Visual Cortical Responses and Visual Perception". eNeuro, 2017. PMCID PMC5429040; PMID 28508035. Graduate School of Pharmaceutical Sciences, University of Tokyo. Open access; full text read.

What kind of study it is, stated first. Basic neuroscience in mice, and methodological in purpose. The authors describe their object as a new method for the noninvasive induction

of long-term plasticity in the mature brain, and propose flashing light as an experimental tool. It is not a study of exposure to any commercial product and makes no claim about one.

Preparation and subjects. Male C57BL/6J mice, postnatal days 68 to 75 for the adult experiments and 28 to 35 for juvenile preparations. Head-plate implantation under ketamine and xylazine, habituation to head fixation, then craniotomy and durotomy over the left hemisphere. Recordings in awake animals, one acute recording per animal, each limited to under an hour. Whole-cell and cell-attached patch clamp of layer 2/3 neurons, local field potentials, and two-photon calcium imaging with Fura-2. Behavior assessed by a virtual optomotor test on freely moving animals. Approved by the Animal Experiment Ethics Committee of the University of Tokyo.

The stimulus. A white screen at 240 candelas per square meter, about 65 lux at the eye, presented for 100 milliseconds every 10 seconds against a continuous gray screen at 60 candelas per square meter. A 17-inch monitor at 30 centimeters covering 38.8 degrees of the horizontal and 29.6 degrees of the vertical visual field. For the pairing protocol a sinusoidal drifting grating was presented 400 milliseconds after each flash, at the onset of the flash-evoked late response, and the pairing was repeated 30 to 50 times.

Findings. That a flash evokes a fast transient response followed by a long-delayed response persisting for seconds, the authors stating in their significance statement that this occurs in mice, rats and humans. That pairing the late response with a drifting grating produced a suppression of the cortical response to that direction and a fall in the animals' ability to detect motion in it. That both the neurophysiological and the behavioral change persisted for at least several hours. And that both were prevented by local application of the N-methyl-D-aspartate receptor antagonist AP5 to the visual cortex, identifying a receptor mechanism.

The limitation the authors state, which governs every use of this paper in the comment. In their discussion: "Although the intensity of the flashing stimulus employed here (Δluminance = ~60 lx) is comparable to that experienced in our daily lives, such as that of a camera strobe, we rarely encounter such repeated, specific exposures to visual stimuli." The intensity is therefore ordinary and far below anything described in Part VI, and the exposure is a conditioning protocol rather than an environmental one. The comment relies on this paper for mechanism and for the existence of an unexamined question, and nowhere asserts that the demonstrated perceptual deficit occurs in people exposed to any product.

Two further qualifications. The suppression was specific to the paired direction and not a general loss of vision. And the direction of the plastic change was not uniform: the authors report that cells in which the flash increased the response to the paired grating later showed facilitation, while those in which it decreased the response showed suppression, with the mean modulation index near zero. The headline result is the mean effect across cells and not a uniform one.

Where it bears. Part V.E.7, which is written on it. Part V.D.2, for the observation that no measurement criterion contemplates a response outlasting the stimulus. Part V.L and Part IX.C, for the research gap.

C.101 Voyzey, Mazzae and Andrella (2023) — a federal measurement of how accurately new vehicle headlamps are aimed, and a statement that no federal requirement governs it

Citation. Voyzey N., Mazzae E. N. and Andrella A. "Assessment of Headlamp Aim for New Vehicles." Report No. DOT HS 813 481. National Highway Traffic Safety Administration, October 2023. 28 pages. Performed at the agency's Vehicle Research and Test Center, East

Liberty, Ohio; performing organization code NVS-120. Two of the three authors are of Transportation Research Center Inc.; the second is of the agency.

What kind of document it is, stated first. A government technical report of original measurements, not a peer-reviewed paper and not a rulemaking document. It carries the agency's standard disclaimer that it is distributed in the interest of information exchange and that no conclusions about safety performance or compliance should be drawn from it. It is placed in Appendix C rather than Appendix D because it reports measurements the authors made, which is the criterion this appendix applies.

What was measured, and how. The vertical aim angle of the lower beam headlamps of fifteen light vehicles of model years 2022 and 2023, measured soon after delivery and before any other testing. Method per SAE J599: the beam was shone on a white matte screen twenty-five feet from the vehicle in a darkened laboratory and the vertical position of the beam cutoff was located relative to the headlamp optical center height, marked by a self-leveling laser. Each vehicle was measured unloaded and again with a 165-pound load in the driver seat. All fifteen were measured visually from digital photographs; five were additionally measured with a Radiant Vision Systems ProMetric Y imaging photometer, the aim being taken as the location of maximum gradient along a vertical line two degrees from the headlamp center. Fourteen of the fifteen vehicles had light-emitting diode headlamps and one a halogen projector.

The finding the comment principally relies on, which is not a measurement. That "There are currently no requirements in Federal Motor Vehicle Safety Standard (FMVSS) No. 108, Lamps, reflective devices, and associated equipment (49 CFR § 571.108, 2011), for aiming headlamps on a vehicle", stated twice, and that "SAE J599 is not an incorporated reference standard to FMVSS No. 108".

The measurements. Against the voluntary SAE criteria most lamps passed. Against the aim targets of the vehicles' own manufacturers, which the report states were in every case as strict as or stricter than the SAE criteria, fewer did: with a driver load, nine of ten driver-side and five of ten passenger-side lamps were within tolerance on visual measurement, and four of five and one of five respectively on photometric measurement of the subset. Driver-side lamps were better aimed than passenger-side lamps in all four test combinations. The two measurement methods differed by an average magnitude of 0.12 degrees, with extremes of plus 0.23 and minus 0.26 degrees.

The direction of deviation, which is the Foundation's tally and not the report's. Of the ten vehicles for which manufacturer targets were available, in the unloaded condition six of ten driver-side and six of ten passenger-side lamps were aimed above the manufacturer's target, the largest upward deviation being 0.50 degrees. The report tabulates the signed deviations and defines a positive value as aimed above the headlamp height; it does not itself count them by direction.

A disclosure about what can be known. For five of the fifteen vehicles the manufacturer's aim target and tolerance are recorded as Confidential Business Information, the report stating that some manufacturers "do not publicly disclose their aim target and tolerance information".

What it does not establish. Anything about glare, which the report mentions twice in a single repeated sentence of rationale and never measures. Anything about vision, injury, or any other biological endpoint; there was no human subject and no illuminance was measured at any eye. Anything about the fleet; fifteen vehicles bought for unrelated research are not a sample. And nothing about dynamic conditions: every measurement is static, on a level laboratory floor, and the report does not address pitch, load change, road profile or any in-use condition. Its reference list contains two items and no scientific literature.

Where it bears. Part VI.B.1, which is written on it. Part II.H.5, for the chronology of the agency's statements and for the second instance of the liaison point, the agency having acquired an imaging photometer in the course of this work. Part V.B.8, for the distinction between the

lamp's coordinate frame and the road's. Appendix D.6, where the European submission makes the dynamic-geometry claim this report's static method cannot reach.

C.102 Hsieh, Tsai, Hung, Lin and Li (2023) — a headlamp designed to the federal standard, in which no biological quantity appears

Citation. Hsieh C.-C., Tsai C.-L., Hung C.-C., Lin H.-H. and Li T.-C. "Design of Multi-module LED Headlamp of Vehicle Under Federal Motor Vehicle Safety Standard." Sensors and Materials, volume 35, number 7 (2023), pages 2433–2448. Article S&M 3333. doi:10.18494/SAM4448. Received 7 April 2023; accepted 3 July 2023. Authors at the National Kaohsiung University of Science and Technology, the National Pingtung University of Science and Technology and Asia University, Taiwan.

What kind of study it is. Optical engineering design, simulated and then prototyped. Not a health study, not a study of any population, and not a measurement of an existing production lamp. Its object is to design a light-emitting diode low beam headlamp that satisfies Federal Motor Vehicle Safety Standard No. 108 using fewer watts than the halogen lamp it would replace.

Why it is in the comment. Because it is a complete, published and checkable record of what the federal standard requires a headlamp designer to achieve. The comment uses it at Part VI.B.1 for two things: the structure of the photometric requirement, and the exhaustive list of what the designers were required to optimize.

The requirement as the authors reproduce it. Eighteen numbered test points, each with an angular position relative to the lamp axis expressed in degrees up, down, left or right, a required luminous intensity in candelas, and the derived illuminance in lux. Stipulated measurement distance sixty feet, given as 18.3 meters; test voltage 12.8 volts ± 20 millivolts. Eleven points specify a minimum only, five a maximum only, and two a range. Of the eight points below the horizontal, six specify a minimum and no maximum, including the two highest requirements in the table: at least 10,000 candelas at 0.6 degrees down and 1.3 degrees right, and at least 15,000 candelas at 1.5 degrees down and 2 degrees right.

The design, in outline. Two commercial light-emitting diodes, a Visera 6363 rated at 5 watts and 340 lumens and a Nichia NVSW119A rated at 3 watts and 190 lumens. The conventional shade of a projector headlamp was replaced by an asymmetric floorboard, raising simulated luminous flux from 228.9 to 334.6 lumens, with an ellipsoidal reflector designed by the simultaneous multiple-surface method, an aspheric lens and a cylindrical condenser. The final system superposes one asymmetric-floorboard module and three horizontal-floorboard modules and draws 16 watts, reported as 70 percent less energy than a 55 watt halogen low beam, with a stated 30 percent reduction in energy loss attributed to the floorboard.

The finding the comment relies on, which is an absence. That no biological quantity appears anywhere in the design. In sixteen pages the words eye, vision, visual, retina, comfort, human and health do not occur. Neither do luminance, wavelength, spectral, blue or color temperature. The word safety occurs four times, three within the name of the standard and one within a cited conference title. The word glare occurs twice, once describing earlier work by others and once in the authors' report that after a condenser recovered light scattered above the cutoff, "drivers of approaching vehicles on the opposite lane do not suffer from any glare caused by scattered light from headlamps". That is the only appearance of a human being in the paper, and it records a consequence of an efficiency change rather than a criterion the design was required to meet.

What it does not establish. Anything about health, injury, exposure or any biological endpoint, none of which it addresses. Anything about industry practice generally; it is one design by one group. Anything about a production lamp; the prototype measured 700 lux peak illuminance at four meters against 1,071 lux in simulation, which the authors attribute to assembly and rotation tolerances and to the reflectivity of polished aluminum. And it is not the

regulation: its table is the authors' reproduction of requirements they attribute to the Electronic Code of Federal Regulations as accessed in June 2023.

Where it bears. Part VI.B.1, which is written on it. Part II.H.5, as independent confirmation of the agency's statement of 13 February 2024 that Standard No. 108 does not directly regulate peak luminance or spectral power distribution. Part V.B.8, for the lamp-axis coordinate frame in which the requirement is expressed. Appendix C.101, with which it pairs: the one shows the requirement is written in the lamp's frame, the other that no federal requirement fixes that frame to the road.

C.103 Sefer, Ayaz, Ajder and Nakir (2023) — at equal illuminance, the source that transmitted best through fog was not the source under which people saw best

Citation. Sefer T., Ayaz R., Ajder A. and Nakir I. "Performance investigation of different headlights used in vehicles under foggy conditions." Scientific Reports 13, article 4698 (2023). doi:10.1038/s41598-023-31883-3. Department of Electrical Engineering, Yildiz Technical University, Istanbul. Open access under Creative Commons Attribution 4.0. Ethical approval of the Yildiz Technical University Ethical Committee (2022.09); informed consent recorded; no competing interests declared.

What kind of study it is, stated first. A bench experiment with human observers. Not a road study, not a driving study, and not a study of any health endpoint. Its subject is target detection under a scattering medium with the quantity of light held constant and the spectrum varied.

Design. Three production headlamps: a 55 watt Philips HIR2 halogen measured at 3031 kelvin, an 8 watt light-emitting diode unit at 5122 kelvin, and a 25 watt Philips D5S xenon unit at 5098 kelvin, spectra measured on an Everfine HAAS-2000 array spectroradiometer. Targets were five-centimeter yellow and red cubes in a matte black box of one meter by eighty centimeters by one meter, fogged by an Antari Z800II machine. Illuminance at the target was equalized across lamps to within five lux. Twelve participants, six female and six male, aged 21 to 36, screened for color blindness, pressed a counter on detecting a cube. Observer angle 20 degrees, target viewing angle 1 degree.

What it reports. That transmittance through the fog was highest for xenon, by about 2 to 3 percent over halogen and the diode lamp, and that relative target luminance was likewise highest for xenon. That detection times by human observers ran in the opposite order: shortest under halogen, then xenon, then the diode lamp. That transmittance was about 20 percent at thirty seconds for all three, rising to 53 to 54 percent at fifteen minutes. The authors attribute the reversal to the white wall effect in the eye of the observer rather than to differential transmission, and recommend diode sources of lower correlated color temperature.

The finding the comment relies on. The divergence itself, and the authors' statement of its methodological consequence: that transmittance is insufficient alone to evaluate headlamp performance under fog, that a luminance camera in fog measures the luminance of the fog rather than of the target, and that user-based tests are therefore required.

A finding in this paper that the Foundation does not rely on, and why. Its abstract reports that female participants detected targets between 1.72 and 3.65 times more slowly than male participants. The Foundation does not use that finding, does not reason from it, and records here that it declines it on methodological grounds. The comparison is between groups of six. Within a single condition the detection times of the twelve participants span a factor of more than eight, from 11.75 seconds to 100.55 seconds. No analysis in the paper separates a group effect from variation of that magnitude, and the single supporting citation offered is to a reaction-time study of first-year medical students. The Foundation states this expressly so that its reliance on the paper is not mistaken for reliance on the whole of it.

Other limitations. Twelve participants. An optical path of about one meter. Fog very much denser than any road condition: the reported transmittances imply, on an assumed one-meter

path, meteorological visibilities of a few meters against the thousand meters by which the paper's own introduction defines fog. No vehicle, no distance, no driving task, no moving target and no roadway. Detection times running to nearly three minutes. One lamp tested at each technology, so nothing in the paper supports extrapolation across color temperature. And no biological endpoint of any kind: the study measures what people could see, not what the light did to them.

Where it bears. Part VI.B.1, in the passage on the condition the certification test does not include. Part V.B.8 and Part V.C.2, as a measured instance of a photometric quantity and a human outcome diverging. Part V.F, for correlated color temperature as a determinant of a visual outcome, with the caution stated above that one lamp at 5122 kelvin supports no inference about higher values.

C.104 American Automobile Association (2019) — the only American evaluation of adaptive driving beam, and the five people who rated it

Citation. American Automobile Association. "Comparison of European and U.S. Specification Automotive Headlamp Performance." April 2019. 58 pages. Published at the association's newsroom.

What kind of document it is. A closed-course engineering evaluation published by a motoring membership organization. Not peer reviewed, and not a health study. It is the American counterpart, in sponsorship though not in method or scale, of the European consumer study at Appendix D.6.

What was tested. Four vehicles from two manufacturers, each manufacturer supplying one United States specification vehicle with light-emitting diode headlamps and automatic high beam switching, and one European specification vehicle of the same model with adaptive driving beam. Static roadway illumination was measured on twelve-inch non-reflective black targets along an unlit asphalt course about 1,300 feet long, at least ninety minutes after sunset. Glare was evaluated dynamically, the test vehicle passing a stationary observation vehicle at thirty-five miles an hour.

What it reports on illumination. That United States specification lower beams delivered 1.9 percent more illumination on the targets, that European upper beams delivered 12.5 percent more, and that the adaptive systems held upper beam operation everywhere except the shaded region while the United States systems were obliged to drop to lower beam, a difference the association puts at as much as 86 percent more roadway lighting. It records the permitted upper beam maxima as 430,000 candelas in Europe against 150,000 in the United States.

What it reports on glare, which does not assist the Foundation. That all four vehicles rated in the low perceived glare band, between Satisfactory and Just Acceptable on the de Boer scale; that one manufacturer's adaptive vehicle rated better than its United States counterpart and the other's rated worse; and that on cresting hills, the scenario the association identifies as the worst case for every headlamp system then available, glare occurred less frequently with the adaptive systems than with the United States automatic systems. The Foundation records these findings in the body of Part VI.B.2 and does not argue against them.

The limitation that governs every use of this report. The glare evaluation rested on five raters. They were the association's own researchers rather than naive participants, all five were men, and they had conducted the illumination testing beforehand and so knew which vehicle was which. Each gave a single retrospective rating on a nine-point subjective scale after one pass, having been instructed to look down the lane rather than at the beam. The report is candid about all of this; the Foundation records it because a reader meeting the phrase low perceived glare should know what produced it.

What it does not establish. Anything about health, injury or any biological endpoint, none of which it addresses. Anything about distraction, which the agency's definition of the technology names and which this evaluation did not measure. Anything about disability glare,

contrast threshold or recovery time. Anything about exposure of any duration. And anything about any person outside a vehicle: the observation point was a parked car with its lower beams lit, which is the object these systems are built to detect, so what was measured is how well the shading works on the one road user it recognizes.

Where it bears. Part VI.B.2, which is largely written on it, including the passages that run against the Foundation. Part VI.B.1, for the permitted upper beam maxima and for the comparison of scale with the European consumer study. Part II.H.5, for the quoted definition of adaptive driving beam and the three criteria in it.

C.105 Stone, Santoni de Sio and Vermaas (2019) — a vehicle that navigates by sensors does not need the light, and the feasibility question that follows

Citation. Stone T., Santoni de Sio F. and Vermaas P. E. "Driving in the Dark: Designing Autonomous Vehicles for Reducing Light Pollution." Science and Engineering Ethics (2019). doi:10.1007/s11948-019-00101-7. Received 28 January 2018; accepted 18 March 2019. Delft University of Technology, Departments of Industrial Design and of Ethics and Philosophy of Technology. Open access under Creative Commons Attribution 4.0.

What kind of document it is, stated first because it governs every use of it. A work of philosophy in an engineering ethics journal. It reports no experiment, no measurement and no original data of any kind. It is classified in Appendix C rather than Appendix D only because it is a peer-reviewed article; it is unlike every other entry in this appendix in reporting nothing empirical.

What it argues. That autonomous vehicles are still a technology in development whose shape is not settled; that engineering ethics should build values into a technology during that phase; that nighttime lighting is a supporting infrastructure which should be a prima facie design consideration for such vehicles; and that two scenarios, parking lots and highways, show how vehicles might be designed to operate with greatly reduced lighting or none.

The proposition the comment relies on. That a vehicle navigating by light detection and ranging, coupled with maps and satellite positioning, does not require visible illumination to move safely, so that the visible emission of its forward lighting is severable from the function of the vehicle. The authors describe systems requiring little or no lighting to navigate at night, state that this can potentially allow such systems to drive in total darkness, and set as their object designing vehicles to function without both streetlights and headlights.

What that proposition rests on in the paper, which is thin. A single secondary reference to press reports of an early Ford test. The authors present it as a design goal to be pursued rather than a demonstrated capability, and describe their own proposals as initial considerations to be assessed through future technical research. The comment states the claim as theirs.B.6 records that a technical source is required.

What the comment does not take from it, recorded expressly. The aesthetic and cultural case for darkness, which occupies most of the paper. Of the eight values the authors tabulate, the comment does not advance stellar visibility, wonder and beauty, connection to nature, or heritage and tradition, and Part VI.B.6 names them in order to disclaim them. The Foundation also takes no health proposition from this paper. It contains no health data; the words glare, headlamp, retina, eye, blue light, circadian and melatonin do not occur in it; and its three mentions of human health are passing citations to secondary literature.

Where it bears. Part VI.B.6, which is written on it, for the severability of the emission from the function and for the consequence under section 360kk(a)(2). Part I.C.7, for the proposition that the moment to ask a design question is before the design is settled. Part II.H.3, which supplies the statutory reading of unnecessary radiation that the subsection applies.

C.106 Fullerton and Peli (2009) — the apparatus built to put a calibrated headlamp in front of a person, and what its authors say about the test the Department uses

Citation. Fullerton M. and Peli E. "Development of a System to Study the Impact of Headlight Glare in a Driving Simulator." In Proceedings of the Fifth International Driving Symposium on Human Factors in Driver Assessment, Training and Vehicle Design, 22–25 June 2009, Big Sky, Montana. Iowa City: Public Policy Center, University of Iowa, 2009, pages 412–418. doi:10.17077/drivingassessment.1351. The second author is of the Schepens Eye Research Institute, Harvard Medical School; the first was then also at the University of York and the Technical University of Munich.

What kind of paper it is, stated first. A conference paper reporting the construction of a prototype instrument. It presents no experiment on human subjects and no result about any population. The only statement in it about people is that drivers testify to being unable to see the area around the headlamps. Nothing in the comment rests on it as a finding.

What was built. A dynamic simulation of oncoming headlamp glare for a driving simulator. A separate diode array is combined with the simulator screen through a fifty-fifty beam splitter, its lit position synchronized in real time to the simulated oncoming vehicle, its intensity set from an interpolated lookup table and calibrated against illuminance measured at the driver's head position. The diode was selected for high intensity and, because of evidence that higher color temperatures cause more discomfort, presorted for the lowest available color temperature. The simulator carries combined head and eye tracking to better than one degree.

Why the instrument had to take that form. Because no display could produce the light. The authors computed required display luminances running from several hundred to several thousand candelas per square meter, against 50 to 100 for a cathode ray tube, 200 to 600 for the liquid crystal displays of the period, and 10,000 only for experimental high dynamic range displays. They concluded that current display technology could not achieve the luminance needed to create realistic headlight glare on a screen.

The two sentences for which the comment principally cites it. First, that the standard test used in a number of Food and Drug Administration studies, the Night Driving Simulator of Vision Sciences Research Corporation, does not accurately simulate glare in terms of light intensity because the headlights appear only as part of a filmed scene. Second, that manufacturers of ophthalmic devices are required to satisfy the Administration's safety concerns and wish to verify that their products are not worsening night driving. Together those place a Departmental glare test on the record, and place the obligation it supports on the maker of the lens rather than the maker of the lamp.

Two further propositions the comment takes from the authors' review. That changes in the ocular media from age, eye surgery, cataract, contact lenses, intraocular lenses and spectacles all worsen the veiling luminance responsible for disability glare, which corroborates Part V.C.5. And that drivers' subjective impression of a glare source does not relate well to their on-road performance, reported from Theeuwes and others in 2002, which bears on the subjective ratings relied on in the evaluation at Appendix C.104.

What it does not establish. Any effect of headlamp glare on anyone. No subject was tested and no outcome measured. The quantities tabulated are computed from the CIE general equation for disability glare for a thirty-year-old with blue eyes, using fiftieth-percentile beam data from a 2001 technical report, and are therefore modeled throughout. The display comparison describes the technology of 2009 and is now dated. And the paper reports a prototype whose limitations the authors state, including diode spacing coarse enough to make the simulated headlamp motion less smooth than they wished.

Where it bears. Part VI.B.1, in the closing movement on measurement, which is written on it. Part II.H.3, for the proposition that developing measurement methods referred to the point of human exposure is directed work and not a detail. Part V.C.5, for the ocular media

corroboration. Part VI.B.2, as the reason the subjective ratings there cannot carry a conclusion about performance.

C.107 Bullough, Skinner, Pysar, Radetsky, Smith and Rea (2008) — the congressionally directed federal glare study, conducted on a fleet that no longer exists

Citation. Bullough J. D., Skinner N. P., Pysar R. M., Radetsky L. C., Smith A. M. and Rea M. S. "Nighttime Glare and Driving Performance: Research Findings." Report No. DOT HS 811 043. National Highway Traffic Safety Administration, September 2008. 118 pages. Prepared by the Lighting Research Center, Rensselaer Polytechnic Institute, under contract DTNH22-05-D-01002. Contracting officer's technical representatives Stephanie Binder and Michael Perel.

Why it exists. Section 2015 of the Safe, Accountable, Flexible, Efficient Transportation Equity Act of 2005 directed the Department of Transportation to study the risks of glare to oncoming drivers, with particular attention to two-lane highways, to drivers over the age of 50, and to the overall effects of glare on driver performance, and to make recommendations. The agency had opened a public docket on headlamp glare in 2001 and records that most responses received were complaints.

What it comprises. Seven studies: a state-of-knowledge report; a pilot study using naturalistic methods on glare, driving behavior and crash risk; analyses comparing headlamp characteristics for visibility and glare; assessments of headlamp illumination and aim on real vehicles; a review of visual needs and metrics; a field experiment on glare recovery in older drivers; and development and demonstration of a prototype safety-based adaptive forward-lighting system.

The countermeasure ratings, which are the report's answer to Congress. Mounting height low; aim high; optical design low; low beam distribution low; adaptive beam distributions high; color medium; cleaning and maintenance medium. The aim rating records that some new and many in-use vehicles have mis-aimed headlamps. The color rating states that bluer sources such as high-intensity discharge headlamps do increase discomfort, so that restricting short-wavelength output could reduce discomfort, though with little effect on visibility.

The fact for which the comment principally cites it. That it is silent on the technology that has since taken the fleet. In 118 pages light-emitting diodes are mentioned twice, both times as a speculative future means of building the adaptive prototype, and no diode headlamp, spectrum or exposure was measured. The report records that during its field work discharge headlamps were very rare and almost all oncoming headlamps were halogen.

Four further findings the comment uses. That glare reduces visibility more for drivers over 50 because of increased scatter in the ocular media. That drivers' perceptions of glare often differ from disability glare and glare recovery, bluer discharge sources eliciting greater discomfort without diminishing visibility more at the same luminous intensity. That present low beam patterns do not appear to give sufficient visibility at many of the speeds at which they are used, even with no oncoming vehicle. And that despite clear evidence relating glare to reduced visibility there is little direct evidence linking glare to increased crash risk.

The instrument it used. A head-worn illuminance meter developed by the Lighting Research Center, the Daysimeter, carrying both a photopic detector and a short-wavelength detector, which together allowed differentiation among sources of differing spectral composition. Light at the eye of a driver on a public road was therefore measured, in both photopic and short-wavelength terms, under federal contract in 2008.

What it does not establish. Anything about health, injury, tissue or any biological endpoint; its outcomes are visibility, discomfort ratings, recovery times and driving behavior. Anything about diode sources. And its pilot study on crash risk is expressly described by its authors as

insufficient to draw firm conclusions, with findings that would need replication at larger sample size.

Where it bears. Part VI.B.1, in the movement on what the agency was told in 2008. Part V.B.3 and Part V.F, for the 2008 recommendation that restricting short-wavelength output be considered. Part V.C.5, for the finding on drivers over 50. Part VI.B.2, for the divergence between discomfort ratings and visual performance. Appendix C.101, with which it forms a fifteen-year chronology on headlamp aim. Part II.H.5, for the liaison point about the Daysimeter.

C.108 Mainster and Timberlake (2002) — the ophthalmological account, which attributes the problem to brightness rather than blueness

Citation. Mainster M. A. and Timberlake G. T. "Why HID headlights bother older drivers." British Journal of Ophthalmology, 2002. PMCID PMC1771460; PMID 12488274. Supported in part by the Kansas Lions Sight Foundation.

What kind of article it is. A perspective, not a report of original research. It reports no experiment, measures no lamp and studies no population. Its contribution is to assemble the optics of headlamps, the physics of intraocular scattering and the clinical literature on glare and photostress into an explanation of why complaints about discharge headlamps came from older drivers.

The finding that corrects the Foundation, recorded first. That brightness rather than blueness is the primary cause of the visual problems these headlamps produce. Intraocular scatter from the cornea and lens falls with increasing wavelength while scatter from fundus reflectance rises with it, so that stray light reaching the fovea has little wavelength dependence and a blue-white source should produce no more disability glare than a white one of the same luminance. No part of the comment asserts the contrary.

What the same authors attribute to spectral content. Discomfort glare. Discharge headlamps are reported to cause more of it than halogen headlamps at the same photopic or scotopic illuminance, with the effect larger in drivers aged 61 to 77 than in those aged 20 to 31. Discomfort glare is described as not impairing vision but as startling or distracting and as causing blinking, squinting, ocular aversion and fatigue, with physiological and psychophysical origins that remain uncertain.

The category the comment had not previously named. Scotomatic glare, or photostress: a brilliant source decreases visual sensitivity, which recovers only as dark adaptation is restored, producing afterimages that interfere with vision. It is attributed primarily to bleaching and slower regeneration of photoreceptor photopigments. Recovery time increases with source luminance and with age.

Three further propositions the comment uses. That light scattering increases in people over 50 and that older individuals have increased intraocular stray light, glare sensitivity and photostress recovery time, with disability glare increased by cataract, intraocular lens implantation and posterior capsule opacification. That transient glare of the kind a headlight encounter produces is worse than static glare from a source of the same luminance, the effect increasing with age and media opacity, and that conventional clinical glare tests accordingly understate disability glare from moving sources. And that scattering by large particles such as fog droplets is not wavelength dependent, which is why fog does not change the apparent color of headlights.

What it does not establish. Anything about light-emitting diode headlamps, which it predates and does not mention. Anything about injury: its subject is scattering and photopigment bleaching, both reversible processes of normal vision, and it makes no claim about damage to tissue. And nothing original: every quantitative claim in it is drawn from the literature it reviews.

Where it bears. Part VI.B.1, in the closing movement on the ophthalmological account. Part V.C.5, as the third source for the age gradient in intraocular scatter. Part V.E.7, as the clinically established human instance of a light effect outlasting its exposure. Part V.D, for discomfort glare as aversion and fatigue rather than annoyance. And throughout Parts V and VI as the authority for keeping disability glare, which follows luminance, separate from the spectral questions, which do not.

C.109 Olson and Aoki (1989) — the adaptation level an oncoming headlamp puts a driver into, and how long it takes to come back

Citation. Olson P. L. and Aoki T. "The Measurement of Dark Adaptation Level in the Presence of Glare." Report No. UMTRI-89-34. University of Michigan Transportation Research Institute, Ann Arbor, November 1989. 14 pages. Performing organization code 302753; government accession number PB90 155987/AS.

Sponsorship, stated first. The University of Michigan Industry Affiliation Program for Human Factors in Transportation Safety. The report lists the members as of 1 November 1989 as GE Lighting, GTE Products Corporation, Ichikoh Industries, the Inland and Fisher Guide Divisions of General Motors, Koito Manufacturing, Stanley Electric and Valeo Automotive. This is industry-funded research and the comment says so wherever it relies on it.

What was measured, and how. Driver dark adaptation level in the presence of headlamp glare, obtained indirectly. The time from extinguishing the glare until a target light source could be detected was recorded, and that readaptation time was read against a laboratory calibration in which subjects were adapted to surfaces of known luminance and the same recovery timed. The field condition was facing standard United States low and high beams at about 150 feet.

What it found. Mean readaptation times of 3.63 seconds after low beam glare, standard deviation 0.59, from fifteen subjects, and 5.14 seconds after high beam glare, standard deviation 0.94, from fourteen. Against the calibration those correspond to adaptation levels of about 5 and 20 foot-lamberts respectively, both of which the authors note fall in the photopic zone.

The comparison figures, which come from the authors' earlier work. At the same site, a pedestrian without illumination is at about 0.005 foot-lamberts, a driver using low beams at about 0.3, and a driver using high beams at about 1.7. Meeting an oncoming low beam therefore places the driver three log units above the pedestrian, and an oncoming high beam four times higher again.

What the authors conclude about a road with traffic. That recovery from high beam glare takes a little over five seconds, in which a vehicle at 65 miles an hour travels almost 500 feet, and from low beam glare about 350 feet; and that when meeting a steady flow of oncoming traffic a driver's vision is seldom as good as it could be in the absence of that traffic, through the combination of disability glare and upward adjustment of dark adaptation.

The observation about the pedestrian. That a pedestrian without illumination can see some things better than a driver can with headlamps, because of the difference in adaptation level, and that this may contribute to pedestrians overestimating their own visibility at night.

What it does not establish. Anything about diode headlamps, which it predates by two decades. Anything about health or injury; its endpoint is visual performance. And its adaptation levels are inferred from readaptation times through a calibration rather than measured directly. Fifteen and fourteen subjects, with no age breakdown reported in the pages read.

Where it bears. Part VI.B.1, in the closing movement on measurement. Part V.C.3, for adaptation state as the mechanism by which a glare source reduces visibility. Part V.E.7 and the photostress material at Appendix C.108, as the quantified instance of a visual effect outlasting its exposure. Part VI.B.2, for the adaptation gap between a driver and a pedestrian, which is the person the adaptive driving beam evaluation did not test.

C.110 Fotios and Gibbons (2018) — a review finding little if any credible empirical support for the light levels recommended on roads

Citation. Fotios S. and Gibbons R. "Road lighting research for drivers and pedestrians: The basis of luminance and illuminance recommendations." Lighting Research and Technology, volume 50, number 1 (2018). doi:10.1177/1477153517739055. The first author is at the University of Sheffield and the second at the Virginia Polytechnic Institute and State University. A correction to the article has been published.

What kind of article it is. A review of the evidentiary basis of quantitative road lighting recommendations. It reports no original experiment. Its subject is where the numbers in the standards came from.

Its conclusion. That recommendations for the amount of light do not appear to be well-founded in robust empirical evidence, or at least do not tend to reveal the nature of any evidence; and, in its closing section, that there appears to be little, if any, credible empirical support for the light levels recommended in much current road lighting guidance.

What it reports about the American recommendations. That the recommendations of the Illuminating Engineering Society, implemented in 1972 and still the basis of current North American standards, derive from Box (1971) on 203 miles of freeway; that Box found the lower range of illuminances associated with a lower night to day crash ratio than the higher ranges, a result the reviewers describe as counter to intuition and attribute to additional glare and to the effect on the driver's adaptation level; that the six-lane road data show no relationship between light level and crash rate, the linear fit returning a coefficient of determination of 0.02; and that the levels for road categories other than freeways had no empirical backing, the 0.5 foot-candle figure having been carried through the standards and translated into a luminance criterion.

What it reports about the other recommendations. That the minimum illuminances of the 1927 British standard had no theoretical basis; that for the modern pedestrian classes the empirical evidence, if any, is unknown and there is no published explanation of the basis for the values; that the facial recognition criteria rest on ratios for which there are no known reasons and which appear to be arbitrary; and that the agreement between the international and European documents reflects overlapping committee membership rather than independent groups reaching similar conclusions.

What it says about the trend. That recommended maxima and measured average illuminances have risen over time, and that light levels may have increased because there was an ability to do so rather than because there was evidence of benefit.

The prescription the comment relies on. That future standards may need to include maximum light levels, limitations for spectral power distribution and spatial distribution, and exposure doses. And, reporting Lucas and colleagues, that the management of light resembles administering a drug, with a need to control the dosage so as to maximize benefit while minimizing side effects.

A further finding used at Part V.B.3. That road lighting is specified in photopic quantities although the conditions of use are mesopic, so that the recommended values ignore the contribution of the rods and the short-wavelength sensitive cones, a limitation the authors say has become more important since the widespread introduction of diode sources.

What it does not establish. Anything about health. It reports no biological endpoint and names the side effects of road lighting as energy consumption, sky glow, light trespass and impact on the natural environment. It is a review and contains no original data. And its account of the American standard is an account; the underlying study has not been read by the Foundation.

Disclosure. The authors declare no conflicts of interest. The second author discloses that much of the research referred to was supported by government agencies including the Federal Highway Administration, by local agencies, by lighting companies and by other interested

parties. The first author's contribution was supported by the Engineering and Physical Sciences Research Council.

Where it bears. Part VI.D, which is written on it. Part V.B.3, for the photopic specification of a mesopic task. Part VI.B.1 and Appendix C.109, for glare and adaptation level as the explanation offered for the Box anomaly. Part VI.B.6, for the observation that automated vehicles reduce the need for roadway lighting. Part II.H.3, for the proposition that maximum levels, spectral limits and exposure doses are the quantities a standard would have to address.

C.111 Krumina, Volberga, Ikaunieks and Naumovs (2021) — a road authority and an optometry department apply the American billboard criterion and report that it cannot be used

Citation. Krumina G., Volberga L., Ikaunieks G. and Naumovs L. "The Development of Brigthness Evaluation Method for Digital Billboards." IOP Conference Series: Materials Science and Engineering, volume 1202 (2021), article 012035. doi:10.1088/1757-899X/1202/1/012035. Presented at the 30th International Baltic Road Conference. Open access under a Creative Commons Attribution licence. The title is reproduced as published, including its misspelling of brightness.

Who the authors are, and who funded it. The first three authors are of the Department of Optometry and Vision Science, Faculty of Physics, Mathematics and Optometry, University of Latvia; the fourth is of the Department of Road Equipment and System of the Latvian State Roads. The work was supported by a grant from that road authority and by university grants. It is not industry funded, which distinguishes it from the report at Appendix D.4 whose method it assesses.

What the authors set out to do. To develop a method by which a supervising authority could assess the brightness of a digital billboard while it is operating, using an inexpensive instrument, namely a lux meter.

What they report about the American method. That the method of the Outdoor Advertising Association of America and the International Sign Association, which they describe as a simplification of the recommendation of a former board member of the Illuminating Engineering Society of North America, cannot be applied to billboards above about 25 square meters, because the measurement distance the method computes from the screen dimensions is so great that the illuminance to be measured falls below the sensitivity of the prescribed instrument. They report further that the permitted luminance the method yields does not vary with the area of the display, and that a larger display dazzles more at the same luminance.

The figures the comment relies on. From their Table 2, the maximum billboard luminance implied by the American method across four ambient zones: 322, 423, 524 and 827 candelas per square meter. From their Table 6, for a real 52 square meter billboard near Riga, the permitted luminances and the De Boer discomfort ratings they imply under the American method at 30 and 100 meters across the same four zones, of which seven of eight ratings fall below the value the authors identify as the threshold of comfort.

The scale definition the comment adopts. That the De Boer scale runs from 1 for unbearable glare through 3 for disturbing, 5 for just acceptable and 7 for satisfactory to 9 for unnoticeable glare, and that ratings are considered comfortable at 5 and above, with 4.7 to 4.9 described as the borderline. This definition is used at Part VI.B.2 as well, where the American evaluation of adaptive driving beam headlamps reported ratings on the same scale.

What it does not establish. Anything about health, injury or any biological endpoint, none of which it addresses. Its De Boer values are predicted from an illuminance-based model rather than obtained from observers, the authors reporting a Pearson correlation of 0.87 between predicted and measured values in the study from which they take the model. Its measurements were made in Latvia, and its assessment of an American instrument is made from a different regulatory and lighting context. It is a conference paper.

Where it bears. Part VI.J.6, which is written on it, as the only independent assessment of the American criterion the Foundation has found, and as a check on the Foundation's own derivation of the luminance that criterion implies. Part VI.B.2, for the definition of the De Boer scale. Part V.E.1, for the 16 hertz finding it reports at second hand.

C.112 He, Zhang, Quan, Mi, Cui, Xu and Tian (2021) — field luminances of typical outdoor display screens, and a reaction time penalty for blue

Citation. He Y., Zhang X., Quan L., Mi R., Cui Y., Xu J. and Tian Z. "Influence of coloured light projected from night-time excessive luminance outdoor LED display screens on vehicle driving safety along urban roads." Building and Environment (2021). doi:10.1016/j.buildenv.2020.107448. Authors principally of Chongqing University. Supported by the National Natural Science Foundation of China and by Chongqing research foundations. The authors declare no competing interest.

What the Foundation has read, stated first. The abstract, the highlights, the introduction and the truncated section summaries displayed on the publisher's preview page. The article is behind a paywall. The methods, the full results and the complete conclusions have not been read, and one sentence relied on is cut off mid-clause in the preview. Every use of this paper in the comment is subject to that limitation.

Design, so far as it can be established. A laboratory simulation. Twenty-four subjects viewed fourteen simulated night road scenes, built by integrating photographs with software simulation, on a television at a viewing distance of 920 millimeters in a darkened room, and responded to small targets. Three screen luminance conditions were used, described as excessive luminance values of typical outdoor display screens at night and given as 1,000, 3,000 and 5,100 candelas per square meter. Five thousand and forty reaction time measurements were obtained. A trial was recorded as a missing dot where the reaction time exceeded two thousand milliseconds or no response was made.

The figures the comment principally relies on. The three screen luminances above, and the authors' statement that the average luminance of an urban road surface at night is usually 1.0 to 2.0 candelas per square meter. The comparison between the two is the Foundation's arithmetic and is set out at Part VI.J.6.

What it reports. That colored light from these screens can improve a driver's ability to recognize small targets and reduce reaction times at low screen luminance, but causes more missing dots; and that blue light is the exception, the conclusions stating that it can increase reaction times and worsen driving safety. The introduction states that the luminance of many advertising signs at night greatly exceeds the control values in the applicable specifications and guidelines, and that the United States, Europe, Australia, China and other countries have issued such guidelines.

A finding the comment expressly declines. That the night recognition ability of female subjects under this exposure exceeded that of male subjects. Twenty-four subjects, with the division not disclosed in the material read. The comment declines a sex-difference finding running in the opposite direction at Appendix C.103 and treats this one the same way.

What it does not establish. Anything about health or injury; its endpoints are reaction time and target detection. Anything about an actual road: the exposure was a television at 920 millimeters in a conference room, not a display beside a carriageway. And nothing that the Foundation can presently verify beyond an abstract.

Where it bears. Part VI.J.6, which is where it is used, for the measured luminance of typical screens against the road surface beside them and against the implied criterion. Part V.B.3 and Part V.F, for the reaction time penalty reported for blue. Part VI.D, for the road surface luminance figure.

C.113 Wachtel (2016) — a review of twenty-one studies on distraction from commercial electronic variable message signs

Citation. Wachtel J. "Compendium of Recent Research Studies on Distraction from Commercial Electronic Variable Message Signs (CEVMS)." The Veridian Group, Inc., Berkeley, California, February 2016. The second in a series of updates to the same author's 2009 report for the American Association of State Highway and Transportation Officials under National Cooperative Highway Research Program Project 20-7/256.

What this document is, stated first because it governs its weight. A review of other people's work. Nothing in it was measured by its author. It summarizes twenty-one studies published between 2008 and 2016 in five countries, each in a table giving date, location, authors, forum, whether peer reviewed, sponsor and funding source, type of study, type of signs studied, method, findings, strengths, weaknesses and availability. The tabulation of sponsorship for every entry is the feature that makes the document useful. It is a consultancy publication rather than a product of the sponsoring association, and it is now ten years old.

What the comment uses it for. Three things and no more. First, the correction at Part VI.J.6 of the eight second dwell time figure the Foundation had reported from a trade article, against the conclusion of the on-road study at the end of this review. Second, the description of attention capture by these displays as an involuntary physiological process driven by changes in luminance. Third, the account of the Israeli natural experiment, expressly at third hand.

The principal studies relied on, with their own citations. Belyusar D., Reimer B., Mehler B. and Coughlin J.F., A field study on the effects of digital billboards on glance behavior during highway driving, Accident Analysis and Prevention 88 (2016) 88–96; one hundred and twenty-three subjects, instrumented vehicle, sixty-five mile per hour highway, sponsored by the United States Department of Transportation Region 1, the University Transportation Center at the Massachusetts Institute of Technology and the Toyota Class Action Settlement Safety Research and Education Program. Roberts P., Boddington K. and Rodwell L., Impact of Roadside Advertising on Road Safety, Austroads Research Report AP-R420-13 (2013). Gitelman V., Zaidel D. and Doveh E. (2012) and Gitelman V., Zaidel D., Doveh E. and Zilberstein R. (2014), both for the Israel National Roads Authority.

What it does not establish. Any health, visual or biological endpoint. Not one of the twenty-one studies measures one. The endpoints throughout are glance duration and frequency, lane position, reaction time, mental workload and crash rates. It establishes nothing of its own in any event, being a review.

What runs against the Foundation, recorded here as in the body. The Federal Highway Administration study of 2012 found digital billboards not associated with unacceptably long glances away from the road. Two industry-sponsored studies found no crash increase and no significant headway difference respectively. The review disputes the first at length and the Foundation does not adopt the dispute, the review's author being the author of the critique on which it relies.

A matter the Foundation expressly does not adopt. The review makes an allegation about the conduct of an industry-sponsored study. No evidence for it is given in the document, the Foundation cannot test it, and the comment does not repeat or rely on it.

Where it bears. Part VI.J.6, which is the only place the comment uses it. Part VI.J.8, for the dwell time criterion. Part V.E.1, for the proposition that a change in luminance captures attention involuntarily.

C.114 Wachtel (2014) — measured luminance of American roadside signs, and the origin of the American brightness criterion

Citation. Wachtel J. "Report on Digital Sign Brightness." Prepared for the Nevada State Department of Transportation, Washoe County, City of Reno and City of Sparks. The Veridian Group, Inc., Berkeley, California, November 2014.

Provenance, stated first because it governs weight. The report states that the work was performed at the request of Scenic Nevada, an advocacy organization, which it records as having had no role beyond supplying maps of sign locations. It is a consultant's report prepared for four public bodies; nothing in it indicates that any of them adopted it, and the comment does not describe it as a Nevada standard. Its author is the author of Appendix C.113, and the comment does not treat the two as independent.

What was measured, and with what. Nighttime luminance of identified signs in Reno, Sparks and unincorporated Washoe County, Nevada, on 22 September and 18 October 2014, with daytime readings on 19 October, using a Minolta LS-100 calibrated photometer with a one degree acceptance angle. Appendix 1 of the report tabulates each sign by number, location, jurisdiction, on-premise or off-premise status, the message displayed, the number of meter readings, and the average and range of readings.

The principal figures. Traditional billboards averaged 59.8 candelas per square meter on 22 September, across sixteen signs, range 2.2 to 291; and 51.1 on 18 October across eleven signs, range 2.1 to 240. LED billboards averaged 1,291 on 22 September across seven signs, range 107 to 5,390; and 1,318.2 on 18 October across eight signs, range 44 to 4,440. The report states that digital signs averaged more than twenty-two times the traditional billboards measured in the same county on the same nights, and twelve to thirteen times the level recommended by the experts it cites. The highest nighttime average for a single sign was 3,850. One digital billboard averaging 1,961.9 carries the tabular footnote that its messages were often too bright to be readable.

The recommended values it collects. Thirty candelas per square meter, from a Federal Highway Administration study reported at second hand, as sufficient to read the message at six hundred and fifty feet at night. Thirty to seventy-five, from the United States Sign Council's own commissioned consultants. About forty as an appearance limit, from Luginbuhl and others reasoning from adaptation. Forty-five to one hundred and eleven, from the Illuminating Engineering Society standard written for this product class. One hundred, from Freyssinier, Narendran and Bullough. One hundred and fifty at night, from Carhart. The report's own recommendation is one hundred rural and one hundred and fifty in brightly lit urban areas, with a daytime ceiling of three thousand.

The finding on the origin of the American criterion. That the methodology underlying the criterion, and its resultant recommendations, are based on a standard for light trespass rather than a standard relevant to roadways and driving, the source being an Illuminating Engineering Society technical memorandum on light trespass; that the same society already had a standard written for advertising signs recommending levels consistent with luminances of forty-five to one hundred and eleven candelas per square meter; and that following the trespass memorandum instead yields three hundred to three hundred and fifty, which the report describes as three to six times higher than necessary or desirable.

A finding quoted in it from 1966. Allen, Smith, Janson and Dyer, Sign Brightness in Relation to Legibility, Michigan State Highway Commission, in cooperation with the United States Department of Commerce, Bureau of Public Roads (1966), quoted at page thirty-three as finding that high-luminance signs can change the adaptation level of the eye or the pupil size or both, and that the driver's vision would consequently be impaired for other tasks requiring dark adaptation. The Foundation has not read that study and relies on it only.

What it does not establish. Any health endpoint measured by its author. The measurements are photometric. The visual and biological propositions in it are quoted from other sources, the

1966 study among them. The readings are of whatever message was displayed at the time rather than of a standardized white field or of the sign's maximum capability, and the report's own note records two readings of one sign differing substantially between dates.

Where it bears. Part VI.J.6, which is written on it. Part VI.J.8, for the ask on measurement quantity. Part V.E.1, for the flash-producing malfunction mode and the absence of any American fail-safe requirement. Part VI.B.1 and Part V, for the adaptation finding, which is the same quantity the comment takes from the headlamp literature at Appendix C.108.

C.115 Herrstedt, Greibe and Andersson (2013) — eye tracking on Danish rural roads, and the safety buffer

Citation. Herrstedt L., Greibe P. and Andersson P.K. "Driver attention is captured by roadside advertising signs." 16th Road Safety on Four Continents Conference, Beijing, China, 15–17 May 2013. Trafitec, Scion-DTU, Diplomvej 376, DK-2800, Denmark.

What the Foundation has read. The full text, obtained as published. This is one of the few sources in Part VI that the comment does not rely on at second hand, and the figures below are from the paper.

The limitation that governs its use, stated before the findings. The empirical part measured conventional static advertising signs — painted and printed boards — and no digital or light-emitting display. It reports no optical quantity of any kind: no luminance, no illuminance, no spectral content, no modulation. Nothing in it bears on the emission of an LED product. Its literature review summarizes digital-sign findings, but those are at second hand and the comment does not use them from here.

Design. Thirty-two drivers aged twenty-three to seventy, men and women, not told the purpose of the drive, on four rural main road routes in three regions of Denmark, by day and outside peak hours. Instrumented car with a three-camera eye-tracking system at sixty hertz, a scene camera, satellite positioning for speed, and an Ibeo Lux laser scanner measuring distance to vehicles ahead across approximately fifty degrees either side at eighty to one hundred and twenty meters. One hundred and nine drive pasts of sixteen signs; two hundred and thirty-three glances recorded. Four year study period beginning 2009.

The attention findings. Sixty-nine percent of drive pasts produced at least one glance at the sign; almost half produced two or more at the same sign. Fifty-six percent of glances lasted under half a second, but eighteen percent lasted one second or more. For more than twenty-two percent of drive pasts the total duration of successive glances reached two seconds or more, and for ten percent three seconds or more. Glance angles reached forty-five degrees; forty-eight of the two hundred and thirty-three glances, twenty-one percent, fell outside the authors' defined normal range by the combination of angle and duration.

The safety buffer. Defined as the time gap to the vehicle ahead minus the glance duration, being the time left to perceive, interpret and respond to a sudden incident after the eyes return to the road. A vehicle was present ahead within three seconds in sixty-five of the two hundred and thirty-three glances. In fifty-nine of those the buffer was under two seconds; for twenty percent of all glances it was under 1.5 seconds; and in two cases it was negative, the glance exceeding the entire gap to the car in front. That fifty-nine of sixty-five is about ninety-one percent of the estimable cases is the Foundation's arithmetic and is not stated by the authors, who express the same figure as twenty-five percent of all tracked glances.

The threshold it is measured against. The two second criterion comes from Klauer, Dingus, Neale, Sudweeks and Ramsey, DOT HS 810 594, the hundred-car naturalistic driving study of the Virginia Tech Transportation Institute and the National Highway Traffic Safety Administration, in which eyes away from the road at driving-irrelevant stimuli for at least two seconds within six almost doubles crash and near-crash risk. The Foundation has not read that report and it is on the acquisition list.

Visual distraction. Seventeen of one hundred and nine drive pasts met that criterion, being more than one in six, spread across eleven of the thirty-two drivers and eight of the sixteen signs. The authors conclude the effect "seems to apply to a substantial part of all road users and is not concentrated on a single – or few – persons".

What it does not establish. Anything about light. Anything about digital or LED displays, from its own measurements. Any health or biological endpoint. And, because the signs it measured emit nothing, it establishes that attention capture is not peculiar to light-emitting products — a reading adverse to a careless version of this comment's argument, which the comment states expressly at Part VI.J.7.

Where it bears. Part VI.J.7, which is where it is used, for the safety buffer and for the measured cost of attention capture. Part VI.C.1, for the premise beneath devices designed to be noticed. Part II.H.6, for the division of responsibility between emission and behavior.

C.116 Dukic, Ahlström, Patten, Kettwich and Kircher (2013) — electronic billboards on a Stockholm motorway, measured by the road authority

Citation. Dukic T., Ahlström C., Patten C., Kettwich C. and Kircher K. "Effects of electronic billboards on driver distraction." Traffic Injury Prevention, volume 14 (2013), pages 469–476. Swedish National Road and Transport Research Institute, Linköping, and the Light Technology Institute, Karlsruhe Institute of Technology. Funded by the Swedish Transport Administration.

What the Foundation has read. The author accepted manuscript, manuscript number GCPI-2012-0104.R1, submitted 8 July 2012, with revision marks visible. The published version of record has not been read.

Design. Field study on a four-lane motorway through central Stockholm, autumn 2010. Forty-one drivers, mean age forty-two, twenty driving in daylight and twenty-one at night, in an instrumented vehicle with a head-mounted eye tracker at fifty hertz. Four electronic billboards against seven conventional signs and one large static paper billboard on the same stretches. Message cycle seven seconds. Participants not told the purpose until afterward. Approved by the local ethics committee.

The regulatory setting. Sweden had not permitted roadside electronic billboards. In 2009 the administration gave temporary permission for twelve, of which eight were installed, subject to a road traffic safety evaluation in which driver distraction was of particular interest.

Findings adverse to this comment, recorded first. The authors conclude that whether the billboards are a traffic safety hazard "cannot be answered conclusively based on the present data". No consistent significant changes were found in speed, lateral placement or headway. No difference was found between day and night on any visual measure, from which the authors infer that the brightness was not high enough to cause considerable glare. The accompanying crash analysis of the larger Swedish investigation found no significant differences attributable to the billboards. And a substantial number of drivers did not look at the billboards at all, which the authors treat as indicating that they can be ignored.

The limitation that qualifies the glare inference. The authors state that they did not have the opportunity to measure the luminance of the billboards. The inference about brightness is therefore drawn from the absence of a behavioral difference and not from photometry.

Findings supporting this comment. Significantly more participants looked at the billboards than at the conventional signs, and when they did, dwell times were longer, fixations more numerous and maximum fixation duration longer, each significant. Six fixations exceeding two seconds, ranging from 2.1 to 3.5 seconds, occurred across the four billboards, against one in total across the seven conventional signs; six of the seven such glances in the study were at the billboards, and every case exceeding the authors' visual time sharing threshold belonged to the billboard group. The authors describe their sample as a best case scenario because novice and older drivers are more affected, older drivers being more prone to glare.

The mechanism. The authors apply the framework of Trick and Enns and state that for electronic billboards the governing mechanism is reflexive, automatic and bottom-up, that reflexive responses cannot be disengaged, and that the negative effects can at best be minimized by intentional inhibition.

The temporal findings. The seven second cycle is described as a compromise between traffic safety demands and the requests of the billboard owners, set by the road administration by trial and error and refined after public complaints. One refinement is recorded: the displays originally blanked between messages, which was found to cause distraction because drivers could not help waiting for the next message, and the transition was altered so that advertisements followed directly on one another.

The outcome. The authors record that on the results reported together with results from other studies, the Swedish authorities decided not to extend the test period and to remove the billboards under investigation. One of those other studies was an unpublished questionnaire, reported as showing that glare and visual clutter were seen as a problem, which the Foundation has not seen and does not rely on.

What it does not establish. Any health or biological endpoint; its endpoints are gaze and driving performance. Any optical quantity, the luminance having gone unmeasured. And, on its authors' own statement, whether these products are a traffic safety hazard.

Where it bears. Part VI.J.7, which is where it is used. Part VI.J.6, for the provenance of temporal criteria and for the qualification of the involuntary-capture proposition. Part V.E, for the effect of blanking between messages.

C.117 Luginbuhl, Israel, Scowen and Polakis (2010) — the adaptation argument, and what the American criterion was built on

Citation. Luginbuhl C.B., Israel H., Scowen P., Polakis J. and Polakis T. "Digital LED Billboard Luminance Recommendations: How Bright Is Bright Enough?" 9 November 2010. Marked DRAFT on its face.

Status and interest, stated first. A draft. The Foundation has found no final version. The first author is identified on the document as of the United States Naval Observatory Flagstaff Station and the third as of Arizona State University, but the document is not a publication of the Observatory or of any agency and must not be represented as one. The authors write from a concern with the darkness of the night sky.

What it measured. Fifty-five floodlit billboards in the Phoenix metropolitan area, August and November 2009, and three in the Chicago area, November 2010, measured on white surfaces with a Minolta LS-100 luminance meter and tabulated individually. Average fifty-four candelas per square meter; fifty-two of fifty-eight at or below one hundred; fifty-six of fifty-eight below one hundred and fifty. Separately, five hundred and ten billboard faces in the Tucson metropolitan area, for which no direct luminance measurements were made: the values were deduced from lamp lumens and sign areas on assumed light loss factor, coefficient of utilization and reflectance, giving an estimated average of fifty-nine.

The adaptation chain. Roadway design luminances of about one candela per square meter; an asymmetry in adaptation taken from the IESNA Lighting Handbook at page 3-9, by which the eye adapts upward faster than downward; and adjacent-area ratio limits of ten to one in RP-33-99, fifteen to twenty to one in RP-20-98 and twenty to one in RP-2-01, each given with the stated reason that exceeding them may hazard motorists. From twenty to one and a one candela roadway the authors obtain twenty candelas per square meter as the maximum for a sign visible to drivers, and recommend a ceiling of one hundred in an urban environment while stating that this may be too high.

The contradiction it identifies. That the same handbook, at page 17-26, recommends luminous background sign luminances of two hundred and fifty to one thousand four hundred

candelas per square meter, which would impose ratios of 250 to 1400 to one; that this is unsupportable on the handbook's own adjacent-area recommendations; and that nowhere in the discussion of advertising sign brightnesses is transient adaptation or the vision of drivers mentioned.

What it says the American criterion was built on. That the industry method rests on light trespass as developed in IESNA TM-11-00; that it effectively limits signage to three hundred to three hundred and fifty candelas per square meter; that the underlying study asked observers only to rate how objectionable illuminated panels of two thousand to seven thousand five hundred candelas per square meter appeared, with no evaluation of visual performance attempted; that objectionability and the ability to see are essentially unrelated; and that the industry report itself states that digital billboards are not the form of lighting TM-11-00 was developed to limit, yet limits them by it. The last of these is a quotation within a quotation and must be verified at source.

What it does not establish. Any health or biological endpoint measured by its authors. Its endpoints are luminance and, by argument, transient adaptation and visibility. It measured conventional floodlit billboards, not digital displays, and its recommendation for digital displays is reasoning rather than measurement. Fifty-eight signs were measured.

Where it bears. Part VI.J.6, which is where it is used, and which previously carried two of its findings at second hand through Appendix C.114. Part VI.J.8, for the ask on measurement quantity. Part VI.B.1 and Part VI.D, for transient adaptation as the common endpoint. Appendix D.4, which it criticizes directly.

C.118 Marchant and Norman (2025) — the relighting of a whole city, measured against a pre-registered plan

Citation. Marchant P.R. and Norman P.D. "To Determine if Changing to White Light Street Lamps Reduces Crime: A Multilevel Longitudinal Analysis of Crime Occurrence during the Relighting of Leeds, a UK City." Applied Spatial Analysis and Policy, volume 18, article 77 (2025). doi:10.1007/s12061-025-09675-1. Open access under a Creative Commons Attribution licence. Received 14 August 2024, accepted 1 June 2025, published 20 June 2025, supplementary materials corrected 8 August 2025.

Funding and declared interests, stated first. No funding was sought or obtained. The first author declares that he has concerns about light pollution affecting astronomical observations and biodiversity, that he has been motivated by them to examine claims of benefit for increased public lighting, and that he has previously published work critical of such claims. The second declares a concern that public money may be wasted on schemes with no proof of achieving their purpose. The comment discloses these as it discloses the interests recorded at Appendices C.114 and C.117.

Procedural discipline. A confirmatory study following a plan fixed in advance. The protocol was sent to three named independent custodians before analysis and is published with the paper. The modeled data are published with it and the analysis is reproducible. Written with attention to the reporting guideline for cohort studies.

Design. Multilevel longitudinal analysis of weekly police recorded crime in all 107 middle-layer super output areas of Leeds across 456 consecutive weeks, from 3 January 2005 to 29 September 2013, against the cumulative number of replacement white lamps operating in each area in each week. 78,189 lamps were installed over the period, replacing predominantly orange ones. Areas were relit at different times, rates and extents, so each serves as a comparison for the others. The underlying time trend was fitted by a polynomial with area-specific random coefficients, with terms for month and for weeks containing a public holiday, and overdispersion was modeled directly. Installation order was determined by contractor convenience rather than by crime levels, which the authors give as the reason regression towards the mean does not arise.

Data. 679,452 recorded crimes in the period, of which 471,374 could be assigned to darkness or daylight: 221,644 in darkness and 249,730 in daylight. Crimes were assigned by computing sunrise and sunset for Leeds and treating darkness as 30 minutes after sunset to 30 minutes before sunrise.

Results. Daylight-adjusted darkness crime, the principal measure, rose 2 percent from start to finish of the relighting, 95 percent confidence interval minus 3 to plus 7 percent. Unadjusted darkness crime rose 3 percent, interval minus 1 to plus 8 percent. Round-the-clock crime rose 3 percent, interval 0 to plus 6 percent. The authors report consistent null results across many checks, including negative binomial models, autoregressive models, models excluding the city center and models using lamp counts rather than fraction completed.

What had been claimed. The city's 2004 outline business case for public funding assumed a 20 percent reduction in night-time crime, put the net present value from crime benefits alone at £109,049,000 and gave a benefit to cost ratio of 3.75. Those figures are quoted by these authors from the business case, which the Foundation has not seen.

What it does not establish. Any health, biological, visual or physiological endpoint; the outcome is recorded crime throughout. Anything specific to light-emitting diodes: the lamps are described as white and broad-spectrum and the conversion ran from 2005 to 2013. And it does not establish that white light increases crime; the point estimates are slightly positive and none is distinguishable from zero.

Where it bears. Part V.M, which is written on it. Part VI.D, for roadway and area lighting, subject to the qualification that this is not a study of diode sources. Part IX, for the proposition that a countervailing safety benefit should not be assumed when the spectral question is weighed.

C.119 Lee, Leitner and Paulus (2024) — nighttime light and recorded crime in Vienna, a contradictory result

Citation. Lee J., Leitner M. and Paulus G. "Spatiotemporal Analysis of Nighttime Crimes in Vienna, Austria." ISPRS International Journal of Geo-Information, volume 13, number 7 (2024), article 247. doi:10.3390/ijgi13070247. Open access. Department of Geography and Anthropology, Louisiana State University, and Department of Engineering and Information Technology, Carinthia University of Applied Sciences. Supported by the Austrian Marshall Plan Foundation. No conflicts of interest declared.

Design, which governs what it can show. Cross-sectional spatial analysis, not a before-and-after study of any change. 522,880 reported crimes in Vienna from 2014 to 2019, of which 128,322 nighttime incidents in four types were analyzed. Night defined as civil dusk to civil dawn, computed daily. Light measured two ways: streetlight density from an open government dataset, and median radiance from the day-night band of the Visible Infrared Imaging Radiometer Suite on 3,106 grid cells of five hundred meters. Ordinary least squares and geographically weighted regression, univariate and multivariate.

The regression finding. Positive associations throughout. The authors state that the analysis shows a mostly positive relationship between streetlight density or satellite radiance and nighttime crimes, and that brighter areas show a statistically significant increase in nighttime crimes. Burglary showed the strongest relationship; geographically weighted models outperformed ordinary least squares throughout.

The descriptive finding, which runs the other way. The paper reports that Vienna replaced older hanging lamps with light-emitting diodes in 2017 and that the largest single-year fall in nighttime crime in the series followed: theft down about 26.6 percent, robbery about 27.0, burglary about 18.9 and assault about 9.4 between 2016 and 2017. The authors write that the change may have contributed to that decrease.

That the two findings are unreconciled. The authors describe the descriptive and regression results as seeming to contradict one another and do not resolve the contradiction. They identify the underlying tension as one between lighting that reveals opportunities to offend and lighting that raises the risk of detection, and call it an avenue for future research.

What it cannot establish. Causation in either direction. The design is cross-sectional, so a positive association between light and recorded crime is consistent with bright places simply being busy places. The authors identify the confounding themselves, noting that brighter areas have a higher chance of crimes being observed and reported, which is an effect on recording rather than on offending. Indoor and outdoor crimes were analyzed together because the dataset did not distinguish them, which the authors state may have biased the lighting results.

Where it bears. Part V.M, which is where it is used, and only for the proposition that the relationship between outdoor lighting and crime is unresolved. The comment does not rely on its correlations as evidence that light increases crime, and does not rely on its before-and-after comparison as evidence that light reduces crime.

C.120 Marchant and Norman (2022) — road collisions through the relighting of a whole city, and what the city's evidence actually said

Citation. Marchant P.R. and Norman P.D. "To determine if changing to white light street lamps improves road safety: A multilevel longitudinal analysis of road traffic collisions during the relighting of Leeds, a UK city." Applied Spatial Analysis and Policy, volume 15 (2022), pages 1583–1608. doi:10.1007/s12061-022-09468-w. Open access under a Creative Commons Attribution licence. Received 10 August 2021, accepted 15 June 2022, published 5 July 2022.

Procedural discipline, and the disclosed departures from it. A confirmatory study. The protocol was lodged with three named independent custodians on 5 August 2016 and is published, and the analysis dataset is in a public repository at doi 10.17605/OSF.IO/KFG64. Written with attention to the reporting guideline for cohort studies. The authors disclose two departures: the focus on the daylight adjusted darkness rate is a variation from the protocol outcomes, which are nonetheless also reported; and an analysis at a smaller spatial scale contemplated by the protocol was not carried out, for want of time.

Declared interests. As at Appendix C.118 and Appendix D.7.

Design and data. Multilevel longitudinal analysis of weekly personal injury collisions reported to police, from the national STATS19 dataset, in all 107 middle-layer super output areas of Leeds across 456 weeks from 3 January 2005 to 29 September 2013, against the cumulative number of replacement white lamps operating in each area in each week. 78,189 lamps installed. 13,977 daylight collisions and 5,302 darkness collisions. An anomalous pattern in the official data for 2012 and 2013 led the authors to repeat the analysis on a series truncated at the end of 2011, with 11,953 daylight and 4,078 darkness collisions and 76,288 lamps.

Results. Daylight adjusted darkness collision rate ratio of 0.990, 95 percent confidence interval 0.971 to 1.010, per hundred lamps; 0.993, interval 0.971 to 1.015, on the truncated series. For a typical area of about seven hundred lamps, 0.934, interval 0.816 to 1.070, being an 18 percent reduction to a 7 percent increase; and on the truncated series 0.950, interval 0.816 to 1.107. Modeled on the fraction of relighting completed, full relighting gives 0.920, interval 0.776 to 1.09. Combined with Birmingham for a typical area: 0.952, interval 0.838 to 1.082 on the full series; 0.971, interval 0.842 to 1.119 on the truncated series. Every interval includes no change. The authors summarize the plausible range as between a 20 percent reduction and a 10 percent increase.

What it establishes about the basis for the scheme. That the city's bid claimed national evidence that good street lighting can reduce night-time road accidents by between 15 and 35 percent, citing the Institution of Lighting Engineers and two transport research reports; that the first of those reports showed no statistically significant effect for roads with speed limits of 30, 40 and 50 miles per hour, which the authors say form the bulk of roads in Leeds; and that the

second was excluded from the Cochrane systematic review of this question because of its poor methodological design. The authors conclude that the evidential basis for the claim was weak.

What the systematic review found. That of 145 potentially relevant studies, seventeen met the inclusion criteria; that none was a randomized controlled trial; that all were controlled before-and-after studies with collision counts mostly under one hundred and none at city scale; and that the methodological quality of the included studies was generally poor. The present authors separately criticize the review's own conclusion for publication bias and regression towards the mean. The Foundation has not read the review.

A finding that runs in an uncomfortable direction. That across the period daylight collisions in the city fell markedly while collisions in darkness stayed roughly constant, so that the darkness to daylight ratio rose throughout independently of lighting change. The authors offer increased night-time road use or risky behavior as possible causes and do not resolve it. Nothing in the paper attributes the rise to lighting or shows that more or whiter lighting would have arrested it.

What it does not establish. Any health or biological endpoint; the outcome is recorded personal injury collisions. Anything specific to light-emitting diodes; the lamps are described as white and broad-spectrum. And it does not establish that white lighting increases collisions.

Where it bears. Part V.M, which is where it is used. Part VI.D, for roadway lighting. Part IX, for the proposition that a countervailing safety benefit should not be assumed.

C.121 Tompson, Steinbach, Johnson, Teh, Perkins, Edwards and Armstrong (2023) — switching street lights off, measured street by street

Citation. Tompson L., Steinbach R., Johnson S.D., Teh C.S., Perkins C., Edwards P. and Armstrong B. "Absence of Street Lighting May Prevent Vehicle Crime, but Spatial and Temporal Displacement Remains a Concern." Journal of Quantitative Criminology, volume 39 (2023), pages 603–623. doi:10.1007/s10940-022-09539-8. Open access. Accepted 3 January 2022, published 30 March 2022. Funded by the National Institute for Health Research, grant 11/3004/02. No conflict of interest declared.

Design. Controlled interrupted time series using conditional Poisson regression, with the street segment as the unit of analysis. Thames Valley police force area, April 2004 to September 2013. 283,275 recorded offenses across five categories. 33,804 street segments, of which 815 had lights switched off between midnight and six, 1,315 were dimmed and 958 were converted from orange sodium to white light. Streets adjoining each treated street were modeled separately to detect displacement. Crimes classified to night or day by civil twilight; where the hour was unknown the midpoint of the possible range was used, and a sensitivity analysis removing those cases did not change the findings.

Principal results for switching lights off. On treated streets, night-time crime adjusted for daytime: all crime 0.74 (0.63–0.87), theft from vehicles 0.56 (0.41–0.78). All times of day on treated streets: total crime 0.81 (0.75–0.88), burglary 0.75 (0.65–0.85), violence 0.83 (0.71–0.97). All times of day on adjoining streets: total crime 0.83 (0.76–0.89), violence 0.75 (0.64–0.89). Net across treated and adjoining streets combined: total crime 0.83 (0.79–0.88), burglary 0.85 (0.78–0.92), theft from vehicles 0.90 (0.81–1.00), violence 0.79 (0.70–0.88).

The displacement finding. Night-time theft from vehicles rose on streets adjoining those switched off, 1.55 (1.14–2.11), and night-time crime overall on those streets rose 1.18 (1.02–1.38). The authors report that the reduction on treated streets and the increase on adjoining streets were equal in magnitude. For dimming, the net effect on theft from vehicles across treated and adjoining streets was an increase, 1.16 (1.04–1.29), which the authors read as temporal rather than spatial displacement.

Results for white light. No evidence of any association with night-time crime of any type examined. On adjoining streets at night, total crime 0.87 (0.77–0.99) and violence 0.74 (0.61–

0.91). Across all times of day on treated streets, total crime 0.91 (0.83–0.99) and burglary 0.72 (0.62–0.83); net burglary across treated and adjoining streets 0.84 (0.77–0.92). The authors attribute the all-day effect to a community cohesion mechanism rather than to visibility, having predicted in advance that a visibility mechanism would appear at night and a cohesion mechanism equally by day and night.

The mechanism stated by the authors. That the visibility mechanism by which lighting is said to reduce crime can also increase it, because an offender requires light to identify targets of value, assess security and work on a vehicle; and that environmental features make some crimes more likely while making others less likely.

Limitations the comment records. The streets selected for switch-off were chosen under exemption criteria that excluded major junctions, town centers with surveillance or night-time activity, locations where lighting was needed for road safety, and locations where crime might increase; so the treated streets were by design those least likely to suffer from the change. The authors also acknowledge that switch-off may have reduced pedestrian and parking activity on those streets, reducing targets, and that they could not test this. One of forty-three police force areas, and the authors state the findings may not be generalizable.

What it does not establish. Any health or biological endpoint. Anything about light-emitting diodes as such. And it does not establish that darkness prevents crime generally: the effects are specific to offense type, and one offense was displaced to neighboring streets.

Where it bears. Part V.M, which is where it is used. Part VI.D, for the proposition that the white light benefit observed did not appear where an optical mechanism would have placed it. Part IX.

C.122 Svechkina, Trop and Portnov (2020) — how much light people need to feel safe, with instrumental measurement

Citation. Svechkina A., Trop T. and Portnov B.A. "How Much Lighting is Required to Feel Safe When Walking Through the Streets at Night?" Sustainability, volume 12, number 8 (2020), article 3133. doi:10.3390/su12083133. Open access. Department of Natural Resources and Environmental Management, University of Haifa. Funded by the Israel Science Foundation, grant 400/18. No conflict of interest declared.

Design. Field study in ten residential neighborhoods across three Israeli cities. 106 observers walked designated routes after dark and reported feeling of safety on a four-point forced scale at 257 marked points, through a purpose-built mobile application that verified position by satellite and would not operate outside the window from thirty minutes after sunset to midnight; 7,255 assessments. Illuminance was measured instrumentally at the same points with a Konica-Minolta CL-200A chroma-meter following the measurement methodology of the International Commission on Illumination: horizontal at ground level, vertical directional at 1.5 meters, and vertical panoramic across about 120 degrees. Analysis by ordinary least squares with city, vegetation density and traffic intensity as controls.

The principal finding. Feeling of safety rose significantly with illuminance, but non-linearly. Logarithmic transformation of illuminance raised the model R-squared from 0.13 to 0.32, which the authors take as showing diminishing returns. Their conclusion states that reasonably high assessments of safety may occur at relatively low illumination levels of 5 to 10 lux and that increasing illumination beyond that threshold produces only minor further rise. They describe the proposition that brighter is better as a common misconception.

Measured levels and variation between places. Mean measured illuminance was 18.52 lux horizontal, 11.92 panoramic and 11.37 directional, close to the 15 lux recommended by the Commission. The illuminance needed to reach the sample average feeling of safety differed by city, about 5.67 lux in Haifa against about 24.46 lux in Be'er Sheba, which the authors attribute to socio-economic position, recorded crime and accustomed daylight. They describe a one-size-fits-all approach as another misconception. Response curves leveled off in all three cities.

What it does not establish, including as to spectrum. It measures a reported feeling and not safety; it is not evidence about crime. And it says nothing about the color of light. Sites were selected on a design crossing high and low illumination with predominantly short-wavelength and predominantly long-wavelength sources, so both are in the sample, but only illuminance and feeling of safety were analyzed. The authors state that light temperature, glare and uniformity are left to follow-up studies and that the analysis solely focuses on illuminance. The comment therefore does not rely on this study for any proposition about amber or long-wavelength light and perceived safety.

A statement in it about spectrum and health. In the introduction, on the authority of other work rather than their own data, the authors state that evidence of adverse effects of short-wavelength outdoor lighting on circadian rhythm and melatonin secretion in humans and wildlife cannot be ignored, and that the health and ecological impacts of long-wavelength light appear to be less severe.

Where it bears. Part V.M, which is where it is used, for the quantity of light the subjective justification requires. Possibly Part V.G. Part IX, for the research the Foundation asks to be put in hand on the spectral question the authors leave open.

C.123 Chalfin, Kaplan and LaForest — three hundred thousand street light outages in Chicago

Citation, with a caveat. Chalfin A., Kaplan J. and LaForest M. "Street Light Outages, Public Safety and Crime Displacement: Evidence from Chicago." Manuscript posted by the Department of Criminology, University of Pennsylvania. The copy read carries no journal, volume or date on its face. A paper by the same authors appears to have been published in the Journal of Quantitative Criminology in 2021 under the title Street Light Outages, Public Safety and Crime Attraction.

Why the comment reports it. Because its lead author is the author of the randomized experiment that found a crime reduction from adding light, which this comment records twice as the principal evidence against its position, and because this study is the largest examination of the converse question that the Foundation has found.

Design and scale. Nearly 300,000 street light outages in Chicago over an eight-year period, affecting nearly 50,000 street segments, giving about 140 million observations. Because the onset of an outage is known only when reported but the repair date is recorded precisely, the authors compare crime shortly before a repair with crime shortly after, approximating a regression discontinuity in time. Major outages, being more than two lamps on a segment, are analyzed separately from minor ones. Crime on segments within 500 feet is analyzed separately. Placebo tests on daytime crimes and on indoor night-time crimes are reported, and neither responds.

Results on the affected street. Index crimes rose 2 percent, violent crimes 1 percent and property crimes 1 percent, none statistically significant, with a confidence interval for index crimes of minus 3 to plus 6 percent. The authors state that the most reasonable interpretation is that outages do not appreciably impact crime in the short term on affected segments. For outages of only one or two lamps there was no evidence of any effect, the coefficients being uniformly small and of mixed sign, from which the authors conclude that ambient lighting has a non-linear effect on crime. Motor vehicle theft is the exception, rising about 9 percent on the affected segment, marginally short of significance.

Results on surrounding streets. Index crimes rose about 3 percent, violent crimes 2 percent and property crimes 3 percent on segments within 500 feet, significant at the conventional level given the size of the data. Robberies rose about 7 percent, confidence interval 0.6 to 13.4 percent. Motor vehicle theft rose about 6 percent. The authors conclude that outages compromise public safety with effects that reverberate through a community, and compare the magnitude to reducing a police force by 5 to 15 percent.

The mechanism the authors propose. Movement of potential victims rather than offenders alone. A robbery requires a victim present, so when a street goes dark people avoid it and robberies move to adjacent streets; a vehicle theft requires no victim and a parked car cannot move, so vehicle theft rises where the darkness is. The authors state the general principle that the effects of place-based measures can be shaped to a considerable degree by the behavior of potential victims.

A finding about unequal maintenance. That higher-crime areas of Chicago suffer more outages and wait longer for repair, which the authors describe as municipal neglect contributing to unequal crime rates between neighborhoods.

What it does not establish. Any health or biological endpoint. Anything about the spectrum of lighting. And nothing about a planned, uniform change in lighting across a jurisdiction: the intervention studied is an unplanned local failure against an otherwise lit background, which is a gradient rather than a level.

Where it bears. Part V.M, which is where it is used. Part IX, for the distinction between a local differential and a uniform standard. Part VIII, if the equity finding is taken up there.

C.124 Perkins, Steinbach, Tompson, Green, Johnson, Grundy, Wilkinson and Edwards (2015) — the LANTERNS study: street lighting reduced across sixty-two authorities, commissioned by a health department

Citation. Perkins C., Steinbach R., Tompson L., Green J., Johnson S., Grundy C., Wilkinson P. and Edwards P. "What is the effect of reduced street lighting on crime and road traffic injuries at night? A mixed-methods study." Public Health Research, volume 3, issue 11 (September 2015), pages v–107. doi:10.3310/phr03110. Published by the National Institute for Health Research Journals Library, Southampton. Crown copyright; the report states that it may be freely reproduced for the purposes of private research and study with suitable acknowledgement.

Funding and interests. Funded by the National Institute for Health Research Public Health Research programme, project number 11/3004/02. The authors declared no competing interests. The copyright notice records that the work was produced "under the terms of a commissioning contract issued by the Secretary of State for Health". Ethical approval for the qualitative component was given by the London School of Hygiene and Tropical Medicine Ethics Committee, reference 6341.

What the Foundation read. Chapter 3 in full, being the controlled interrupted time series, from a text rendering of that chapter as published on the National Library of Medicine Bookshelf. The abstract, the scientific summary, the table of contents, and the methods and survey results of Chapter 2, from the full report as published by the funder. Not read: Chapter 1; Chapter 4, the cost-benefit analysis of part-night lighting; Chapter 5, the discussion; the appendices; and the qualitative findings of Chapter 2 beyond the point at which the retrieved text ends.

Article type. A report of commissioned primary research, published in the funder's own peer-reviewed journal series. Mixed methods: a rapid appraisal in eight case study areas with 59 residents or workers and 16 stakeholders interviewed formally, 63 informal intercept interviews and 112 documents (Chapter 2); a controlled interrupted time series (Chapter 3); and a cost-benefit analysis (Chapter 4). The quantitative chapter follows the STROBE reporting guidelines for observational studies.

Design of the quantitative component. Panel analysis with fixed effects, so that time-invariant characteristics of a street or area contribute no information and cannot confound. Conditional Poisson regression. Collisions modeled at road segment level by region, with night-time counts adjusted by the change in daytime counts on the same segments. Crime modeled at middle layer super output area level by police force, the explanatory variable being the proportion of road kilometers in the area carrying the intervention. All four interventions entered in one model. Indicator variables for calendar month and year. Overdispersion

accommodated by a scale factor, averaging 1.69 for crime, with none detected for collisions. Zero inflation tested for and not found. Sensitivity analyses under negative binomial and zero-inflated specifications did not alter the interpretation. Night was defined as one hour after sunset to one hour before sunrise, and for part-night lighting as midnight to six in the morning.

Coverage. 174 local authorities in England and Wales approached; contact achieved with 140; usable data from 62. More than thirty thousand kilometers of road affected by lighting change. By December 2013: white light on 15,833 kilometers, part-night lighting on 12,101, dimming on 10,519, permanent switch-off on 946. Collisions 2000–2013: 859,935 in total, 161,049 at night. Crime December 2010–December 2013: 581,837 burglaries, 475,657 vehicle thefts, 67,470 robberies, 730,280 offenses of violence. Anti-social behavior (2,882,758) and criminal damage (486,367) were excluded from analysis for incomplete reporting by some forces.

Collision results. Night-time rate ratios adjusted for daytime change: switch-off 0.97 (0.82–1.15); part-night lighting 0.95 (0.84–1.07); dimming 1.00 (0.91–1.10); white light 1.01 (0.93–1.09). Unchanged and less precise when restricted to killed or seriously injured casualties. No association in any deprivation stratum. One regional exception: white light in London 1.30 (1.03–1.65), described by the authors as weak evidence.

Crime results. Aggregate count, expressed for full coverage of an area: part-night lighting 0.96 (0.86–1.06); switch-off 0.11 (0.01–2.75), uninformative; dimming 0.84 (0.70–1.02); white light 0.89 (0.77–1.03). The authors characterize the last two as weak evidence for a reduction and note that all point estimates for both interventions pointed toward less crime. Individual offenses: part-night lighting with robbery 1.48 (0.99–2.21); dimming with violence 0.78 (0.60–1.01). Strong heterogeneity across the thirty-one police forces, with strong evidence of decreases in some and strong evidence of increases in others, for part-night lighting, dimming and white light alike.

Household survey (Chapter 2). One Shropshire area; five hundred households sampled in part-night lighting streets and five hundred in unaffected streets; 483 responses, 250 and 233. The only significant difference was in perceived safety: 15.6 percent in part-night streets felt very safe walking alone after dark against 26.2 percent in unaffected streets, odds ratio 0.52 (0.32–0.84). No significant difference in walking alone after dark, perceived safety when driving, worry about vehicle crime, trust in the council, whether there was enough lighting to see clearly, carrying a torch, or seeing the stars. Half the residents of part-night streets, 50.4 percent, reported that their street's lighting had been reduced, against 24.0 percent in the unaffected streets.

The sleep item, and why the Foundation draws nothing from it. The survey asked whether street lights keep the respondent awake at night. Strong disagreement was recorded by 74.4 percent in part-night streets and 69.5 percent in unaffected streets, odds ratio 1.27 (0.84–1.94). Switching the lights off for part of the night was therefore not followed by a measurable improvement in self-reported sleep. The Foundation records that and uses it in neither direction, for four reasons. Only half the residents of the treated streets noticed that their lighting had changed at all, which bounds what any self-report could detect. The item asks about being kept awake, which is an awareness of light and not the endpoint at issue at Part V.F, where the question is melatonin suppression and phase shift. Part-night lighting switches off around midnight and leaves the evening exposure window, which is the biologically consequential one, unchanged. And the sample is 483 respondents in a single locality. A null on this item is not evidence that street lighting does not affect sleep, and the Foundation does not report it as though a positive result would have been evidence that it does.

What the report says about the prior literature. Of the systematic review of increased street lighting and crime: a reduction was found in studies examining the entire day, but in the four studies examining night-time crime alone there was "no evidence of an impact of changes to street lighting on crime"; and a major limitation was inadequate control areas, only two studies using multiple controls and some using a control adjoining the treated area. Of the systematic

review of street lighting and road traffic injury: a rate ratio of 0.78 (0.63–0.97) across seventeen controlled before-and-after studies, and 0.68 (0.61–0.77) in the ten that used daytime data as the control, but with the methodological quality of the included studies considered "to be poor, with a high risk of bias". The authors state that they identified no previous research into the effects of reduced street lighting on either outcome.

Limitations the authors state. No measure of exposure, so a reduction in casualties could reflect fewer road users rather than unchanged risk, and an increased hazard to those remaining could be masked; they could not test this. No measure of risk compensation. No measure of fear of crime, which they say might be expected to have increased where lighting was reduced. Other crime prevention and road safety measures could not be accounted for, and they state that such confounding is likely to account for part of the crime associations observed. Crime locations in the public data are deliberately obfuscated to protect victims, which confined the crime analysis to area rather than street level; a companion reliability study established the smallest area at which the public data agree with force records. Switch-off coverage was too small for a precise estimate. Regression to the mean was planned for but not assessed, because no increase was found to assess.

Internal inconsistency recorded. Chapter 3 reports under deprivation analysis that the stratum-specific estimates "were not materially different from the overall estimates, and each was imprecise", and that there were insufficient data for switch-off. The generalizability discussion then reports that the stratified analyses suggest switch-off was associated with increased burglary and vehicle crime in more deprived areas and in city and town centers, and part-night lighting with decreases in less deprived areas. The Foundation relies on neither passage.

The use the comment makes of it. Three. First, as the largest and best-designed test of whether reducing or whitening street lighting is followed by more collisions, which it was not. Second, for the distinction between night-only and all-day findings in the prior literature, which the comment treats as the analytical key to this field and which converges with the independent finding of the Thames Valley study at Appendix C.121. Third and principally, for the published conclusion of a study commissioned by a Secretary of State for Health that "the public were also concerned about other health outcomes" and that "Research is needed also on other public health impacts of light at night". No chapter of the report measured any visual, physiological or biological endpoint of light exposure.

Not relied on for. The state of the health science. The report characterizes the evidence that light at night affects health as weak and describes links to anxiety, depression and cancer incidence as theoretical. That characterization dates from 2015, the report does not claim to have reviewed that literature, and Parts V.C through V.G of this comment set out the evidence as it now stands.

Authorship overlap. Five of the eight authors — Tompson, Steinbach, Johnson, Perkins and Edwards — are co-authors of the Thames Valley study at Appendix C.121, in which Tompson is first author. The two studies are not independent in authorship, and the comment does not present them as independent corroboration of each other's crime findings. The convergence the comment does rely on is between this report's account of the prior review, published in 2015, and the Thames Valley authors' mechanistic interpretation, published in 2023.

C.125 Fyie, Meuti, Sivakoff, Fiorta and Gardiner (2026) — residential lighting prevents overwintering dormancy in the principal West Nile virus vector

Citation. Fyie L.R., Meuti M.E., Sivakoff F., Fiorta M.A., Gardiner M.M. "Artificial light at night (ALAN) is a stronger inhibitor of overwintering dormancy than urban warming in mosquitoes." Journal of Applied Ecology, first published 18 May 2026. doi:10.1111/1365-2664.70407. Handling editor Mariana Mayer-Pinto. Read in full from the publisher.

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Design. Semi-field experiment. Larvae of Culex pipiens f. pipiens were reared to adulthood in enclosures sited in the yards of private properties, schools and churches across Columbus, Ohio and Franklin County, in the autumns of 2022 and 2023. Eight sites in 2022 and seventeen in 2023. Each site carried two enclosures: one beneath an artificial light source the property owner had already installed, being porch, garage, pathway or security lighting, and one in a dark microhabitat on the same property. Mosquitoes came from the Buckeye laboratory colony, established in 2013 from above-ground egg rafts in Columbus with field material added in 2021.

Instrumentation. An Onset HOBO MX2202 logger in each enclosure recorded temperature and light at thirty-minute intervals. Additional single-night readings were taken with an Extech LT300 photometer for illuminance and an International Light Technologies ILT350 chroma meter for correlated color temperature and peak wavelength. Illuminance was measured at the center of the empty enclosure; color and wavelength were measured outside the enclosure near the fixture.

The exposure, as measured. Mean illuminance 4.93 lux with a standard error of 0.97 across all months and years, a maximum of 19.07 lux and a minimum of 0.87 lux. Most sources were warm white at approximately 2,700 to 3,000 kelvin, with a few cooler and more blue-rich. Exposure was entered in the models as the first principal component of all nighttime brightness variables, which accounted for 92.8 percent of their variance.

Outcome measures. Diapause status from mean egg follicle length, a female being classed as in diapause below 75 micrometers; blood-feeding proclivity on an artificial membrane system with chicken blood; and fecundity, being egg rafts laid and rafts hatching, among females that blood-fed. Linear and generalized linear mixed models with site, or enclosure nested in site, as a random effect.

Principal results. Across both Octobers, 100 percent of mosquitoes reared in dark enclosures entered diapause, against 41 percent with a standard deviation of 26 among those reared beneath a light source. In October no female in a dark enclosure took a blood meal, while 29 percent with a standard deviation of 25, being 25 of 117 females, did so beneath the lights; that difference was not statistically significant at p equals 0.09. Of the October light-exposed females that blood-fed, 72 percent produced egg rafts and 55 percent produced living larvae. In September 2023, 70 of 99 light-exposed females took a blood meal against 27 of 73 in the dark. Exposure to light and temperature interacted significantly for egg follicle length and for diapause incidence in both months. Temperature predicted these outcomes in the dark enclosures and did not predict them under light, which is the basis for the conclusion in the title.

The finding the comment treats as most important, and it is adverse to a Foundation position. That warm white light at illuminances below one lux prevented diapause. The authors' policy implication is that "changes in brightness or light colour may not be sufficient to mitigate ecological impacts". The comment adopts this against its own earlier framing, with two qualifications the authors supply. Light color was deliberately excluded as a factor from every analysis, because the only color-brightness relationship detected was driven by one unusually bright site; the study therefore does not test spectrum and shows only that warm white sufficed. And the authors distinguish broad-spectrum warm white from narrow-

band emission, suggesting that phosphor-converted amber or monochromatic sources may mitigate the effect and noting that moths and spider mites exposed to pure red light did enter diapause.

What it does not establish. Any human health effect. The outcome is mosquito reproductive physiology. No human case, no infection and no measure of vector competence. The step to disease incidence is an inference the authors mark as potential, and the further proposition that light-exposed females may be more susceptible to infection is assembled from three findings of other groups, one obtained in males of a different ecotype. It establishes nothing about light-emitting diodes as a class: the fixtures were whatever the property owners had installed and are not separately characterized by technology. And it is one species, one ecotype, one city.

Considerations bearing on confidence. In favor: the comparison is within site, between two enclosures on the same property, which controls the local environment better than any design in this appendix outside the street-level work at Part V.M; exposure was instrument-logged rather than modeled; the fixtures were real installations rather than laboratory lamps; two autumns; the result is consistent with laboratory work on the same species and with field work on other insects; and the data are deposited. Against: small and uneven numbers, with diapause assessed across five to sixteen sites and blood-feeding and fecundity across five to seven; only two dark-treatment cages yielded blood-fed females in September, forcing a chi-square in place of the model; the enclosure design changed between years from plastic containers to mesh cages, expressly to limit a greenhouse effect, while the October analysis pools both years; year was itself a significant predictor of blood-feeding, 38 percent in 2023 against 3 percent in 2022; enclosures were excluded or relocated for light malfunction, animal interference and logger failure; an outlier site was removed from the September analyses; the October 2023 cohort was brought indoors early because of forecast freezing temperatures and finished development in a chamber; and the colony is a laboratory strain.

Two internal inconsistencies, recorded for verification. First, the results section reports that 41 percent of light-exposed mosquitoes entered diapause in October, which implies that 59 percent averted it, while the discussion states that 37 percent averted diapause. Those cannot both be right as stated and the comment uses the results figure. Second, in the September panel of the model summary table the interaction term for egg follicle size is given as an estimate of minus 12.03 with a standard error of 3.67 and a t statistic of minus 13.08; that estimate divided by that standard error is approximately minus 3.28, which is the value reported in the same table for a different term. The reported t statistic is therefore inconsistent with its own estimate and standard error. Separately, the text gives the September interaction for egg follicle length as F equals 7.66 at p equals 0.02 while the table gives p equals 0.006 for the same term; those are different tests and may both be correct, but the pair should be checked. None of these touches the central October contrast of 100 percent against 41 percent, which is reported as a simple proportion.

A distributional finding recorded. The authors state, on the authority of four other studies, that lower-income neighborhoods are more exposed to light pollution and to higher urban heat island magnitudes. The comment records this and draws no lighting recommendation from it, consistently with the position stated at Part V.M.

Bearing on the statutory question. Narrow and expressly not through human health. Paragraph 360ii(a)(2) directs the Secretary to minimize the emissions of, and the exposure of people to, unnecessary electronic product radiation, and Part II.D.4 establishes that the two objects are coordinate and that the first does not require a human receptor. This study is evidence about an emission, measured in a biological endpoint, and the mitigations its authors recommend are shielding against light trespass and limiting duration, light trespass being one of the four categories Part II.D.3 identifies as instances of the statutory term. Separately and independently, the research was funded in part by this Department, and its published recommendation is addressed to public health departments. Part V.I, which is where it is used; Part II.D.3 and Part II.D.4 for the statutory construction; Part II.E for the grant.

C.126 Vardi-Naim, Janovsky, Kronfeld-Schor and Wine (2026) — immune rhythms and survival in a diurnal and a nocturnal mammal under characterized light at night

Citation. Vardi-Naim H., Janovsky G., Kronfeld-Schor N., Wine Y. "Artificial light at night disrupts immune rhythms in wild rodents under semi-natural conditions." Environmental Pollution. doi:10.1016/j.envpol.2026.127774. Read in full from the publisher. The volume, issue and article number are not recorded above and must be supplied from the published version.

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Why this entry matters to the structure of the comment. Part V.A.3 sets out three grounds, taken from rodent investigators, on which rodent evidence is indirect for a human, the first being that most laboratory rodents are nocturnal so that light at night falls in their active phase rather than their rest phase. That Part formerly recorded that no entry in this appendix used a diurnal model. This entry closes that gap: a diurnal mammal and its nocturnal congener were exposed to the same light in the same enclosures at the same time, and the principal finding was indexed to the rest phase in both. Part V.A.3 has been amended accordingly.

Subjects and design. Semi-natural enclosure experiment. 160 animals: 80 Acomys dimidiatus, nocturnal, and 80 Acomys russatus, diurnal, from a breeding colony at the Zoological Research Garden, Tel Aviv University. Sixteen outdoor enclosures of 1.5 by 3 meters, ten animals of one species per enclosure at an even sex ratio, permitting free movement, social interaction and reproduction. Eight enclosures exposed, eight control. Eight-week acclimation; experiment approximately eight months, December 2021 to August 2022. Animals tagged by radio-frequency identification; biweekly live-trap monitoring; offspring removed at weaning to hold density constant. Physiological sampling was cross-sectional, each animal sampled once; survival was followed longitudinally.

The exposure, as characterized. Low-intensity white light-emitting diode, correlated color temperature approximately 6,000 kelvin, illuminance 10 to 15 lux, a Eurolux G334W. Intensity and spectral composition were measured at the entrances of nesting shelters, the primary resting microhabitat; levels inside shelters were lower, so illumination across an enclosure was spatially heterogeneous. This is the entry in which the emission is best characterized of any animal study in the appendix, and the reason the comment can use it. Contrast Appendix C.125, where the exposure was warm white at 2,700 to 3,000 kelvin and 0.87 to 19.07 lux.

Endpoints. Antibody response to keyhole limpet hemocyanin, administered subcutaneously in two injections fourteen days apart during the species-specific rest or active phase, with complete then incomplete Freund's adjuvant, measured by a species-specific enzyme-linked immunosorbent assay developed for the study; circulating lymphocyte frequency by flow cytometry; fecal cortisol by commercial assay; and survival. Rhythmicity assessed by linear mixed-effects cosinor models against null models by likelihood-ratio test.

Antibody result, which is the cleanest and holds in both species. Under natural light, the ratio of the secondary response at day 28 to the primary response at day 14 was significantly higher in animals immunized during their rest phase than during their active phase, in both species, at p below 0.05 by t-test. Under artificial light at night that time-dependence was absent in both species. In the diurnal species the control secondary response was significantly higher for rest-phase immunization and showed no difference under light; in the nocturnal species the active-period primary response was marginally higher at p equals 0.054 in controls, and the trend was diminished under light. The effect was indexed to activity phase and not to temporal niche, which is the finding the comment relies on.

Rhythm results, all four combinations. Lymphocyte frequency, diurnal species: 24-hour rhythm in controls at p below 0.05, none detectable under light. Lymphocyte frequency, nocturnal species: rhythm in both groups, and formal comparison of treatment-specific models found no difference between them. Fecal cortisol, nocturnal species: 24-hour rhythms in both groups at p below 0.001, with a significant treatment-by-rhythm interaction, chi-square 6.34 on 2 degrees of freedom at p equals 0.042, reflecting reduced amplitude and a small phase shift. Fecal cortisol, diurnal species: no significant daily rhythm in either group, which the authors note is contrary to earlier evidence of daily glucocorticoid variation in this species. Two disruptions, one null, one undetected underlying rhythm.

A dissociation the authors raise against their own mechanism. In both species lymphocyte frequency peaked during the daytime, which is the rest phase for only one of them, while the antibody advantage followed the rest phase in both. The authors conclude that lymphocyte trafficking cannot alone explain the antibody result, and hypothesize that lymphocytes may be more permissive to activation during the rest phase, citing work on circadian gating of CD8 T-cell responses. The comment reports this as the hypothesis the authors label it.

Survival. Kaplan-Meier log-rank p equals 0.035. Cox proportional hazards: hazard ratio 2.35 with an interval of 1.03 to 5.38 at p equals 0.042, concordance 0.615, on 80 animals with 24 events, with treatment and sex as fixed factors and no difference observed between species or sexes.

Qualifications on the survival figure, which are substantial. The lower bound of the interval is 1.03, so the result barely excludes no effect. Cause of death could not be determined and the authors state the result should be read as a fitness-related association rather than evidence of a pathological mechanism; in their earlier work in the same system a subset was examined and no clear pathological cause was found. Shared frailty models including enclosure as a random effect failed to converge for want of events within enclosures, so fixed-effects results are reported and 80 animals housed ten to an enclosure are treated as independent, which overstates precision. A priori power calculation was not feasible; the authors' retrospective sensitivity analysis gives approximately 72 percent power to detect a hazard ratio of 2.35. The survival analysis was restricted after the fact to animals with a complete set of immune measurements, excluding those that died in acclimation and offspring added later. And the finding is described by the authors as consistent with their own previous work in the same enclosures with the same species, so it is a replication by the same group and not independent corroboration.

What it does not establish. Any human effect; every endpoint is a rodent's. Any melatonin-mediated mechanism: melatonin was not measured and the authors state that direct inference about melatonin-dependent mechanisms is therefore limited, which matters because that is the mediator Part V.F treats. Any immunophenotype: lymphocytes were gated on light-scatter morphology alone, species-specific reagents being unavailable, and the authors note the gate may overlap other leukocyte populations. Any within-animal rhythm: physiological sampling was cross-sectional, so daily curves are assembled across animals. And nothing about free-ranging conditions: the authors state that semi-natural enclosures limit pathogen diversity, predation pressure and resource unpredictability, and call the approach a deliberate compromise.

An analytical choice recorded. Outliers were defined as values outside the group mean plus or minus two standard deviations and excluded from subsequent analyses. That is an aggressive rule applied group by group, and at these sample sizes it can affect which comparisons reach significance. The authors disclosed it. The comment records it because a reader weighing these findings is entitled to know it, and imputes nothing.

Bearing on the statutory question. Two grounds. First, the emissions limb of paragraph 360ii(a)(2), as Part II.D.4 construes it: a characterized emission, a blue-rich white diode at a

stated illuminance, producing measurable biological effect, with no human receptor required. Second and more important, mechanism. The pathway proposed — retinal photoreception, the suprachiasmatic nucleus, melatonin and glucocorticoid output, peripheral clocks in immune tissue — is the pathway Part V.F describes in humans, and the authors selected these species expressly as a model for diurnal mammals including humans. Paragraph 360ii(a)(4) directs the Secretary to study and evaluate conditions of exposure; this is a study of a condition of exposure in a mammal, at an exposure a person commonly receives. Part V.I, where it is used; Part V.A.3, whose diurnal-model gap it closes; Part V.F for the mechanism; Part II.D.4 for the construction.

C.127 Ajduković, Drobnjaković, Šošić-Jurjević, Vučić, Petrović and Prokić (2026) — thyroid gland histology in a newt under characterized light at night

Citation. Ajduković M., Drobnjaković M., Šošić-Jurjević B., Vučić T., Petrović T., Prokić M. "Influence of Artificial Light at Night on Thyroid Gland Histology in Triturus Newts (Urodela, Salamandridae)." Animals. 2026;16(3):483. doi:10.3390/ani16030483. Published 4 February 2026. Read in full from the publisher. Open access.

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Why the comment includes a weak study, stated first. Because of the organ. Appendix C.44 is a prospective cohort of 464,371 American adults in which the highest quintile of light at night carried a 55 percent higher incidence of thyroid cancer, and that entry records that its exposure measurement is spectrally blind and that its melatonin mechanism was hypothesized rather than measured. This entry is the converse: a stated spectrum and illuminance, a measurement in the tissue of the gland, and six animals. The comment uses the pair to describe a research gap and for nothing else. It does not present this study as support for the human finding, and the overdiagnosis objection set out at C.44 is unaffected by it.

Subjects. Metamorphosed juveniles of Triturus ivanbureschi, the crested newt, bred in the laboratory from eggs laid by nine gravid females collected from a natural population at Brebevnica, Serbia. Larvae were reared under a natural day and night regime; the treatment began after metamorphosis, identified by complete gill resorption. Animals were housed individually in two-liter boxes in a dedicated dark room with partitions between light regimes, at 18 degrees Celsius, fed Tubifex without restriction. Six animals per group for the stereological analysis; four per group for the immunohistochemical analysis. The authors state that six is the minimum required for histological analysis and that the species is strictly protected in Serbia, so the smallest possible number was used.

The exposure, as characterized. Night: a white light-emitting diode at 30 lux and a correlated color temperature of 6,000 kelvin for the treatment group, against below 0.1 lux for the control. Day, for both groups: approximately 450 lux of the same 6,000 kelvin diode light. Sixty days. Day length controlled by timer and adjusted weekly to follow the natural photoperiod, from thirteen hours light and eleven dark to eleven and thirteen, corresponding to early September and late October in Serbia. Intensities were measured repeatedly during the experiment. The authors give their reasons for the two settings: 30 lux as corresponding to the intensity perceived in public gardens and emitted by street lights, and 6,000 kelvin as the temperature mostly used outdoors.

Methods. Hematoxylin and eosin and periodic-acid-Schiff staining; immunohistochemistry for thyroglobulin with a horseradish-peroxidase conjugated secondary antiserum. Stereology by Cavalieri's principle in the newCAST package at 20 times objective magnification on a six by six

test grid, with a point area of 12,385.99 square micrometers and a block advance of 25 micrometers, estimating absolute thyroid volume and the volumes of follicular epithelium, colloid and interstitium. Immunostaining quantified semi-quantitatively in ImageJ Fiji with the IHC Profiler plugin by color deconvolution, ten images per animal at 40 times objective, optical density computed as the logarithm of maximum over mean intensity. Shapiro-Wilk for normality; data not normally distributed; Mann-Whitney U throughout.

Results, nulls first. No significant difference between groups in the absolute volume of the thyroid gland, p equals 0.873; nor in the volume of the follicular epithelium, p equals 0.689; nor of the colloid, p equals 0.749; nor of the interstitium, p equals 0.936. One difference: the optical density of thyroglobulin immunopositivity was higher in the light-treatment group, p equals 0.030, which the authors interpret as accumulation of thyroglobulin at the apical surface of the follicular cells and a reduced release into circulation, indicating a hypofunctional gland. Reported without quantification, from representative micrographs: macrofollicles filled with colloid, flattened follicular epithelium and absence of the resorption vacuoles present in controls.

The unresolved question about the one positive result. Ten images were analyzed for each of the eight animals in the immunohistochemical comparison, and the methods do not state whether the Mann-Whitney test was computed across the eight animals or across the eighty images. Images from one animal are not independent observations of a treatment applied to animals, so a test computed over images would return a probability the design does not support. The two readings are both consistent with the figure printed: computed over four animals against four, the smallest two-sided probability a Mann-Whitney test can return is approximately 0.029, so 0.030 would indicate complete separation of the groups, which would be a stronger fact than it appears; computed over images, it would be an artifact of pseudoreplication. The comment reports the result and relies on no part of it until the question is answered.

What the authors state against their own finding. That no circulating thyroid hormone was measured, because a juvenile newt is too small to yield enough blood for reliable quantification without pooled samples or a species-specific validated assay; thyroxine, triiodothyronine, thyroid-stimulating hormone and melatonin are therefore all unmeasured and the hypofunctional state is inferred from histology. That the mechanisms proposed, melatonin suppression acting on the hypothalamic-pituitary-thyroid axis and corticosterone acting through the hypothalamic-pituitary-interrenal axis, require confirmation at hormonal and molecular levels. That in amphibians the effect of light at night on circadian regulators remains poorly understood, one cited study finding only slight effects on the melatonin signaling pathway in two anuran species. And that the changes observed are relatively subtle compared with those produced in the same species by thiourea, a recognized endocrine disruptor studied by the same laboratory.

What it does not establish. Anything about human thyroid function or disease. Any hormone concentration in any animal. That artificial light at night is an endocrine disruptor: the authors use the term as the category of their inquiry, not as a conclusion. And nothing on its own quantified measures, all four of which were null. It is one species, one laboratory, one spectrum, one intensity, sixty days, six animals.

Bearing on the statutory question. Narrow. It is a third characterized emission in this subsection, after C.125 and C.126, and the three together establish that researchers in this field now routinely state the spectrum and illuminance of what they apply, which is what paragraph 360ii(a)(4) directs the Secretary to do for the emissions and conditions of exposure actually encountered. Beyond that it contributes only the pairing described above, which is a description of a gap and an occasion for the research paragraph 360ii(a)(2) directs. Part V.I, where it is used; Appendix C.44 for the human counterpart; Part V.J.4 for why that counterpart's exposure measurement cannot answer the spectral question.

C.128 Briolat, Galloway, Cornelius, Wright, Bennie, Gaston and Troscianko (2026) — proposed lighting remedies tested against each other in 843 moths, and each found insufficient

Citation. Briolat E.S., Galloway J.A.M., Cornelius E., Wright C.J., Bennie J., Gaston K.J., Troscianko J. "Severe and widespread reductions in night-time activity of nocturnal moths under modern artificial lighting spectra." Proceedings of the Royal Society B. 2026;293(2063):20252704. doi:10.1098/rspb.2025.2704. Published 28 January 2026. Open access. Read in full from the publisher. Review history published by the journal. All data and code deposited in Dryad; electronic supplementary material at doi 10.6084/m9.figshare.c.8230308.

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Authorship overlap, stated before anything else. Jonathan Bennie and Kevin Gaston are authors of Appendix C.94, the collation of critical fusion frequencies on which the first half of Part V.I rests, and co-authors of the satellite instrument paper relied on at Part V.J.4. The same University of Exeter group therefore appears three times in this comment and the two halves of Part V.I are not independent in authorship. Nothing in the comment presents them as mutual corroboration.

Why this is the strongest entry in the ecological material. Because it is the only study in this comment that tests candidate mitigations against one another at a fixed intensity. Every other entry establishes that an exposure has an effect. This one establishes what happens when the remedies proposed for that exposure are applied, which is the question a standard has to answer.

Design and scale. 843 moths of 23 species in three families, Erebidae, Geometridae and Noctuidae, from 887 collected, 44 excluded for equipment failure or damage. 124 nights, 25 May to 7 September 2023 and 8 May to 16 September 2024, at two locations on the University of Exeter's Penryn campus in Cornwall. Each moth individually in a custom-built chamber outdoors, lit from above, filmed by infrared time-lapse at one frame per ten seconds from the end of nautical twilight to sunrise; activity scored as the percentage of frames in which the animal had moved by at least ten pixels. Up to eight chambers per night, each randomly assigned a treatment, with opaque shields preventing contamination between treatments. Moths marked and released. Collected both by light trap and by hand net, deliberately, to include species of differing attraction to light.

Treatments, as characterized. All at 10 lux at the chamber lid except where stated, calibrated with an open-source spectroradiometer of 0.005 lux sensitivity and a JETI Specbos 1211-UV. A dark control under the open sky; a broad-spectrum white diode at 5,986 kelvin; a narrowband amber diode at 1,621 kelvin; a broadband phosphor-converted amber diode at 1,743 kelvin; two composite lights each made of three narrowband red, green and blue diodes matched to the white and to the broadband amber in human CIE XYZ space to a Euclidean distance below one; and the broadband amber at 1 lux and at 0.1 lux. A further experiment on five species, 83 animals from 85 collected, net-caught only, filmed four hours, tested white at 10, 1 and 0.1 lux and broadband and narrowband amber at 1 lux, in Falmouth and St Neots from August to November 2022.

The natural baseline, measured. Natural night-time illuminance at the field sites, measured 111 times with the same instrument at the moment animals were introduced: median 0.0168 lux, interquartile range 0.0102 to 0.0332 lux. Roughly a sixth of the dimmest treatment and about a six hundredth of the standard treatment. The comment uses this figure at Part V.I and notes its parallel with the question asked at Part V.B.5 about the sources under which human physiology developed.

Analysis. Linear mixed-effects model on square-root-transformed activity with light treatment, capture method, collection location, year, moon phase, mean temperature, mean humidity and Julian day as fixed effects and species and family as random effects; significance by likelihood-ratio test; planned comparisons by Tukey. Repeated as a Bayesian phylogenetic mixed model in MCMCglmm with a Brownian-motion phylogenetic random effect, 13 million iterations, 3 million burn-in, sampled every 5,000, on the 21 species with genomes available. The phylogeny was inferred by maximum likelihood in IQ-TREE2 from a concatenated alignment of 4,976 single-copy orthologous protein sequences drawn from Darwin Tree of Life genome assemblies, all nodes supported at 100 percent by 1,000 bootstrap replicates. The two analyses agreed on treatment, year and Julian day; they differed on capture method, which lost significance once phylogeny was accounted for.

Principal results. Light treatment significantly affected total night-time activity, chi-square 350.95 on 7 degrees of freedom, p below 0.001. Median reduction in activity per species at 10 lux: composite white 93 percent; broad-spectrum white 85 percent; composite amber 82 percent; broadband phosphor-converted amber 73 percent; narrowband amber 57 percent. Broadband amber at 1 lux, 24 percent. All treatments at 10 lux differed significantly from the control in both analyses; broadband amber at 1 lux and 0.1 lux did not, in the main experiment. Between 65 and 100 percent of species, depending on treatment, had lower median activity under light.

The composite-light null, which is a proposed mitigation failing. No significant difference between broad-spectrum lights and the composite red-green-blue lights matched to them for human vision: p equals 0.580 for white against composite white, p equals 0.917 for broadband amber against composite amber. The composite white produced the largest suppression of any treatment. The authors record that this contradicts recent findings in moths and in mosquitoes, and attribute the discrepancy to endpoint: the earlier work measured attraction or flight past light pulses, this work measured continuous exposure, and the attractiveness of a light is not a good proxy for its other effects. The comment relies on that distinction at Part V.I and commends it to the Department as a caution applying equally to human assessment.

Lower intensities. In the second experiment, white light at 10 and at 1 lux significantly reduced activity, both p below 0.01, as did broadband amber at 1 lux, p equals 0.0464. White at 0.1 lux and narrowband amber at 1 lux were not significant overall, p equals 0.246 and 0.214. Species-level comparisons nevertheless showed many species affected at these levels, including under white light at 0.1 lux, which the authors describe as comparable to skyglow.

Results running against the general picture, recorded. Several species increased activity under the dimmest amber light rather than decreasing it. Under broadband amber at 0.1 lux the peppered moth Biston betularia increased activity by 618 percent relative to the control, and Xestia xanthographa, Noctua janthe and Chondrostega trigrammica by 166, 126 and 119 percent. Under broadband amber at 1 lux Biston betularia increased by 240 percent and Noctua janthe by 137 percent. The direction of effect at low intensity is therefore not uniform across species. The comment states this in the body and draws from it that the biological consequences of these lamps are not understood, rather than that dim amber light is safe.

The capture-method finding, which bears on a literature and not only on this paper. A significant three-way interaction between species, capture method and light treatment, F equals 3.583 on 2 and 42 degrees of freedom, p equals 0.0366. Light-trapped Noctua pronuba were on average 46 percent less active than net-caught individuals in the control; in Hypena proboscidalis control activity was on average 89 percent lower in light-trapped animals, so that using trap-caught moths of that species would suggest a smaller effect of white light than net-caught animals do. The authors state the general consequence: using artificial light to collect the animals whose responses to artificial light are then measured can mask the effect under study.

The governing limitation, in the authors' words and adopted without softening. That the moths could not escape the light or seek refuge from it. The authors call for future work measuring activity in more natural conditions and offer in support only the observation, which they label anecdotal, that moths are known to remain at lights for long periods and sometimes through the following day. Until the experiment is performed where the animal can leave, the magnitude of these reductions is a property of the apparatus as well as of the light.

What it does not establish. Any human effect, and no part of the comment's submission requires one. Any fitness endpoint: activity is a proxy, and reproduction, feeding, predation and survival were not measured, so the link to moth population declines is an inference the authors mark as such. Whether light delays the onset of activity, since animals were introduced after astronomical twilight had begun. And nothing beyond 23 common and widespread British species in three families of macro-moths.

Bearing on the statutory question. The emissions limb of paragraph 360ii(a)(2) as Part II.D.4 construes it, and beyond that the adequacy of remedies. The comment asks the Department to characterize spectral content, quantity, geometry and duration. The standing objection is that spectrum is the variable that matters and that warmer or narrower sources dispose of the question. This is the most direct evidence the Foundation has found that they do not: at a fixed intensity every spectrum tested produced a large effect, the best leaving more than half in place, and a spectrum engineered to avoid non-human sensitivities produced no benefit at all. Part V.I, where it is used; Part V.B.3, on which it bears through the Andalusian narrowband specification; Part V.M, whose part-night lighting material it qualifies; Part IX, for the four-variable request.

An installation switched off and on for seven years, and the one demonstration in this comment that the effect of an emission stops when the emission stops

Every design difficulty recorded in this Part — that the exposure cannot be assigned, that controls are not dark, that confounding by urbanization cannot be excluded, that the dose-response is unknown — is answered in one study by an accident of circumstance. The National September 11 Memorial and Museum operates an installation in New York called the Tribute in Light, and by agreement with a conservation organization its operators extinguish it for about twenty minutes whenever observers on the ground count more than a thousand birds circling in the beams. The exposure is therefore switched off and on, repeatedly, at a fixed location, on nights of heavy migration, by people recording when they do it. Described at Appendix C.150.

What was found. During illumination, birds aggregated above the installation at peak densities more than twenty times the surrounding baseline in every one of the seven years analyzed, more than sixty times in five of them and more than a hundred and fifty times in three; in the absence of illumination the peak never exceeded thirteen times baseline. Across all observations the number of birds within five hundred meters averaged 3.4 times higher when the lights were on. Birds slowed, flew in circles and called far more often. The authors estimate that about 1.1 million birds, with an interval from 0.6 to 1.6 million, were affected by this single light source across seven nights in seven years.

Three features of that result matter more to this comment than its size, and the Foundation takes them in order.

The first is that the effect ended when the emission ended. In the authors' words, removal of illumination produced rapid changes, with birds dispersing, increasing flight speeds, decreasing calling and moving away from the site "in a matter of minutes," and short-term removal "eliminated its disruptive effects almost instantaneously." Appendix C.129 records an assertion by other authors, in a climate journal, that unlike climate change and land use change the effects of light pollution could be mitigated overnight. That was a characterization and the Foundation presented it as one. This is the measurement behind it, and it is the clearest answer in this comment to the

objection that regulating this emission would be a long and uncertain undertaking. For this endpoint the remedy acted in minutes and the instrument of the remedy was a switch.

The second is that the characteristic controlled was duration. Not spectrum, not intensity, not direction. The installation was not dimmed, refiltered or reaimed; it was turned off for twenty minutes at a time. Part IX asks the Secretary to characterize four attributes of this emission and duration is the one this study isolates, which is worth stating because the comment has had to record at Part V.I that spectral mitigation is partial and at Part II.D.4 that shielding addresses only the directed fraction. Here a temporal control removed the effect entirely, and the authors recommend exactly that: selective removal of light on nights of substantial migration.

The third is what the conditions were. The effects appeared under clear skies, which the authors emphasize because the previous literature associated bird-and-light incidents with fog, low cloud and poor visibility; and they appeared in Manhattan, which is to say against one of the most heavily lit backgrounds in the world. A single installation produced a twentyfold aggregation on top of that background in good weather. The objection that these effects require unusual conditions, and the objection that one more light source cannot matter where there is already so much light, are both answered by the same observation.

Two further findings and then the limits. The behavioral response was detected at radar sampling altitudes of 2.4 to 4.1 kilometers and the authors describe responses up to about four kilometers above the ground, stating that to their knowledge no previous study had reported attractive effects of ground-based lights extending far above the ground. And their simulation could reproduce the observed concentrations only by including directed flight toward the light by disoriented birds, which distinguishes attraction from mere failure to leave.

The limits, and the Foundation states them because the study is used for an argument about remedies. No bird was counted dead and no collision was observed; mortality is not an endpoint of this study and the comment does not assert one. The subject is nocturnally migrating birds, predominantly small songbirds, which is as far from a person as most of this appendix. The installation is extraordinary and the authors say there are few of comparable intensity in the United States, naming one in Las Vegas, so the magnitudes here do not transfer to ordinary street lighting; what transfers is the shape of the response and the reversibility. One year was excluded from the on-and-off comparisons because the lights were not shut down, and two further years were excluded for rain. And, as Part V.J.4 records, the study reports no optical quantity for the source at all.

A publication of a United States federal agency, which organizes the whole subject around the question this comment begins with

Longcore T. and Rich C., Artificial Night Lighting and Protected Lands: Ecological Effects and Management Approaches, Natural Resource Report NPS/NRSS/NSNS/NRR 2017/1493, National Park Service, Fort Collins, Colorado, revised August 2017. Described at Appendix D.1. Seventy pages, published by the Natural Resource Stewardship and Science office of the National Park Service, United States Department of the Interior, and stated by the publisher to have received formal peer review by subject-matter experts not involved in the work. The authors are outside the agency and the report carries the agency's standard disclaimer that its views do not necessarily reflect those of the Service or the Department. The Foundation states all of that because what follows is a federal publication and the comment elsewhere records federal engagement with this subject largely as absence.

The report reviews effects by habitat type and then sets out how mitigation is to be approached. It is guided, in the authors' words, in five ways, and the Foundation asks the Department to notice the order. The first is not spectrum, not intensity and not shielding. It is Need: "The first question that should be asked about artificial lighting, especially in natural areas, is whether it is in fact needed," and "Only when the need is demonstrated and necessary for visitor experience, safety, or security, should lights be installed." The remaining four are spectrum, intensity, direction and duration, which are the four emission characteristics Part IX asks the Secretary to characterize.

A federal agency therefore published, in 2017, a framework whose first element is whether the light is necessary at all and whose other four are the characteristics this comment asks to have specified. The Foundation does not suggest that the National Park Service was construing paragraph 360ii(a)(2), which it was not, and does not rely on the coincidence for anything legal. It records that the structure of the statutory duty and the structure a federal land agency arrived at from the biology are the same structure.

And two sentences in it about the lighting industry's own standards, which the Foundation did not expect to find in a federal publication

Under Intensity the report states: "Guidelines for lighting intensity from the lighting industry should not be followed when trying to reduce impacts to wildlife, because they are usually higher than necessary for human vision and do not take into account impacts to wildlife." And in the body of the same section: "Land managers should not rely on standards promulgated by professional societies to guide lighting levels for natural areas because these are generally developed for urban/suburban areas with little to no regard for wildlife."

The Foundation reads those narrowly and says so. They are addressed to land managers in natural areas, not to anyone else, and the second clause of the first sentence is the operative one: the objection is that the guidelines take no account of wildlife. But the first clause is not about wildlife at all. It says the levels are usually higher than necessary for human vision, and the report explains why that is so rather than asserting it: the eye adapts to the brightest light in view, bright lights plunge their surroundings into shadow, and reducing the contrast between lit and unlit areas increases what a person can see. That is a federal publication stating that the recommended practice of the lighting industry specifies more light than human vision requires, supported by an argument about human vision. Part V.C and Part VI treat the status of voluntary professional standards in this field, and this is the only United States government document the Foundation has found that tells a reader not to follow them.

Three further statements, two of which run against the direction a reader might expect

On spectrum, the report is as careful as this subsection has had to be. "It is tempting to believe that a certain spectrum of light will minimize the effects of lighting in all situations. Unfortunately, no universal solution exists." And: "The only 100% wildlife-friendly light is one that is switched off or never installed." That is the fourth source in this comment to say that one spectral rule will not serve every taxon, and the second to say it in a government publication.

On shielding, the report supplies both a definition and a limit. The definition: a full cutoff fixture emits little or no light above the horizontal plane and less than ten percent within ten degrees below it. The limit, which Part II.D.4 reaches by arithmetic from the reflectance of surfaces and which is here stated directly: shielding in that manner "greatly reduces (but does not eliminate) sky glow. Light still reflects off the ground and scatters, so reduction in intensity should be combined with shielding." The report adds that downward-directed light may still attract insects and the species that feed on them, and may still fall into sensitive habitat.

And on duration, a caution against the remedy that Appendix C.150 shows working. The report recommends motion detectors and curfews and then qualifies them: reducing duration "reduces some impacts, but it may have some adverse consequences for those species sensitive to a changing light environment," and lights that switch on and off at irregular intervals may themselves disrupt nocturnal behavior. The Foundation records that beside the Tribute in Light result rather than in place of it. A twenty-minute shutdown of a fixed installation on nights of heavy migration and a motion detector that fires unpredictably all night are both temporal controls and they are not the same intervention.

One pro-technology statement is recorded with the others. The report states that light-emitting diodes have no ultraviolet emissions and therefore attract fewer insects than lamps of comparable

intensity and color temperature that do, which is consistent with the figure of less than a tenth recorded at Appendix D.1 from the same author's trade essay of the following year.

A mammal, and a lamp sold for the purpose that did not work

The study at Appendix C.146, set out at Part V.J.4 for what it establishes about measurement, carries a finding that belongs here. Among its two treatments was a yellow compact fluorescent bug light emitting only between 550 and 650 nanometers, which is the long-wavelength narrow-band remedy this subsection has been examining. It was not a null result. Foraging by an endangered nocturnal rodent was significantly suppressed out to forty meters from that lamp, against fifty meters for a broad-spectrum white flood light of more than twice the rated output, and the difference between the two lamps was not statistically significant. The authors state the point in their own words: even low-intensity yellow bug lighting significantly affects the animal's energetics through alteration of its foraging decisions.

Three things follow and the Foundation separates them. The first is that this is a mammal. The settled position stated above rests on studies in insects, molluscs, fish and birds, and the most obvious objection to it is that the taxa are remote from a person. A heteromyid rodent is not. The second is that the authors note, citing the 2018 rapid-assessment paper described at Appendix D.6, that the prediction in the literature is that yellow and amber sources will have less impact, and that their result does not bear that out at this endpoint. That is now the second experiment in this comment, after the moth study, in which a spectral remedy performed worse than the prediction, and the first in a mammal.

The third is a qualification the authors state and the Foundation adopts rather than argues around: the experiment did not disentangle intensity from spectrum. The two lamps differed in rated output, in spectrum, in shielding and in diffusion, so the comparison between them does not isolate wavelength. What the study establishes is that a lamp marketed as the gentle option, at less than half the rated output of the other, produced a significant effect over four fifths of the distance. It does not establish that the spectrum was irrelevant, and the Foundation does not say so. The authors offer a mechanism that cuts the other way and it is recorded at the appendix entry: nocturnal rodent spectral sensitivity is reported to peak between 350 and 370 and between 490 and 520 nanometers, the second of which the white lamp reached and the yellow lamp did not.

C.129 Johnston, Kim and Harris (2025) — artificial light at night and ecosystem carbon metabolism across eighty-six flux towers

Citation. Johnston A.S.A., Kim J., Harris J.A. "Widespread influence of artificial light at night on ecosystem metabolism." Nature Climate Change. 2025;15:1371–1377. Published 12 November 2025. Open access. Read in full from the publisher. Authors at the Cranfield Environment Centre, Cranfield University.

Funding and interests. United Kingdom Natural Environment Research Council grant NE/W003031/1. No competing interests statement was located in the text read. Derived data and the analysis code are deposited at Figshare, doi 10.6084/m9.figshare.29958455; the underlying half-hourly flux data are not redistributable under the FLUXNET data policy.

Why this entry is in the appendix, stated first and against the ordinary reading. Not for its finding. This is a carbon-cycle paper in a climate journal, and the comment does not rely on its conclusion about ecosystem respiration for any purpose. It is here because its authors, whose entire analysis depends on satellite nighttime light measurement, state among their own limitations that the instrument cannot see the emission this comment is about and that their exposure variable cannot be converted into a physical unit. That is the use made of it at Part V.J.4, where it is the fifth such statement. A reader who expects the Foundation to cite a Nature Climate Change headline about carbon feedbacks should note that the Foundation declines it.

Design. Observational, cross-continental. The harmonized global nighttime light dataset of Li and others, which intercalibrates Defense Meteorological Satellite Program-like digital numbers

into an annual series from 1992 to 2018 at about one kilometer, was combined with eddy covariance carbon flux observations from the FLUXNET2015 network. Three fluxes: net ecosystem exchange, gross primary production and ecosystem respiration. Three timescales: half-hourly, daily mean and annual. Fluxes were first referred to a baseline of their shared physical constraints, temperature and incoming shortwave radiation, through a modified Arrhenius function used as a comparative baseline and not as a mechanistic model.

Sites. Eighty-six FLUXNET2015 sites from the 203 for which light values were extracted: thirty-four in North America, of which four at high light intensity, five medium and twenty-five low; and fifty-two in Europe, of which thirteen high, seventeen medium and twenty-two low. 623 site years between 1992 and 2014. The authors state that flux tower locations are biased toward dark sky regions and that only North America and Europe contained more than one high-intensity site. Analysis was restricted to latitudinal bands containing medium or high intensity sites to limit climatic confounding.

Analysis. Linear mixed-effects models with site and latitude as random effects, tested incrementally against about eighteen candidate explanatory variables under thresholds requiring both a fall in Akaike information criterion and a rise in marginal R-squared per degree of freedom. Then generalized additive mixed models with tensor product interactions, selected backward on penalized likelihood, adjusted R-squared, deviance explained and approximate significance of smooth terms, with terms showing concurvity above 0.8 treated as redundant, and compared against variance-weighted versions to address heteroscedasticity. Then a piecewise structural equation model at annual scale on 605 site years across 84 sites, with mediation estimated by 1,000 nonparametric bootstrap replicates and a leave-one-out sensitivity analysis. Half-hourly datasets ran to between four and ten million observations and 10 percent random subsamples were used for bootstrapped fit statistics.

Findings. At annual scale, light intensity influenced net ecosystem exchange indirectly, through increased ecosystem respiration, rather than by suppressing gross primary production, which showed no direct response and was instead associated with growing season length and distance to the nearest urban area. Respiration responded more strongly and more consistently across timescales. All three fluxes retained a significant nonlinear interaction between light intensity and night duration at half-hourly and daily scales. A leave-one-out analysis found that removing light intensity significantly degraded model performance. A balanced sensitivity analysis using four sites per intensity stratum per continent, twenty-four sites in total, retained the core structure and strengthened the coefficients linking light to respiration and respiration to net exchange.

The exposure measurement, which is the weakest in this appendix. The authors state that the satellite digital numbers “represent relative radiance indices and cannot be directly converted into absolute illuminance units such as lux, as they do not capture spectral composition or ground-level variability”, and that the resulting categories “should thus be interpreted as relative exposure gradients rather than specific ecological thresholds”. They further state that the satellite products “are insensitive to blue light emitted by white light-emitting diode (LED) lighting”. The exposure is therefore not merely spectrally blind, as at Appendices C.3 and C.44, but unitless. No quantity in this study can be referred to any level of light at any ground surface.

Why the comment does not rely on the carbon finding. Five reasons, and the Foundation would state them even if the conclusion suited it. The exposure variable is an uncalibrated index, as above. Light intensity is a proxy for urbanity, and although the authors include distance to the nearest urban area and the proportion of urban land cover within three and ten kilometers, the model contains nothing for nitrogen deposition, ozone, particulate deposition, soil disturbance, management history, species composition or the urban heat island, each of which could raise respiration near cities for reasons unconnected with light. The authors acknowledge that present observational data do not permit the contribution of artificial light to be disentangled from that of sunlight. The direction of the principal interaction reverses with

temporal aggregation: respiration rose most with light during short nights in the half-hourly models and during long nights in the daily models, which the authors present as a lesson about aggregation and which means the sign of the interaction is not stable to an analytic choice. And the high-intensity arm rests on four sites in North America and thirteen in Europe, with the balanced analysis on twenty-four sites in all, against a selection pipeline of great flexibility applied to millions of observations, in which statistical significance is close to automatic.

Two statements the comment does take, neither of them the finding. First, the instrument admission set out above, used at Part V.J.4. Second, a statement about reversibility which the Foundation regards as the most useful sentence in the paper for Part IX: that unlike climate change and land use change, the effects of light pollution could be mitigated overnight. That is an assertion rather than a result, and the comment presents it as the authors' characterization and not as a finding; but it is a characterization published in a climate journal by authors whose subject is carbon feedbacks, and it bears directly on the proposition at Part IX that measures addressed to this exposure are available now and are reversible if wrong.

A third matter, recorded for verification rather than use. The paper states, citing a United Nations Environment Programme report of 2013, that lighting accounts for 20 percent of global electricity consumption and 6 percent of carbon dioxide emissions. Those figures are at second hand and the source is more than a decade old, predating most of the conversion to light-emitting diodes, so they are likely to have fallen. They are recorded because quantified waste bears on the statutory adjective at Part II.D.3 and not because the comment relies on them. Obtain the current figures from the International Energy Agency or the Department of Energy before any use.

What it does not establish. Any human health effect, and it does not address human health. Anything about light-emitting diode products, by the admission of its own authors. Any effect at a stated illuminance, radiance or wavelength. And, on the Foundation's reading, the carbon conclusion itself, which requires the experimental work the authors call for.

Bearing on the statutory question. One use and one only. Paragraph 360ii(a)(4) directs the Secretary to study and evaluate emissions of, and conditions of exposure to, electronic product radiation. This entry establishes, from a paper that depends on the measurement, that the national and international measurement of this emission is unitless and blind to the wavelengths at issue. Section 360kk requires that a performance standard prescribe an emission characteristic. A quantity that cannot be stated in a physical unit cannot be prescribed. Part V.J.4, where it is used; Part IX.C, for the research request; Part IX.I, for why the standard cannot presently be written in the terms the available data supply.

C.130 Team Nachtlichter (2025) — 234,044 light sources counted and classified by hand, and what the satellite was hiding

Citation. Team Nachtlichter. "Citizen science illuminates the nature of city lights." Nature Cities. 2025;2:496–505. Published 16 June 2025. Open access. Read in full from the publisher. The authorship is collective as published; the corresponding project is Nachtlicht-BüHNE, the Citizen-Helmholtz Network for research on night light phenomena. Processed data and analysis code at GFZ Data Services, doi 10.5880/GFZ.1.4.2024.006; raw data downloadable from the app itself.

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What it is. A complete hand inventory of visible outdoor light sources within defined satellite pixels, performed by citizen scientists using a purpose-built application. Not an exposure study,

not a health study, and not radiometry. The comment uses it for the composition of the light environment and for the limits of satellite measurement.

Method and scale. Autumn 2021, principally 23 August to 14 November. 258 registered participants; 3,868 transects, usually one street corner to the next; 4,409 surveys, some transects surveyed more than once; 234,044 individual light sources classified into eighteen categories; about twenty-two square kilometers in thirty-three communities, twenty-four of them in Germany. About 600 kilometers walked over more than 500 hours. Transects were laid out to cover completely the publicly accessible area of reprojected pixels of the satellite day-night band. Mandatory online training. 181 analysis areas, usually one pixel each. A logistic correction was fitted to extrapolate counts to 19:00 and to midnight for the five categories that demonstrably switch off during the night.

Validation. Streetlight counts were compared against municipal databases: agreement better than seven percent in Berlin, Cologne and Dresden; hand counts forty and ninety percent higher in Fulda and Leipzig, because they captured streetlights on private roads that the public databases omit. Between-observer variability on the two most frequently surveyed streets was fifteen percent for observations between 19:30 and 21:30, and the authors note that ten to twenty percent variability is comparable to the month-to-month variability of the satellite sensor. Counts were more consistent for streetlights than for signs and windows, where participants estimated sizes.

The composition finding. Private windows were the most frequently observed light source, ahead of streetlights and commercial windows. In dense urban land cover, lights used for advertising outnumbered streetlights, with roughly one illuminated sign and one commercial window per streetlight in the early evening. Late at night the streetlight share rises as signs and windows extinguish, but streetlights remained outnumbered by other sources by a factor of about five to seven in dense areas. Extrapolated nationally: approximately 78 million light sources plus or minus 3 million illuminated at midnight across mainland Germany, and 2.52 million plus or minus 0.11 million in Berlin, against published estimates of nine to nine and a half million public streetlights in the country.

Shielding, color and brightness. German streetlights: 48 percent fully shielded, 49 percent partially. Pathway lighting far more frequently unshielded. Lights mounted on the sides of buildings: 29 percent fully shielded, 26 percent unshielded. Floodlights: 58 percent unshielded, which the authors state implies upward rather than downward lighting, rising to 70 percent in continuous urban fabric. Color: canopy lights 88 percent white; streetlights the category most often classified orange, at 46 percent. Brightness: 24 percent of bollards reported bright, read by the authors as indicating glare or mismatch with surroundings; over a quarter of signs in commercial and industrial areas reported exceptionally bright. Presence detection controlling at least one light on a transect was more common in dim villages and suburbs, 29 percent, than in continuous urban fabric, 15 percent, or industrial and commercial areas, 11 percent.

The glare sentence the comment relies on. That the reported brightness of signs is consistent with earlier research finding signs often much brighter than recommended or appropriate, and that this “may reflect a need to update regulations about glare as the existing guidelines predate the use of highly luminous LEDs by several decades.” This is the proposition Part VI.J.6 argues, attributed for the first time in this comment to a source other than the Foundation.

What the authors tried and could not do. They attempted to derive per-light-type weights representing each light type’s contribution to overhead radiance, by minimizing a cost function against three datasets: the satellite day-night band at 750 meters, SDGSat-1 imagery at 10 meters, and aerial photographs at about one meter. To make the fit tractable the 370 combinations of light type and characteristic were reduced to 22 parameters. It failed in every case: the returned parameters were unphysical, for example assigning larger weights to small signs than to large ones and large weights to traffic lights, and the authors state that regardless of

what they tried the procedure never returned physically meaningful results. They attribute this to the absence of radiometric information in the observations and to the effect of building heights and street widths on how readily light escapes upward.

The translation factor, and its limits. Median relationship across 181 analysis areas: one nanowatt per square centimeter per steradian of satellite radiance per 317 counted lights per square kilometer. Treating all observations as one area: 302. For Germany with the temporal correction applied: 385 plus or minus 16 at 19:00 and 219 plus or minus 11 at midnight. For the areas surveyed outside Germany: about 120. Spearman correlation between radiance and total lights per square kilometer was 0.67, and positive for seventeen of the eighteen light types, garden decoration lights alone being negative. The relationship is a bulk statistical one, is country-specific on the authors' own account, and converts radiance into a count of lamps rather than into any quantity describing what reaches a person.

Two matters of federal and foreign regulation recorded from it. The paper states that a 2017 report of a Department of Energy national laboratory concluded that widespread conversion to light-emitting diode street lighting was likely to decrease skyglow, and that measurements over 2011 to 2022 indicate an increase of roughly ten percent a year, the authors concluding that it is at least clear that existing policy results in increasing light growth. The ten percent figure derives from citizen-science observations of star visibility rather than from radiometry, and stands against about two percent a year from late-night satellite observation over a similar period. And the paper supplies the correct citation of the French instrument the comment has been pursuing: an arrêté of 27 December 2018 on the prevention, reduction and limitation of light nuisances, described as requiring advertising lighting to be switched off when pedestrians are unlikely to be present and interior lights when buildings are not occupied. Both are used at Part V.J.4.

What it does not establish. Any health effect. Any radiometric quantity: a count is not a measurement of emission, and the brightness categories are participants' judgments, the authors noting that signs of twenty and of a hundred candelas per square meter would both likely be recorded as normal in a bright area. Anything outside Germany, the radiance relationship being specific to it on the authors' own statement. Anything about areas with high-rise buildings or private industrial parks, which were not surveyed. A complete inventory: lights not visible from public space, in back yards, courtyards and on rooftops, were not counted. And nothing about vehicle headlamps, whose contribution the authors describe as unknown.

Bearing on the statutory question. Paragraph 360ii(a)(4) directs the Secretary to study and evaluate emissions of, and conditions of exposure to, electronic product radiation. This entry is the closest thing the Foundation has found to a characterization of the emission sources of a national light environment, and it was produced by volunteers in one country over one autumn. No American counterpart exists. Its composition finding also bears on the product taxonomy at Part VI.A and on the weight the comment gives roadway lighting at Part VI.D relative to signage at Part VI.J. Part V.J.4, where it is used; Part IV.G for the federal prediction; Part IX for the two foreign instruments.

C.131 Wang, Meng, Richardson, Hölker, Li, Mao, Longcore, Xia and She (2025) — light at night outweighs the urban heat island in lengthening the growing season across 428 cities

Citation. Wang L., Meng L., Richardson A.D., Hölker F., Li H., Mao J., Longcore T., Xia J., She D. "Artificial light at night outweighs temperature in lengthening urban growing seasons." Nature Cities. 2025;2:506–517. Published 16 June 2025. Open access. Read in full from the publisher. A correction was published on 30 June 2025 altering a value in Extended Data Table 2 from minus 7.1 to plus 7.1; the corrected version must be cited.

Data, code and interests. Data at Zenodo record 15495270; preprocessing code on Google Earth Engine and analysis scripts on GitHub. Underlying products are all public: VIIRS day-night band monthly composites, a global one-kilometer daily air temperature dataset, the VIIRS

Global Land Surface Phenology product VNP22Q2, MODIS land cover, a global urban boundary product, a global artificial impervious area product and the Köppen-Geiger climate map. No competing interests statement was located in the text read.

Why the comment uses it. For one comparison and one lead. The comparison is with the urban heat island, which is the only instance in this comment of this exposure being weighed against another environmental stressor. The lead is the pathway its authors identify from a phenological shift to pollen allergy and asthma, which is the first route from this exposure to a clinical endpoint in the ecological material.

Design. Observational, spatial-gradient. 428 Northern Hemisphere cities, 2014 to 2020, each divided into ten concentric bands by impervious surface area index at intervals of 0.1, the first band the outermost rural area and the tenth the urban center, with kernel density smoothing applied to the index. Four quantities measured in each band: satellite light at night, near-surface air temperature, the date of onset of greenness increase in spring, and the date of onset of greenness decrease in autumn. Light averaged over January to March for the spring analysis and July to September for the autumn; temperature over fixed forty-day preseason windows, with three alternative windows tested. Cities selected at over 100 square kilometers with rural areas extended outward to balance areas. Curve fitting by quadratic polynomial for phenology and temperature and logistic growth for light. Drivers separated by partial correlation, each computed holding the other constant, with Fisher Z transformation testing whether the two coefficients differed in each city. Validated against a thirty-meter urban phenology product for 62 cities in the continental United States, both including and excluding developed open space.

The gradient. Across the ten bands, light at night rose from 3.1 plus or minus 0.1 to 53.3 plus or minus 0.6 nanowatts per square centimeter per steradian, an increase of about seventeenfold, the rise being exponential with about half of it occurring between the seventh and tenth bands. Air temperature rose from 10.7 plus or minus 0.1 to 11.5 plus or minus 0.1 degrees Celsius, a concave quadratic rise of eight tenths of a degree with about half occurring between the first and second bands. The urban minus rural differences were 25.5 nanowatts in spring and 20.1 in autumn for light, against 0.3 and 0.5 degrees for temperature. North American cities were the brightest of the three continents examined, at 30.1 nanowatts in spring against 23.6 for Europe and 20.8 for Asia.

Phenology results. 378 of 428 cities, 88.3 percent, showed the consistent pattern of earlier spring onset and later autumn senescence toward the center. Spring onset advanced from 94.4 plus or minus 0.4 to 81.8 plus or minus 0.3 day of year across the ten bands; autumn senescence extended from 227.6 plus or minus 0.3 to 238.8 plus or minus 0.3. Urban minus rural: spring onset 6.4 plus or minus 0.2 days earlier, autumn senescence 7.1 plus or minus 0.2 days later. The thirty-meter validation reproduced the pattern at smaller magnitude and survived exclusion of lawns and other developed open space.

Attribution, which differs between the two ends of the season. Spring onset: partial correlation with light minus 0.37 plus or minus 0.31, with temperature minus 0.33 plus or minus 0.35. Of the 279 cities in which the two coefficients differed significantly, light was dominant in 135 and temperature in 144. The two are comparable. Autumn senescence: partial correlation with light plus 0.38 plus or minus 0.28, with temperature minus 0.03 plus or minus 0.39. Senescence was positively correlated with light in 310 cities, 72.7 percent, while its relationship with temperature was inconsistent in direction, negative in 134 cities and positive in 118. Across the seven climate zones the light coefficient averaged 0.49 and the temperature coefficient 0.003, light outweighing temperature in every zone at p below 0.01. Results held when daily maximum and minimum temperatures were substituted, when an interaction term was added, and in the thirty-meter validation. The comment therefore reports the title as holding for autumn and not for spring.

Latitude and climate. Below 48 degrees north both phenological metrics were more sensitive to light than to temperature. Above it, spring onset was more responsive to

temperature while autumn senescence remained more responsive to light. The correlation between senescence and temperature changed sign with increasing latitude. Temperature had greater influence on spring onset than light in arid zones, which the authors attribute to water stress.

The human pathway the authors identify. That earlier leaf-out and later senescence driven by light may increase the risk of frost damage in early spring and late autumn, disrupt plant and pollinator interactions, and lead to an earlier occurrence of pollen allergy symptoms. For the last they cite Sapkota and others, on the association between changes in the timing of spring onset and asthma hospitalization in Maryland, published in JAMA Network Open in 2020. The comment treats this as a lead requiring acquisition and not as a finding; the three links are each measured but no study joins them, and in particular no study has examined whether light at night is associated with pollen season timing or with allergy or asthma presentations.

The exposure measurement, and a refinement specific to plants. The same instrument criticized at Part V.J.4. The authors state its spectral range as 500 to 900 nanometers and call for a sensor capable of capturing a broader spectrum, particularly in the blue. They add a point the comment had not previously recorded: plants sense light through several photoreceptor families, phytochrome responding to red and far-red between roughly 620 and 1,000 nanometers while phototropins and cryptochromes respond mainly to blue. The satellite band therefore covers much of the phytochrome range and is blind to the blue range. Their defense of their own analysis is that the conversion to light-emitting diodes probably occurred at about the same time across each urban region, so that the resulting spectral change is roughly common across the bands of their gradient; the comment records this as an assumption which the authors state as one and do not test. This is the sixth such attestation in the comment.

What it does not establish. Any human health effect; the outcome is satellite-observed vegetation greenness. Causation: the design is spatial and observational, and light and temperature both rise toward a city center along with many variables the model does not contain. The authors address species composition, noting that cities carry more non-native plantings, and validate against a higher-resolution dataset with lawns excluded; they do not address carbon dioxide, ozone, nitrogen oxides, particulate deposition, soil compaction, irrigation or drainage, all of which vary along the same gradient. Partial correlation separates light from temperature and from nothing absent. And the Foundation records a criticism of its own: the two variables compared differ grossly in range across the gradient, light varying about seventeenfold and temperature by less than a degree, and a comparison of correlation magnitudes between variables of such unequal range is not straightforwardly a comparison of importance. The authors do not address this.

Authorship, and recurrence. Franz Hölker is a co-author of the cloud-amplification work cited at Part II and of the satellite instrument paper relied on at Part V.J.4. Travis Longcore is the author of three papers recorded elsewhere in this comment as acquisitions: the 2015 paper proposing the composite spectral approach that the moth study at Appendix C.128 tested and failed to confirm, a 2018 paper on rapid assessment of lamp spectrum, and a 2023 compendium of photopigment peak sensitivities for terrestrial wildlife. The comment does not present this entry as independent of those.

Bearing on the statutory question. Two grounds. The emissions limb of paragraph 360ii(a)(2) as Part II.D.4 construes it, for which this is evidence about an emission. And paragraph 360ii(a)(2)'s direction that the Secretary plan, conduct, coordinate and support research: the comparison with the urban heat island supplies a reason to begin, and the pollen pathway supplies an unusually tractable question, since the exposure is already measured nationally by satellite, pollen counts are already collected and asthma presentations are already recorded. Part V.I, where it is used; Part V.J.4 for the instrument; Part IX.C for the research request.

C.132 Fabusova, Gaston and Troscianko (2024) — a single pulse of headlamp-intensity light replaces the escape response in 428 moths, and the composite spectrum helps

Citation. Fabusova M., Gaston K.J., Troscianko J. "Pulsed artificial light at night alters moth flight behaviour." Biology Letters. 2024;20(11):20240403. doi:10.1098/rsbl.2024.0403. Published 13 November 2024, in the journal's Conservation special collection. Open access. Read in full from the publisher. Review history published by the journal. Data and R script in the electronic supplementary material, Figshare collection doi 10.6084/m9.figshare.c.7524698.

Funding, interests and relationship to Appendix C.128. Natural Environment Research Council grant NE/W006359/1, which is the same grant that funded the study at Appendix C.128. No competing interests declared. The authors state that no artificial-intelligence tools were used. Kevin Gaston and Jolyon Troscianko are authors of both studies, which were conducted at the same site in Cornwall; the acknowledgements here thank Briolat and Galloway, the first and second authors of C.128, for fieldwork and light calibration. The two studies are not independent and the comment does not present them as such. They are used as a matched pair reaching opposite conclusions on the same remedy.

Why this entry matters. Two reasons. It is the only entry in this appendix applying an ecological method to vehicle lighting, which is the product class of Part VI.B. And it is the counterpart to Appendix C.128 on the composite-spectrum question: tested against a brief intense pulse the composite spectrum helped, while tested against continuous exposure at ten lux it did not, and the reason for the difference is the finding the comment relies on most.

Design. 428 wild-caught moths of 64 species in seven families, each tested individually. June to September 2023, at night, Tremough Campus, Penryn, Cornwall. Moths were caught by hand net under a red headtorch along five pre-determined transects sampled in random order for ten minutes each, beginning half an hour after sunset, expressly to avoid the sampling bias of light traps; they were then held in an unlit pot for at least ten minutes to dark-adapt. Each animal was released while exposed to a single ten-second pulse at one meter, or 1.06 meters for the control, and tested in the same area and ambient light where it was caught. The first behavior was recorded by observation under a red headtorch, from five categories established in a pilot of 72 animals: erratic flight, flight into the light, downward flight and shelter-seeking, upward flight with return to normal activity, and no response. Trials ran two minutes.

Treatments, as characterized. Four, matched in correlated color temperature and intensity to human vision by metamers, with residual brightness differences corrected by adjusting distance, and measured with a JETI Specbos 1211-UV spectroradiometer: cool phosphor-converted diode 5,664 kelvin at 454.9 lux; warm phosphor-converted diode 3,102 kelvin at 429.7 lux; cool composite red-green-blue diode 5,661 kelvin at 433.5 lux; warm composite 3,222 kelvin at 463 lux. Group sizes 100, 92, 98 and 96, with a dark control of 42 not balanced across treatments and handled statistically. The illuminance is of a different order from the other ecological entries in this comment, which used under 1 lux to 30 lux; the authors state that headlamp beams are typically an order of magnitude more intense than static street lighting.

Analysis. Linear and generalized linear mixed-effects models with binomial error, species and family as random factors, checked for overdispersion. Temperature, humidity, wind speed and moon phase as additive fixed effects; only temperature and humidity predicted response and were retained. Interactions between color temperature and spectrum were fitted and simplified to minimal adequate models. Three comparisons: erratic flight against other behavior, n equals 386; erratic flight and flight into the light combined against other behavior, n equals 386; and upward against downward flight, n equals 199. Latency log-transformed. All analyses repeated separately for the four most abundant families.

Results. Against darkness: 86 percent of control moths flew directly upward, which the authors read as the normal escape response, against an average of 37 percent after a light pulse. Erratic flight alone: most frequent under the cool phosphor-converted diode but not significant

on any test, color temperature, spectrum and their interaction each at a probability of 0.350. Flight into the light: significantly predicted by color temperature, more frequent under cool lights of either spectrum, probability 0.002; spectrum alone not significant at 0.104. The two combined: significant interaction between color temperature and spectrum, probability 0.006, most pronounced under the cool phosphor-converted diode, with harmful responses 1.8 times more likely under that lamp than the other three and 25.5 times more likely than in darkness. Latency: mean 21.45 seconds with a standard deviation of 26.50; fastest under the cool phosphor-converted diode by about twelve seconds, the interaction near-significant at 0.06 but each factor highly significant alone. Upward rather than downward flight was more frequent under warm lights but neither factor was significant. Moon phase predicted nothing. No taxonomic differences were detected across the four main families, which the authors contrast with family-level biases reported for attraction to static lights.

The insect pupillary mechanism, recorded for its parallel. The authors set out why a pulse should affect an insect differently from a person. A vertebrate pupil constricts in roughly one second. Insects adapt instead by migrating screening pigment granules within the optical units, radially in apposition eyes and longitudinally in superposition eyes, a process which can take over thirty minutes to return to a dark-adapted state and which has been found to operate more slowly at night than by day. The spectral response of this mechanism varies among closely related hawkmoth species and among individuals of one species. The comment records this at Part V.I as a parallel to the human glare-recovery material at Part V.C.3, expressly as a parallel and not as evidence about human recovery.

The authors' closing proposition about human beings. Noting that the blue peak of phosphor-converted diodes has been associated with decreasing alertness in older drivers, the authors write that they can speculate that reducing the blue peak in car headlights will likely be associated with beneficial changes to road safety for moths and humans alike, and that it would be beneficial to avoid continued use of cool phosphor-converted diodes in headlamps. The comment reports this as the authors framed it. It is speculation, so labeled; it is outside the authors' field; and it rests on two cited sources on human pupillary response and alertness which the Foundation has not read and which are recorded as acquisitions. It is not evidence about human drivers. Its value is that the proposition is reached by investigators with no connection to the Foundation or to the American regulatory dispute, in the course of reaching a different conclusion about a different taxon.

What it does not establish. The light did not move: the authors state that the source was static and the pulses were intended to simulate a passing headlamp at close range, whereas a real headlamp approaches, brightens, sweeps and recedes with noise and air movement. A single pulse was used, where a roadside animal receives many. Only the first behavior within two minutes was recorded; no measure of survival, reproduction, collision or energy expenditure was taken, and harm is inferred from the character of the response. The animals were handled, and the authors list an escape response to handling among mechanisms that could confound or supersede the others. The mechanism was not determined and the authors state that behavioral data cannot determine it. Red light was used for capture and observation, and the authors note that red sensitivity cannot be ruled out in moth taxa other than hawkmoths. The control arm was 42 animals and unbalanced. And the erratic flight result that the abstract leads with was not significant on its own.

Bearing on the statutory question. Three. The emissions limb of paragraph 360ii(a)(2) as Part II.D.4 construes it, for which this is evidence about a characterized emission of a product class. Paragraph 360ii(a)(4), which directs the Secretary to study and evaluate emissions and conditions of exposure: this study makes the duration and the pulsed character of an exposure the variable of interest, which no other entry in this appendix does. And the form of a performance standard: read with Appendix C.128 it establishes that the value of a spectral prescription depends on the exposure regime, so that a standard prescribing a spectrum without

specifying the regime cannot be assessed. Part V.I, where it is used; Part VI.B; Part V.C.3 for the pupillary parallel; Part IX for the standard-drafting point.

C.133 Atchoi, Mitkus, Machado, Medeiros, Garcia, Juliano, Bried and Rodríguez (2024) — shearwaters chose darkness over white light and red over blue, in an exposure specified in the bird's receptor space and in human lux, which disagreed by a factor of 1.6

Citation. Atchoi E., Mitkus M., Machado B., Medeiros V., Garcia S., Juliano M., Bried J., Rodríguez A. "Do seabirds dream of artificial lights? Understanding light preferences of Procellariiformes." Journal of Experimental Biology. 2024;227(19):jeb247665. doi:10.1242/jeb.247665. Received 1 March 2024, accepted 2 September 2024, accepted manuscript 25 September 2024, version of record 10 October 2024.

How it was read, which qualifies everything below. The bibliographic detail, methods and results were read from the publisher. The publisher page available to the Foundation truncates in the middle of the Discussion, and the remainder was read in the authors' own bioRxiv deposit, doi 10.1101/2024.03.01.582998, dated 1 March 2024, which matches the journal's received date. That deposit precedes peer review. Every quotation and figure in this entry drawn from the Discussion is marked for verification against the version of record, and the version of record governs on any difference. The Foundation also records that the study reached its attention through a secondary research highlight in the same issue, Knight K., Journal of Experimental Biology 2024;227(19):jeb249593, doi 10.1242/jeb.249593, whose headline describes the effect as disastrous. That is the writer's word and not the authors'. The comment cites only the primary article.

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Why this entry matters, stated first. Not primarily for its subject. It is the only entry in this appendix whose exposure was characterized in the receptor space of the animal tested as well as in human photometric units, and the two characterizations disagree: two stimuli within about four percent of each other in the bird's achromatic channel measure 75 and 120 lux to a human, a factor of 1.6. That is a direct demonstration of the proposition Part V.J.4 argues, supplied by investigators who were not arguing for it. Secondarily, it is the only entry reporting a measured avoidance response, and its white lamp at 3,000 kelvin with a peak at 455 nanometers is a fourth demonstration in Part V.I that a low correlated color temperature is not a narrow spectrum.

Subject and setting. Cory's shearwater, Calonectris borealis, whose largest population breeds in the Azores, breeding from mid-February to early November with fledging in late October and early November. About six percent of fledglings are grounded annually in fallout events in the Azores; the SOS Cagarro rescue campaign has operated every year since 1995. Fledglings were tested on a cliff edge on the outskirts of Horta, Faial, at 38.5199 degrees north and 28.6202 degrees west, with the maze exits facing the sea; adults at the foot of the Capelinhos colony, a Natura 2000 special protection area, at 38.5895 north and 28.8233 west, within ten meters of the surf.

Design. 131 rescued fledglings tested over five nights in October and November 2020 and four in 2021, and 84 adults over eleven nights between May and September 2022. Each bird received one trial. The maze was plywood, 100 by 50 by 40 centimeters, matte black, with a central separator forming two arms and exits and a light above each arm; the bird was covered by a

black box for one minute before release, the start position laid with black cardboard, and the arena cleaned with 70 percent ethanol between birds. Light positions were randomized. A trial ended after ten minutes if the bird did not move. Recorded: arm entry, choice, and latency to enter in minutes. Three treatments — white against dark, blue against red at equal brightness to the bird, and a control with both arms dark. Fledglings were ringed and measured, held in dark rescue boxes until testing, and released at the cliff; adults were held at least fifteen minutes and redirected back to their burrows.

Exposure, which is the best-specified in this appendix in one respect and loose in another. White arm: a named commercial warm-white diode strip, 3,000 kelvin, measured spectral peaks at 455 and 625.2 nanometers, 175 lux at the start position. Dark arms: below 0.1 lux. Blue and red arms: single-peak diodes at approximately 450 and 620 nanometers, 75 and 120 lux respectively in human photopic terms, the authors noting that these illuminances correspond to civil twilight. The two chromatic stimuli were designed to be approximately isoluminant in the bird's achromatic system, differing by about four percent in achromatic contrast while differing by about 60.7 just-noticeable differences in chromatic contrast, with spectral sensitivities modeled on the wedge-tailed shearwater, Ardenna pacifica. The white stimulus was not isoluminant with the chromatic pair, so the two experiments are not comparable to one another on intensity. The loose element is the dark control, specified as below 0.1 lux, which is a ceiling rather than a measurement; Appendix C.128 measured a natural night sky at a median of 0.0168 lux.

Statistics. Fisher exact tests for entry and choice between age groups; exact two-tailed binomial tests for choice within each treatment and age group; Welch two-sample t-tests for latency; a principal component analysis of wing, tarsus, culmen and gonys to form a body size index, the first component retaining 51 percent of variation; body condition as residuals of mass regressed on that index; binomial generalized linear models with a logit link, and linear models, for size and condition. R version 4.1.2.

Results. Entry: fledglings entered an arm in 101 of 131 trials, 77 percent, against 45 of 84 for adults, 54 percent, Fisher exact probability below 0.001 with an odds ratio of 2.88; the difference was significant within the blue-red treatment, probability 0.015 and odds ratio 3.4, and not within white-dark, 0.367 and 1.55. In the control every fledgling chose; adults chose in 70 percent of trials. Choice: no side bias in the control, fledglings 0.627 and adults 0.115. White against dark, fledglings chose dark in 77 percent, binomial probability 0.009; adults chose dark in 66 percent, not significant at 0.3. Blue against red, both ages chose red, fledglings at 0.003 and adults at 0.00052, with only one adult choosing blue. The choices did not differ between age groups, 0.25 for the red arm and 0.5 for the dark arm. Latency: fledglings slower than adults, Welch probability below 0.01 with a 95 percent interval of 0.531 to 1.766; both groups fastest in the control; every within-treatment comparison between the two arms null, fledglings at 0.521, 0.353 and 0.314 and adults at 0.363 and 0.373, the adult blue-red comparison impossible because one adult chose blue. Size and condition: larger fledglings tended to enter more often in blue-red trials, estimate 0.581 with an interval of 0.007 to 1.253, and larger adults in control trials, 1.161 with an interval of 0.120 to 3.000; no other relationship with choice or latency.

What the authors concluded. That the birds were not attracted. At close range they were, in the authors' words, "apparently disoriented by the stimuli rather than being behaviourally attracted to them"; that "artificial light appears to impair the fledglings' ability to exit the unknown lit environment"; and that "the presence of a close-range artificial light can be disruptive to Cory's shearwater fledglings." They also report a result against their own expectation: because choices did not differ significantly between ages, "behavioural differences cannot account for the age bias observed in fallouts" — the bias by which fallout falls overwhelmingly on fledglings. Their alternative explanation, that the fledgling visual system is still immature, is offered as a hypothesis and not tested here. They note that the high contrast of white light against darkness may itself disorient, and describe that as an extrapolation. On

mitigation they cite others' recommendations to shift urban lighting toward longer wavelengths and offer no lamp specification of their own.

What it does not establish. It is not a model of fallout and the authors say so: a close-range two-armed maze is not a bird encountering a lit town in flight. Within-treatment samples are small, the choice results resting on roughly two to four dozen birds in each, and the adult arm is underpowered by the authors' own calculation that 176 to 305 adults would be required. Only about half the adults made any choice. Trial numbers per treatment were uneven. The white stimulus was not isoluminant with the chromatic pair. The visual model was built on a different species. The fledglings had already been grounded by urban light and then handled, ringed, measured and boxed, so they were not naive; the authors raise this, argue from earlier work that it is unlikely to have skewed the result, and recommend testing unexposed fledglings. And the tested fledglings were selected at or above 660 grams and averaged 820 plus or minus 74 grams against 766 plus or minus 96 for the 1,111 birds rescued across the two seasons, so they were the fitter part of an already injured group. Nothing bearing on human health was measured.

Bearing on the statutory question. Three. The emissions limb of paragraph 360ii(a)(2) as Part II.D.4 construes it, for which the avoidance result is evidence of the organism's own assessment of the emission. Paragraph 360ii(a)(4), the duty to study and evaluate emissions and conditions of exposure, for which this entry shows that the condition of exposure can be specified in more than one receptor space and that the choice of space changes the answer. And the form of a performance standard under section 360kk: a limit in lux is a limit in a human weighting, which is appropriate to this statute and is the reason the Department cannot synthesize the ecological literature by converting it into lux. Part V.I, where it is used; Part V.J.4; Part V.G for the limit of the avoidance analogy.

C.134 Grillo, Marrone, Gauci and Deidun (2024) — an entry taken for the authors' lighting recommendations and for a unit error, and not for its findings

Citation. Grillo F., Marrone A., Gauci A., Deidun A. "Maltese Coastline Never Sleeps: The Effects of Artificial Light at Night (ALAN) on the Local Infralittoral Assemblages—A Case Study." Journal of Marine Science and Engineering. 2024;12(9):1602. doi:10.3390/jmse12091602. Marine Ecology section. Received 10 August 2024, revised 30 August 2024, accepted 4 September 2024, published 10 September 2024. Open access under Creative Commons Attribution 4.0. Oceanography Malta Research Group, Department of Geosciences, University of Malta. Funded internally as part of the first author's Master's thesis and through Interreg Italia-Malta CapSenHAR. No competing interests declared. Data available on request to the corresponding author rather than deposited.

Why this entry is in the appendix, stated first and against the ordinary reading. Not for its finding. The Foundation declines the findings for the reasons set out below, and would decline them if they pointed the other way. The entry exists for two things that do not depend on the design. The first is the recommendation set the authors give in their section 4.5, which is organized by the same four emission characteristics as Part VI and Part IX of this comment and which includes a numerical limit of the form section 360kk requires. The second is the characterization of the two study sites, which is given in lumens, a unit that does not measure light arriving at a place, and which is therefore a concrete instance of the problem Part V.B.3 and Part V.J.4 describe.

Design, as reported. A horizontal-facing baited remote underwater video unit, built in-house from PVC with a frame of about 355 by 400 millimeters, 4 kilograms of ballast, and a one-meter bait arm standing 260 millimeters above the seabed holding 250 grams of chopped bullet tuna and European sprat in a four-to-one ratio. A GoPro Hero 10 recorded at 1080p and 60 frames per second. Two Bigblue AL2600XWP-II dive torches were mounted on gooseneck arms, each rated at a maximum output of 2,600 lumens at 6,500 kelvin with a 120 degree beam, and each carrying integrated red diodes. Eighteen one-hour samples were taken in August 2023 at Ċirkewwa harbor on the northwest coast of Malta, two per night beginning at 10 p.m., under a

two-factor design: three light treatments, being high-intensity white, low-intensity white and red, by two habitats, being a light-polluted harbor quay and a darker rocky reef, with three replicates per combination. Video was analyzed at 0.4 times speed using Count-N, the cumulative count of individuals observed, the authors having rejected MaxN. Analysis in Primer v7 and PERMANOVA+, with dispersion weighting, a square-root transformation, Bray-Curtis dissimilarity, SIMPER, non-metric multidimensional scaling, principal coordinates ordination and a BEST analysis against wind, lunar phase and cloud cover.

Why the Foundation declines the findings. Nine reasons, the first four sufficient on their own. (1) There was no dark control. The red treatment is described by the authors themselves as a pseudo-control, so every one of the eighteen samples had a lamp burning and the study compares three lamps to one another, never a lamp to darkness; red light is also strongly attenuated in seawater, so the red arm differed from the white arms in intensity as well as spectrum and the two cannot be separated. (2) The camera was baited. A preference for the bright treatment cannot be distinguished from an improved ability to locate bait under it, and the authors report that the fish exploited the bait bag specifically on illuminated nights, citing prior work on precisely this artifact of illuminated baited video. (3) The site contrast is not a light contrast. The authors assert that other environmental variables are not expected to differ much between the two locations and then themselves record differences in seabed composition, in exposure to prevailing winds, in boat traffic that varied in both presence and duration across sampling occasions, in occasional fishing activity, and in the presence of a single moray den beside one deployment which they suggest may account for that species' frequency there. One location is a working ferry quay with restaurants; the other is a reef. (4) The species constituting eighty percent of all counts was differentially undercounted in the treatment of interest, and the authors disclose it: under high-intensity light the bogue kept away from the camera because a horse mackerel was holding station in front of it, so they were counted only in the background and the authors write that greater schooling densities may therefore have been overlooked. (5) Three replicates per cell, in one month, at one harbor. (6) The claim that light mattered more than habitat rests on comparing probability values, 0.0001 against 0.0005, which is not a comparison of magnitude; the pseudo-F values and components of variation needed to support it are in a table the Foundation has not seen. (7) The diversity result contradicts the headline: the PERMANOVA on the Shannon index returned no significant effect of light, and only the interaction was significant. (8) Several claims of significance in the biodiversity section are read off boxplots with no test reported. (9) The same observation, the greater abundance of bogue under red light at the lit site, is interpreted as habituation in section 4.1 and as attraction in section 4.2.

What the authors nonetheless report, recorded for completeness and not relied on. 23,985 individual counts from eighteen hours of video, comprising eighteen species of fish, two molluscs, one cnidarian and one polychaete, of which 19,200 were the bogue Boops boops. PERMANOVA probabilities of 0.0001 for light treatment, 0.0005 for habitat and 0.0003 for the interaction, with pairwise t values of 2.2347 for red against low, 3.5938 for red against high and 2.267 for low against high, the strongest contrast being red against high at 0.0022. Shannon index not significant for the factors at 0.2471 with the interaction at 0.0021. SIMPER average similarities of 67.07 percent under red, 65.2 under low white and 60.1 under high white. Horse mackerel Trachurus trachurus present in every high-intensity sample, absent from every red sample and present in two low-intensity samples, engaging in what the authors describe as station holding; the authors note this contrasts with earlier work in which the same species hid from intense white light. Cardinalfish Apogon imberbis and painted comber Serranus scriba more frequent under red. The bearded fireworm Hermodice carunculata recorded 55 times under red, 49 under low and 24 under high. Two cuttlefish, both under red. The first two principal coordinates captured 60.97 percent of variance.

The recommendations, which are the reason for this entry. From the authors' section 4.5, as their own statement of what coastal lighting should be required to do. Direction: full cut-off fixtures aimed downward, achieving a zero percent Upward Light Output Ratio. Quantity:

intensity limited to what is strictly necessary for safety and operational purposes. Containment: lighting focused on specific areas, preventing overflow into ecologically fragile regions, nearby residences, or the sky. Duration: schedules to dim or switch off during periods of inactivity. Spectrum: a correlated color temperature below 3,000 kelvin. And reflectance: non-reflective, dark-colored materials in coastal construction. The recommendations are cited by the authors to BirdLife Malta guidance and to a marine energy lighting paper, both recorded as acquisitions. Four of the six are the four emission characteristics this comment asks the Department to regulate, and the Upward Light Output Ratio limit is expressed as a number against a defined ratio, which is the form a performance standard takes.

The spectral recommendation, and why this subsection uses it against itself. The recommendation of a correlated color temperature below 3,000 kelvin is the standard one in the field. Four studies collected in this appendix show it to be partial. At Appendix C.125 lamps at 2,700 to 3,000 kelvin under one lux did not prevent the loss of diapause in the mosquito, and those authors wrote that changes in brightness or light color may not be sufficient. At Appendix C.133 the lamp the shearwater fledglings avoided was 3,000 kelvin with a measured spectral peak at 455 nanometers. At Appendix C.128 reducing short-wavelength content reduced moth activity suppression without removing it, and at low intensity some species increased activity under amber. At Appendix C.132 the same remedy did help against a brief intense pulse, which is why the Foundation's position concerns exposure regimes rather than amber as such. The explanation is that a low correlated color temperature is not a narrow spectrum: warm white is broad-spectrum light with a reduced blue fraction and it retains a blue peak. The consequence for section 360kk is that a standard prescribing a correlated color temperature would prescribe a quantity that does not determine the emission it is used to control, and that the Department should instead prescribe a limit on radiant power within a stated wavelength interval or a spectral index computed from the distribution, of the kind the Andalusian instrument at Appendix D.2 employs.

The unit error. The ambient light at the two sites is given as a photometer reading in lumens: zero at the reef deployment, eighty at the harbor deployment, and up to one hundred and forty-five when charter boats passed. The lumen is a unit of luminous flux and measures light leaving a source integrated over all directions; it is not a measure of light arriving at a location, and a photometer placed at a point does not read it. The quantity such an instrument reads is illuminance, in lumens per square meter, the lux. The same methods section uses the lumen correctly when stating the torches' maximum output of 2,600 lumens, that being a source quantity. The difference in light between the two sites is the entire premise of the habitat comparison, and it is expressed in a unit that cannot express it. The Foundation records this as an instance and not as a criticism of these authors in particular: it is the practice of the field that Part V.B.3 and Part V.J.4 describe, and the contrast with Appendix C.133, published in the same year with its lamp spectra reported to a tenth of a nanometer and its stimuli matched in the subject's receptor space, is the range of practice the Department would have to build a standard on.

An internal inconsistency in the published counts, resolved by arithmetic. The abstract reports 23,955 individuals; the results section reports 23,985 twice. The Foundation summed the species table in the paper's own Appendix A and obtained 23,985 exactly: 23,835 fish, 9 molluscs, 13 of the cnidarian and 128 of the polychaete, with Boops boops at 19,200, which is 80.05 percent of the total and matches the eighty percent the abstract states. The abstract figure is therefore the error. This is the Foundation's computation from the published table and is marked as such.

Bearing on the statutory question. Two, neither evidentiary. The form of a performance standard under section 360kk, for which the authors' recommendation set is an independently arrived-at statement of the characteristics to be regulated, and their spectral recommendation is a demonstration that the convenient number does not determine the emission. And paragraph 360ii(a)(4), the duty to study and evaluate emissions and conditions of exposure, for which the

unit error is an instance of why the Department cannot rely on the published literature to supply the exposure information and must measure. Part V.I, where it is used; Part V.B.3 and Part V.J.4 for the measurement argument; Part IX for the standard-drafting request.

C.135 Degen and eleven co-authors (2024) — harmonic radar tracking showed that four percent of light-caught moths flew to a streetlight, while the lights changed the flights of the rest and barred a family from crossing a lit circle

Citation. Degen J., Storms M., Lee C.B., and nine co-authors, the last being Degen T. "Shedding light with harmonic radar: Unveiling the hidden impacts of streetlights on moth flight behavior." Proceedings of the National Academy of Sciences of the United States of America. 2024;121(42):e2401215121. doi:10.1073/pnas.2401215121. Received 18 January 2024, accepted 31 July 2024, published 8 October 2024. Edited by Marlene Zuk, University of Minnesota. The publisher's display abbreviates the middle eight authors, whose initials from the contributions statement are A. Jakhar, S.W., A. Jechow, A.L.S., F.H., T.W., O.M. and T.H.; the full list is not recorded here, and surnames are not reconstructed from initials. Funded by the Deutsche Forschungsgemeinschaft, grant DE 2869/1-1. No competing interests declared. Capture and release permitted by the Regional Council of Giessen. Raw data deposited in Dryad; the deposit identifier must be obtained. Supporting Information not yet obtained.

Why this entry matters, stated first. Because it measured the blindness of the method by which this exposure has been studied. Every moth tested had been captured using light and was therefore known to approach light. Four percent of those released with the streetlights on flew to a streetlight. The lights nonetheless changed the flights of the others, measurably and significantly. The established observational method, the light trap at the lamp post, can by construction record only the four percent. This is the seventh instance in this comment of an instrument that cannot see the exposure it is used to observe, the first six being the satellite radiometers collected at Part V.J.4, and it is the only one in which the shortfall was quantified against a method that could see both.

Design. 95 flights of 94 individuals, 10 June to 29 July 2018, on an open flat pasture near Großseelheim, Germany, release point at 50 degrees 48 minutes 50.3 seconds north and 8 degrees 52 minutes 32.7 seconds east. Harmonic radar, Raytheon Marine NSC 2525/7 XU, tracking to one kilometer with a position every three seconds. A 10.5 milligram, 12 millimeter transponder, carrying no battery and powered by the radar beam, returning the signal at twice the transmitted frequency, was fixed with double-sided tape to a numbered tag shellacked to the thorax; attachment took about thirty seconds under red light only. Six streetlights on poles about 3.5 meters high, fitted with high-pressure sodium lamps at 2,000 kelvin and 6,700 lumens, 70 watts, were set in a circle of 85 meter radius about the release point, 85 meters from each other, with non-overlapping light cones; one lamp was replaced after measurement to equalize brightness. Lights were on or off on alternating nights to balance weather and ambient light. Moths were released singly and tracked until the signal was lost for more than ten minutes. Minimum acclimation between capture and release was 40 minutes and usually more than 60, against a stated 30 minutes for return to full ocular sensitivity. Experiments ran only above 10 degrees Celsius, not in rain or strong wind, with 83.2 percent of flights below 5 kilometers per hour of wind. Trajectories were analyzed to 270 meters from the release site. Flights under 85 meters or with fewer than five waypoints were excluded.

Subjects, and the selection that qualifies them. All tested animals were male; the authors report catching almost no females. All were captured using light, hawk moths at a large light trap built each night far enough away to be invisible from the release site, and lappet moths at the experimental field by driving field paths slowly and taking animals that entered the car headlight, which the authors describe as making uncoordinated movements on the ground. The authors state that the sample "might not be representative for the whole population." Principal species were Euthrix potatoria, Laothoe populi, Deilephila elpenor and Sphinx ligustri, with single or few individuals of Smerinthus ocellata, Catocala sponsa, Noctua pronuba and Cossus cossus; counts are in Table S1, not yet obtained.

Exposure characterization. Illuminance and spectrum of each streetlight measured with a JETI Specbos 1211UV spectroradiometer in irradiance mode with a cosine-corrected head facing the zenith, at 1.5 meters because vegetation prevented measurement at ground level, on a grid at 2 meter spacing along the lamp's main axis to 10 meters and 5 meter spacing beyond and off-axis. Sky brightness recorded at the start of every flight by a calibrated all-sky camera, a Canon EOS 6D with a 180 degree fisheye lens, luminance computed per pixel in millicandelas per square meter with Sky Quality Camera version 1.8.1, then divided into twelve 30 degree sectors and normalized to the whole-image mean. Moon phase and position from a published almanac; all but eight flights at waxing or waning moon. The site was relatively dark but not dark: the village edge was about 430 meters away and towns and cities lay between 3.7 and 30 kilometers off. The same spectroradiometer model was used in Appendix C.132. The measured illuminance values are in Figure S3 and have not been obtained, so this comment states no illuminance for this study.

Results. Of 50 individuals released with the lights on, two, being four percent, terminated their flight at a streetlight and showed the described disorientation, circling the lamp and falling to the ground. The distance from the last recorded waypoint to the nearest lamp did not differ between lights on and off, estimate minus 0.73 at a probability of 0.97. Twenty-eight individuals entered the 23 meter attraction radius, a figure taken from earlier work with the same lamp type; besides the two that terminated at a lamp, two more ended their flights inside the radius without being seen in the lit area, and the remaining 24 flew out again. Six, being twelve percent, passed within ten meters of a burning lamp without interrupting flight, and the distance of closest approach did not differ between lights on and off for moths leaving the circle, estimate minus 1.1 at 0.67. In a separate close-range check, seven Sphinx ligustri released ten meters from a lamp all circled and crashed. Tortuosity, by straightness index for hawk moths and sinuosity index for lappet moths: significantly increased by the lights in hawk moths when the moon was above the horizon, n equals 31, and in lappet moths when the moon was below the horizon, n equals 32. Barrier effect: lappet moths were significantly prevented from leaving the circle when lights were on and the moon not visible, probability 0.039, n equals 32; no barrier effect in hawk moths, probability 0.57, n equals 27, with 23 of 27 leaving the circle regardless of condition. One Laothoe populi was flown twice by chance, with tortuosity 0.19 with lights off and the moon below the horizon and 0.68 with lights on and the moon above it.

The skyglow null, recorded against the Foundation's interest. The authors tested whether flight direction followed sky brightness and found no evidence that it did. The brightest sky sectors were those carrying skyglow from named towns, and flight directions were widely scattered with overlapping credible intervals in Bayesian circular regressions; the animals also did not fly toward the moon when the moon was the brightest feature. The authors state this consolidates earlier findings. The comment reports it because it has elsewhere treated diffuse sky brightness as an exposure, and notes two limits on what it means: the authors tested direction only, so failing to find a directional preference is not finding no effect; and the result is consistent with the comment's product focus, since what changed these flights was the emission of a nearby product rather than the diffuse sum of distant ones. Part V.J.4 must be conformed to this.

The lamp, and the spectral position at its full strength. High-pressure sodium at 2,000 kelvin, which the authors note is "considered to be 'insect-friendly' because of the spectral composition of their light emissions." That is warmer than any white diode offered as a mitigation and warmer than the 3,000 kelvin ceiling the ecological literature recommends, including at Appendix C.134. It produced a barrier across a landscape and reduced flight efficiency in two families. With Appendices C.125, C.128, C.132 and C.133 this is the fifth and strongest demonstration that a spectral shift is a mitigation and not an answer. The authors expressly decline to generalize to diodes, writing that these "can vary considerably in spectrum and intensity" and that repeatability "will need to be specifically investigated for the different LEDs in the future." The comment respects that limit: this study does not show that a diode fragments a landscape, it shows that the lamp nominated as the least harmful does. That the

direction of the inference is unfavorable to the replacement lamp is the Foundation's own observation and is marked as such.

The geometry, which understated the exposure. The lamps stood 85 meters apart, which the authors note is unusually wide against European municipal pole spacing for roads of 25 to 45 meters, and they conclude that the barrier effect "would be even stronger with the typical streetlight design."

Controls, which are better than most in this appendix. Four conditions on Sphinx ligustri males other than those radar-tracked, released from the same point with the streetlights never on, toward female moths placed as pheromone traps 105 meters north and south: transponder fitted more than three hours earlier with no handling at release; transponder fitted immediately before release; the same handling without a transponder; and neither handling nor transponder. Nine to twenty releases per condition. Neither arrival frequency nor time to reach the females differed, at probabilities of 0.99 and 0.26. The limits are that the controls ran with the lights off throughout and in one species only. Where this comment criticizes other studies for the absence of a control, this design should be cited as the attainable standard.

What it does not establish. No females were tested, which bears on the authors' inference about reproductive success. The sample was pre-selected for positive phototaxis, which strengthens the four percent finding but means the behavioral results describe phototactic animals. The radar cannot resolve flight altitude, which is the authors' own explanation both for the close passes and for the difference between the two families, and they state that proving it requires three-dimensional tracking not presently available. Cells in the tortuosity analysis are small and unbalanced by the authors' description, and exact logistic regression was used in the barrier analysis for that reason. The choice of tortuosity index per family rests on an assumption about which family was native to the field, supported by where each was caught but not tested. The 23 meter attraction radius was borrowed. A flight ended where the signal was lost, which the authors say may mean the animal landed, flew out of detection range high or low, shed the transponder or was eaten, so the null on last-waypoint distance rests on an ambiguous endpoint. The twice-flown individual is a single animal in which both variables changed together. And nothing bearing on human health was measured.

Bearing on the statutory question. Three. The emissions limb of paragraph 360ii(a)(2) as Part II.D.4 construes it, for which the barrier effect and the tortuosity increase are effects of a characterized emission from a product class the Department regulates. Paragraph 360ii(a)(4), the duty to study and evaluate emissions and conditions of exposure, for which this is the strongest item in the comment: a direct measurement of how much of an exposure effect the established method of observation omits, and therefore a reason for the Department to measure rather than to rely on the published record, and a reason not to read an absence of recorded effect as evidence of absence. And the form of a performance standard under section 360kk, for which the 2,000 kelvin result shows that a spectral prescription does not dispose of the need to limit quantity, direction and duration. Part V.I, where it is used; Part V.J.4, where the instrument-blindness material must be consolidated; Part VI.B for the headlight observation; Part IX for the standard-drafting consequence.

C.136 Dietenberger, Jechow, Kalinkat, Schroer, Saathoff and Hölker (2024) — dimming fivefold did not reduce insect attraction; confining the same light to the target area reduced it to the level of no lighting at all

Citation. Dietenberger M., Jechow A., Kalinkat G., Schroer S., Saathoff B., Hölker F. "Reducing the fatal attraction of nocturnal insects using tailored and shielded road lights." Communications Biology. 2024;7:671. doi:10.1038/s42003-024-06304-4. Published 31 May 2024; erratum 24 June 2024 correcting stray text in a figure caption. Open access, Projekt DEAL. Leibniz Institute of Freshwater Ecology and Inland Fisheries, Berlin; Freie Universität Berlin; Albert-Ludwigs-Universität Freiburg; Brandenburg University of Applied Sciences. Data and code at Figshare, doi 10.6084/m9.figshare.23773365.

Funding, which is part of why the entry matters. The German Federal Agency for Nature Conservation, under the Federal Programme for Biological Diversity, with resources from the Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection, reference FKZ 3518685A_H08, for the project AuBe, which includes the experimental field site. The municipal sites belong to the project NaturLicht, funded by the Regierungspräsidium Karlsruhe under a state biodiversity program. The luminaire prototypes were developed with Selux GmbH, Berlin. A national conservation agency and a regional council therefore paid for the design, manufacture, installation and multi-year field evaluation of a product intended to emit less light where it was not wanted.

Why this entry matters, stated first. Because it is the only entry in this appendix that tests a product rather than observing an exposure. One emission characteristic was changed, the others were held fixed, the altered product was installed on public streets, and the effect was measured against an unlit control. That is the form of evidence a performance standard rests on. It is also the clearest instance in this comment of paragraph 360ii(a)(5) being discharged, by a government other than this one. And the characteristic it isolates is manufactured into the luminaire rather than chosen by whoever operates it, which places it within what section 360kk can prescribe without reaching anyone's conduct.

Design, experiment (i): the controlled field site. Westhavelland Nature Park, Brandenburg, 1,315 square kilometers, designated an International Dark-Sky Reserve in 2014. Two managed grassland fields about 600 meters apart, each carrying twelve commercial road lights at 4.5 meters on a 20 meter matrix: the western field lit, the eastern field permanently unlit as control. Flight interception traps on all twenty-four luminaires, with containers of 80 percent alcohol from sunset to sunrise, sampled monthly from March to October each year from 2019 to 2022, every sampling night scheduled near the third-quarter half-moon. Three lit configurations in succession, all at 3,000 kelvin: conventional diodes at a mean illuminance of 30.6 lux in 2019 and 2020, corresponding to the European standard EN 13201 for roads carrying motorized traffic at medium to high speeds and for conflict zones; the same luminaires dimmed by 82 percent to 5.6 lux in 2021, corresponding to class P4 for restricted traffic up to 30 kilometers per hour, residential streets, parking and cycle paths; and in 2022 tailored and shielded diodes at 5.2 lux, carrying an external glare shield around the panels and adjusted to a 2.5 meter path width, also meeting P4. Weather recorded on site by a Vaisala WXT520. Photometry by a mobiLux lux meter and a JETI specbos 1201-UV spectrometer; luminaire characteristics measured on an LMT Go-DS-2000 goniophotometer by the Technical University of Berlin.

Design, experiment (ii): three municipal sites. Baden-Württemberg, 2022, on streets beside nature reserves chosen to span urbanization and sky brightness, with 28 flight interception traps in total, sampled monthly from April to October on consecutive nights near half-moon. Half the trap-equipped luminaires at each site were converted and half left conventional; there were no dark controls, because the authorities would not permit street lighting to be switched off under real traffic. Alter Flugplatz, Karlsruhe, urban, the brightest site: conventional diodes at 4,000 kelvin against tailored diodes at 4,000 kelvin, five luminaires per treatment, nine samplings. Backofen Riedwiesen, suburban, Rhine floodplain: high-pressure sodium at 2,000 kelvin against tailored diodes at 2,700 kelvin, five per treatment, seven samplings. Heimbachaue, rural, northern Black Forest, the darkest: sodium at 2,000 kelvin against tailored diodes at 2,700 kelvin, four per treatment, seven samplings. A further control at Heimbachaue fitted amber film inside the tailored luminaires to bring them to 2,000 kelvin at 5.2 lux, over five additional sampling nights from June to September. Illuminance by an ILT-1600 and spectra by a JETI Specbos 1211 UV; luminance by a calibrated Canon EOS 6D with a 50 millimeter lens and iQ Luminance software and with a fisheye lens and Sky Quality Camera software; aerial images by drone.

The luminaire design. Optics selected and modeled in DIALux evo 11, then shielding added to a prototype and tested in the laboratory and fine-tuned, then one customized version

manufactured for each site from the measured width and length of the target surface and the height and spacing of the existing poles, then validated after installation and dimmed to match the illuminance of the fixture replaced. The stated aim was to suppress two kinds of spill light: light falling outside the target area, and the high luminance and near-horizontal emission at the exit aperture that makes a conventional luminaire visible from a distance. At the experimental site a hard cutoff reduced illuminance outside the target area to very low values. At the municipal sites the cutoff was deliberately softened to include one to two meters on each side of the path, the authors stating that this was so as not to impair any subjective sense of security. The prototypes were not optimized for energy efficiency, which the authors state was sacrificed to the shielding.

Statistics. Generalized linear mixed models per site in R, fitted with glmmTMB, negative binomial for Westhavelland, Alter Flugplatz and Heimbachaue and Poisson for Backofen Riedwiesen, with light treatment as a factor and mean temperature, wind speed and precipitation as continuous fixed effects, and luminaire number and sampling date as crossed random effects. Checked for overdispersion, zero inflation and residual autocorrelation with DHARMa. Tukey post hoc comparisons by emmeans. Community analysis by principal component analysis on the untransformed matrix, then PERMANOVA on Bray-Curtis dissimilarities of the square-root transformed matrix with 999 permutations, and homogeneity of group dispersions by betadisper.

Results. 7,240 insects over four years at the experimental site, excluding a mass emergence of more than two thousand Nematocera on 19 May 2019; the most abundant groups in the lit treatments were Nematocera at 3,196, Ephemeroptera at 754 and Sternorrhyncha at 689. Dark control totals were almost constant across the four years: 430 in 2019 and 2020, 397 in 2021 and 421 in 2022. Attraction relative to the unlit control was 7.7-fold for conventional diodes at 30.6 lux, 5.4-fold for the same luminaires dimmed to 5.6 lux, and 1.3-fold for the tailored and shielded luminaires at 5.2 lux. In the model, dimming had no significant effect, probability 0.812, while the tailored and shielded luminaires significantly reduced abundance, probability below 0.001, and in pairwise comparison did not differ significantly from any dark control. Temperature raised abundance and wind lowered it, both below 0.001; precipitation had no effect, 0.771. Community composition differed significantly between treatments, PERMANOVA with five degrees of freedom, R squared 0.633, F 22.764, probability 0.001, and within-group dispersion also differed, the tailored treatment falling between the lit treatments and the dark controls. At the municipal sites 1,553 insects were caught, most abundantly Nematocera at 465, Coleoptera at 329 and Hymenoptera at 319; the tailored luminaires caught about half as many as the conventional ones at each site, with probabilities below 0.001 at Alter Flugplatz, below 0.001 at Backofen Riedwiesen and 0.005 at Heimbachaue, and composition differed significantly at all three. Dispersion rose at the tailored luminaires at all three sites, significantly only at Heimbachaue, 0.049, against 0.140 and 0.055 elsewhere. In the amber-film control the catch fell to 33 percent of the conventional figure, against 50 percent at 2,700 kelvin. Fewer Lepidoptera were caught at the tailored luminaires at every site.

The three spectral results, which confirm the position settled at Part V.I. First, with correlated color temperature held at 4,000 kelvin on both sides at the urban site, the reduction still occurred, so the benefit was spatial. Second, at the two sites where the replacement raised the color temperature from 2,000 to 2,700 kelvin the reduction still occurred, which the authors note is not a matter of course because a higher value is expected to increase attraction; a geometry change overcame a spectral change in the adverse direction. Third, bringing the tailored luminaires down to 2,000 kelvin with amber film improved the result further, to a third rather than a half, which the authors say could constitute an additional optimization. Spectral change is a real mitigation; it was not the mitigation that did the work.

What it does not establish. It does not say what to prescribe. The luminaires were tailored individually and the shielding fine-tuned, and the published text states no cutoff angle, no upward light output ratio and no luminous intensity distribution; the goniophotometric

measurements are in a supplementary table not yet obtained. The dimming null is bounded: the authors write that a further reduction of intensity could have produced a measurable effect and that a threshold is hard to predict across taxa, so the null holds for 5.6 against 30.6 lux in this setting and is not a finding that quantity does not matter. At the experimental site the three lit treatments ran in successive years rather than simultaneously, so treatment is confounded with year, mitigated by the covariates and by the stability of the unlit controls. There were no dark controls at the municipal sites, and the authors state that the dispersion results would probably have reached significance at all three had there been. Insects were identified only to order or suborder. The cutoff at the municipal sites was deliberately not sharp. And trap catch measures insects that came to the luminaire: citing the radar study at Appendix C.135, these authors write that the number caught "represents only a fraction of the insects affected," which is the eighth attestation in this comment that the instrument cannot see the whole exposure and which here makes the reported reductions more likely to understate than to overstate the benefit. Nothing bearing on human health was measured.

Bearing on the statutory question. Four, and this is the widest bearing of any entry in this appendix. The emissions limb of paragraph 360ii(a)(2) as Part II.D.4 construes it. Paragraph 360ii(a)(5), the duty to develop, test and evaluate the effectiveness of procedures and techniques for minimizing exposure, of which this is a worked example performed by another government and the answer the Foundation offers to question 5.0. Paragraph 360ii(a)(4), for the characterization of the emission before and after modification. And the form of a performance standard under section 360kk, because the characteristic isolated here is the spatial distribution of a luminaire's emission, which is built into the product, testable on a goniophotometer before installation, and independent of how anyone subsequently operates the fixture. Part V.I, where it is used; Part II.G.3 and Part II.G.4, where the duty and the gap are set out; Part IV.G for the efficiency trade the authors disclose; Part V.M for the perceived-safety concession in the municipal design; Part VI.D for roadway lighting; Part IX.J for the shielding recommendation this supports.

C.137 Fabian, Sondhi, Allen, Theobald and Lin (2024) — insects do not fly toward light; they tilt their backs toward it, and a lamp at close range is a false vertical

Citation. Fabian S.T., Sondhi Y., Allen P.E., Theobald J.C., Lin H.-T. "Why flying insects gather at artificial light." Nature Communications. 2024;15:689. doi:10.1038/s41467-024-44785-3. Published 30 January 2024. Open access. Department of Bioengineering, Imperial College London, and the Institute for Environment, Department of Biology, Florida International University. Fabian and Sondhi contributed equally; Theobald and Lin jointly supervised. No competing interests declared. A peer review file is published and one reviewer, Aaron Corcoran, is named. Data and code at Figshare, doi 10.6084/m9.figshare.24771978.

Funding, recorded because of whose it is. The European Research Council, starting grant 804315, Vision-In-Flight; the National Science Foundation, award IOS-1750833; and the United States Air Force Office of Scientific Research, MURI award FA9550-22-1-0315. Fieldwork was additionally supported by the Susan Levine Foundation, a National Geographic Explorer grant, the American Philosophical Society and a Tinker Field Research Collaborative grant. Two agencies of the United States part-funded the determination of the mechanism by which artificial light disrupts insect flight. The comment records this at Part V.I.

Why this entry matters, stated first. Because it answers the question that every other entry in this subsection assumes. The entries on moths and the mosquito report that light changed what an animal did. This one establishes why, and the answer is not attraction. Most flying insects keep their backs to the brightest part of the visual field, which through evolutionary time has been the sky and is therefore a reliable indicator of which way is up. A bright lamp at close range substitutes a false vertical. An insect obeying the reflex banks toward it, banking turns the flight path, and the animal circles the source. On that account the governing characteristic of the emission is its direction, which is what the study at Appendix C.136 independently found by building a luminaire and measuring the result.

Design. Three strands. Field: 477 stereo-videographic recordings at 500 frames per second of wild insects near artificial light, at the Monteverde biological stations in Costa Rica in January and February 2022 and May 2023 under national permits, filmed under 850-nanometer infrared illumination taken to be invisible to the subjects, median recording duration 1.7 seconds. Laboratory: eight Qualisys infrared motion capture cameras at 240 frames per second around a two-meter white tent, tracking a three-marker L-shaped frame glued to the thorax under local ultraviolet cure after immobilization on ice, the frame weighing about 5 percent of bodyweight for the lightest subject, with a marker residual of about 0.24 millimeters; 538 continuous trajectories from 599 tracks across four species, being the common darter dragonfly Sympetrum striolatum, n equals 12, the migrant hawker Aeshna mixta, n equals 2, the yellow underwings Noctua pronuba and N. fimbriata, n equals 8 and 2, and Lorquin’s atlas moth Attacus lorquinii, n equals 3. Light sources were an ultraviolet diode bulb at 395 nanometers, an actinic tube peaking at 370 nanometers, and a cool-white diode bulb; controls were broad-spectrum diffused ceiling light for the dragonflies and a low-intensity diffuse ultraviolet ceiling for the moths. Manipulations: reversing the light direction against a white sheet above or below; 200 trials on insects under 2 centimeters from 13 families in 6 orders in a 20-centimeter tank with light above or below; switching between two ultraviolet lamps while a wild insect circled one; and an agent-based simulation of the proposed reflex.

Results. Velocity concentrated orthogonally to the light in all four species, Rayleigh z of 1356.10, 102.09, 624.90 and 359.30, all probabilities below 0.001, against z of 0.43 at probabilities of 0.36 under a diffuse canopy and 0.65 in darkness. Dorsal tilting index, the dot product of the projected dorsal axis with the direction to the light on a scale of minus one to one: 0.84, 0.79, 0.82 and 0.82 with the light on, and 0.17 with it off. Bank angle medians rose from 11.9, 13.9, 20.2 and 8.7 degrees under control conditions to 43.8, 48.0, 29.3 and 30.7 degrees near a point source, Wilcoxon probabilities all below 0.001. Three abnormal motifs — orbiting, stalling and inverting — occurred in ten orders of insect near light and in under 2 percent of recordings made in the dark. Path tortuosity had a median of 3.21 near a point source against 1.21 under a diffuse canopy, Wilcoxon Z of 6.32; insects turned preferentially toward the light near a point source, chi-squared 114.66 at n equals 371, and not under the canopy, 0.79 at n equals 183. Reversing the light: insects inverted and crashed over a downward-lit sheet and flew normally under an upward-lit one. Small insects: all taxa flew upward stably under a diffuse ultraviolet ceiling and, with the same light below, none except Drosophila could maintain flight; the flies tipped and crashed over ultraviolet but not over cool-white light. Light switching: of 70 recordings, 37 showed an insect transferring to the second lamp, and in 25 of those 37 the animal changed the side it presented to the light, with three further animals reversing on the same lamp without a switch. Simulation: a four-parameter proportional controller reproduced all three motifs from a single tuning with different entry positions, and across 300 randomized five-second runs the dorsal-tilting agents did not escape, median range change minus 0.06 meters per second and not different from zero at 0.45, while agents without the response dispersed at plus 1.85, and agents implementing a corrupted celestial compass escaped at minus 1.75. Statistics were Bonferroni corrected to a threshold of 0.003 and trajectories subsampled to 10 hertz against pseudoreplication.

The four prior explanations, and what became of them. Escape to the light is refuted by orthogonal flight. The corrupted celestial compass is refuted by the light-switching result, since a compass requires the light to be held on a constant side, and by the simulation, in which compass agents escaped; the authors also note the absence of the logarithmic spirals that model predicts, and that it cannot explain stalling or inversion over a lamp. Thermal radiation was already refuted and is refuted again by diodes, which emit negligible infrared and trap insects in great numbers. Blinding is refuted by the regularity of the behavior. On that last point the comment enters a caution of its own at Part V.I: what is refuted is blinding as the explanation of this insect behavior, and nothing here bears on the high-luminance impairment of human vision and recovery that Part V.C treats on its own evidence.

The authors' mitigation sentence. That "reducing unnecessary, unshielded, upward-facing lights and ground reflections can mitigate the impact on flying insects at night, when skylight cannot compete with artificial sources." Quantity, direction, direction, and the reflectance of the surface beneath. The comment observes at Part V.I, as its own observation and not the authors', that the adjective they reached for first is the one Congress used in paragraph 360ii(a)(2).

What it does not establish. Nothing about human health. Within its own subject: the field classification of motifs was by eye and the authors call it somewhat subjective; the field dataset is biased toward large insects because a subject had to reflect enough infrared to track, the authors stating that most insects at their light were under a centimeter while the mean in their data was 29 plus or minus 9 millimeters and that clear-winged butterflies showed the response but could not be digitized; wind could not be excluded and airspeed could not be estimated; the laboratory work rests on four species with 2 to 12 individuals each, with a marker glued to the thorax and no formal control beyond the absence of visible difference; wavelength was not systematically studied and the authors say so; range was not tested at all and the authors expressly decline to explain arrival from a distance, citing one experiment in which 2 of 50 moths released at 85 meters ended their flights at the light; two taxa were immune, three oleander hawkmoths across 71 trajectories with an index of 0.24 and wild vinegar flies, for reasons the authors cannot give, noting that oleander hawkmoths are readily trapped in the field; and the authors state that they do not understand why insects do not tilt toward the moon or a low sun, which is an acknowledged gap at the center of the account. No fitness, reproductive or population endpoint was measured.

Bearing on the statutory question. Three. The emissions limb of paragraph 360ii(a)(2) as Part II.D.4 construes it. Paragraph 360ii(a)(4), the duty to study and evaluate emissions and conditions of exposure, for which this is a characterization of what a condition of exposure does mechanically rather than statistically. And the form of a performance standard under section 360kk: of the characteristics of an emission, the direction is the one that determined this effect, with quantity and spectrum held constant across the decisive comparison. Part V.I, where it is used and where it precedes the study at Appendix C.136 that supplies the remedy; Part V.C for the caution about blinding; Part V.J.4 for the reason a trap at a lamp post records a fraction of what is affected; Part II.H and Part IX.E for the funding observation; Part IX for the direction request.

C.138 Jones, Llamas and Phillips (2023) — resident songbirds in brighter parts of a city have smaller eyes; migratory ones do not, and the exposure variable is the satellite index this comment criticizes

Citation. Jones T.M., Llamas A.P., Phillips J.N. "Phenotypic signatures of urbanization? Resident, but not migratory, songbird eye size varies with urban-associated light pollution levels." Global Change Biology. 2023;29. doi:10.1111/gcb.16935. First published 20 September 2023. Volume, issue and page range to be completed. Funded by the Life Sciences Department and the College of Arts and Sciences at Texas A&M University-San Antonio, Friends of Government Canyon, and Texas Eco-Lab. No conflicts or competing interests. Data openly available in the Illinois Databank, doi 10.13012/B2IDB-6010827_V1. Capture and handling under Texas A&M-San Antonio animal care protocol 2021-05, United States Geological Survey Bird Banding Laboratory permit 24294 and Texas Parks and Wildlife permit SPR-0522-086.

Why this entry is in the appendix, stated first. For two reasons, neither of which is the headline finding. It is the clearest instance in the collection of a causal claim about light pollution resting on an exposure variable that cannot record the wavelengths at issue, with no acknowledgment of the limitation; Part V.J.4 uses it for that and explains why an instance without an admission is worth more to the argument than another admission would be. And its contrast between year-round and seasonal residents is a statement about duration of exposure that does not depend on the accuracy of the exposure metric. The eye-size finding itself is novel and the Foundation does not dispute it, but the authors read it as adaptation rather than as injury, and the comment does not offer it as evidence of harm.

Design. San Antonio, Texas, March to July 2022. Nine sites classified by the proportion of impervious cover within a 3.22 kilometer radius, digitized by hand from 2022 satellite imagery: five edge sites below 50 percent and four core sites above it. 502 breeding birds caught in mist nets using conspecific playback, mobbing calls or flushing from nests, then banded, aged, sexed, measured and released. Four species: the resident Carolina Wren, 21 edge and 68 core, and Northern Cardinal, 50 and 35 females and 54 and 66 males; and the migratory Painted Bunting, 76 and 35, males only, and White-eyed Vireo, 44 and 53. Morphology: tarsus, wing and tail length, reduced by principal component analysis to a single frame-size variable per species explaining 44 to 55 percent of variance, together with body mass and lateral eye width, the eye measurement replicating a published method. Analysis by generalized linear mixed models with study site as a random effect, ranked by Akaike information criterion corrected for small samples against a null model, with inference based on whether 85 percent confidence intervals of coefficients overlapped zero.

Exposure characterization, which is the reason for the entry. Three environmental variables. Noise: A-weighted equivalent continuous level over four minutes at nests and territories with a type 1 sound level meter, the microphone repositioned to each cardinal direction each minute, sampled in the morning or between four and eight in the evening. Light pollution: values read from a public online light pollution map using its 2021 Visible Infrared Imaging Radiometer Suite product, in radiance units of 10 to the minus 9 watts per square centimeter per steradian, sampled at one point per tenth of a square kilometer and averaged per site. Brightness: the proportion of open, brightly lit area on each site, digitized by hand in the same way as the impervious cover. Temperature from a public climate database, five-year mean annual, excluded from the analyses because it appeared confounded by latitude. The light pollution variable is therefore the Day/Night Band radiance whose band begins at 500 nanometers and which is blind to the emission of a white diode below that wavelength, as Part V.J.4 sets out. The authors do not mention that limitation anywhere.

The collinearity the authors do state. Light pollution and brightness were correlated at 0.96 across the nine sites. The authors report it, decline to include both in any model because of it, and state that sites with greater light pollution also had more open, brighter areas during the day. Their own summary attributes the finding to light levels comprising both daytime brightness arising from urban development and artificial light at night. The study therefore cannot separate a nighttime exposure from a daytime one, and does not claim to.

Results. Body mass: the null model was best for four of the five species and sexes. Frame size: the null model was best for four of five. The exception in both was the Painted Bunting, which was smaller in the core — and a post hoc analysis showed why. The ratio of older to younger males was six to one at edge sites and one to two in the core, older males are significantly larger, and when age was included as a covariate the core-edge difference disappeared, the 85 percent intervals running from minus 0.743 to plus 0.086 for frame size and minus 0.429 to plus 0.49 for mass. The negative association between bunting body size and noise survived. Eye size: the null model was best for both migratory species, indicating no effect. In the Carolina Wren, eye size was negatively associated with light pollution, coefficient minus 0.007 with an 85 percent interval of minus 0.013 to minus 0.002, and with brightness, minus 0.525 and minus 0.937 to minus 0.113, and core birds had smaller eyes, minus 0.170. In male Northern Cardinals the same pattern held, light pollution minus 0.008 with an interval of minus 0.011 to minus 0.004, brightness minus 0.540. In female cardinals brightness was the best model, minus 0.578, but the null model competed within two units of the information criterion, so the authors pooled the sexes post hoc and recovered the association, light pollution minus 0.007 with an interval of minus 0.010 to minus 0.003. The authors also observe that variation in eye size appears to narrow in more light polluted areas.

What it does not establish, beginning with the exposure. The exposure metric cannot record the wavelengths most relevant to a visual system, and cannot be separated from daytime openness at a correlation of 0.96. All environmental variables are site-level and there are nine

sites, so the effective number of exposure units for the central relationship is nine rather than 502; the authors handle this correctly by treating site as a random effect, but the coefficient is still estimated across nine values. Inference rests on 85 percent confidence intervals, which is a defensible convention in information-theoretic model selection and is not the conventional 95 percent; the wren light-pollution interval in particular runs from minus 0.013 to minus 0.002 and would be unlikely to exclude zero at 95 percent. The mechanism is unknown and the authors say so: they cannot distinguish selection from developmental plasticity, and they could not test for the age-structure confound in the resident species because those species cannot reliably be aged, which is notable because the age-structure confound is what their own bunting analysis uncovered. Their argument that age cannot explain the eye result, being that eye size should not change with age while wing and tail do, is reasoning rather than measurement. One city, one breeding season, cross-sectional. And the authors interpret smaller eyes as advantageous in bright environments, so the finding is that the exposure is strong enough to shape morphology and not that it injures.

A transcription error in the published text. For male Northern Cardinals the sentence reporting the core-edge difference gives a coefficient of minus 0.144 with a standard error of 0.062 and an 85 percent interval of minus 0.011 to minus 0.004. That interval does not contain the coefficient and is evidently repeated from the light-pollution line above it. The correct interval must be obtained from the authors or from the deposited data before the figure is cited.

The methodological lesson, which is worth more than the finding. The bunting result looked like phenotypic divergence caused by urbanization and was demography. The authors state the general point themselves: without accounting for differences in age and age structures they might have erroneously concluded that they had evidence of an evolutionary response. That is a test a reader can apply to any observational comparison between a more exposed and a less exposed population, and it belongs beside the photoperiod test recorded at Part V.A, which came from a different study and does the same work: before an apparent effect of exposure is accepted, ask what else differs between the groups that was not measured.

Bearing on the statutory question. Three. Paragraph 360ii(a)(4), the duty to study and evaluate emissions and conditions of exposure, for which this is the tenth and most instructive instance of an exposure variable that cannot record the quantity at issue, and the first in which the limitation is not disclosed. The emissions limb of paragraph 360ii(a)(2) as Part II.D.4 construes it. And the duration of an exposure as a characteristic a performance standard may address, for which the contrast between the year-round and the seasonal residents is suggestive. Part V.J.4, where it is used and where it is added to the satellite-exposure census; Part V.A, for the age-structure test; Part V.C, only to note that a study of eye morphology is not a study of visual function and the comment does not treat it as one.

C.139 Sánchez de Miguel, Bennie, Rosenfeld, Dzurjak and Gaston (2022) — the spectral composition of European night lighting mapped from astronaut photographs, and the masking by the satellite instrument measured rather than inferred

Citation. Sánchez de Miguel A., Bennie J., Rosenfeld E., Dzurjak S., Gaston K.J. "Environmental risks from artificial nighttime lighting widespread and increasing across Europe." Science Advances. 2022 Sep 14;8(37):eabl6891. doi:10.1126/sciadv.abl6891. Open access. Supported by Natural Environment Research Council grant NE/P01156X/1 and by the European Union's Horizon 2020 research and innovation programme under Marie Skłodowska-Curie grant agreement number 847635 (UNA4CAREER).

Why this entry is in the appendix. For four things, none of which is a finding about health. The specification of the two satellite instruments on which the global record of artificial light at night depends. The measurement, rather than the inference, of what those instruments omit. The demonstration that an index weighted by the biological consequence of a spectrum can be computed and mapped across a continent. And the authors' statement that the short-wavelength

content of white light-emitting diode lighting is a design choice rather than a property of the technology.

Design. Remote sensing. There are no human or animal subjects, no organism is exposed to anything, and no outcome is measured in any organism. Color photographs of the night side of Earth taken by astronauts aboard the International Space Station with Nikon D3, D3S, D4 and D5 digital single-lens reflex cameras were obtained from the NASA Johnson Space Center, passed individually through a nine-stage calibration and correction pipeline — decodification, linearity correction, flat field and vignetting, spectral characterization of the channels, astrometric calibration, georeferencing, photometric calibration against stars of known flux, radiometric correction for the camera settings, and atmospheric correction — with cloud masked manually, then mosaicked into two composite maps, one for 2012 to 2013 and one for 2014 to 2020, at five-hundred-meter resolution, clipped to twenty-six European countries.

The instrument specification, which is the first reason for the entry. Quoted in full at Part V.J.4. In summary: the key sensors are panchromatic and carry no spectral information; they are insensitive to the blue part of the visible spectrum, which the authors give as 380 to 450 nanometers; the Defense Meteorological Program Operational Line-Scan System was sensitive from 450 to 1,000 nanometers; and the Suomi-National Polar-Orbiting Partnership and NOAA20 Visible and Infrared Imaging Radiometer Suite Day/Night Bands are sensitive from 480 to 920 nanometers. The Foundation does not treat these figures as findings. They are properties of the sensors and are checkable against the sensor documentation independently of this paper, which is why the methodological reservations recorded below do not reach them.

Finding — the spectral shift. The blue-to-green ratio rose from a median of 0.35 with an interquartile range of 0.22 to a median of 0.36 with an interquartile range of 0.17 (Kruskal-Wallis chi-square 50.34, one degree of freedom, p below 0.001). The green-to-red ratio rose from 0.50 with an interquartile range of 0.19 to 0.55 with an interquartile range of 0.17 (chi-square 23,459.12, p below 0.001). Synthetic photometry attributes the first period to a mixture of high-pressure sodium and white lamps and the second to white light-emitting diode or other white technologies. The baseline varied greatly by country: Belgium and Ireland orange from low-pressure sodium, Austria and Germany whiter from fluorescent and mercury vapor. The authors record that in 2005, 56 percent of European streetlights were sodium (47 percent high-pressure, 9 percent low-pressure) and 43 percent white (32 percent mercury, 3 percent metal halide, 8 percent fluorescent); that 51 percent of United Kingdom public street lighting had been converted to light-emitting diodes by early 2019; that in Spain light-emitting diodes were 61 percent of sales and 56 percent of street lighting by 2017; and that Milan was the first mayoral city in Europe to convert its street lighting wholly to white light-emitting diodes.

Finding — intensity, and an arithmetic discrepancy the Foundation reports because it found it. Green-band median intensity is reported as rising from 10.59 to 11.77 nanowatts per square centimeter per steradian, which the paper gives as 11.1 percent and which those two medians yield as 11.14 percent. Blue-band median intensity is reported as rising from 3.6 to 3.88 in the same units, which the paper gives as 24.4 percent and which those two medians yield as 7.78 percent. The parallel construction of the sentence, and the exactness of the green-band agreement, indicate that one of the three blue-band figures is wrong. The Foundation cannot determine which from the published text and does not rely on the magnitude. It notes that the Kruskal-Wallis statistic for the blue-band change is 166.50 against 1,366.09 for the green, so the blue comparison is much the weaker of the two, which sits more comfortably with the smaller figure than with the larger. Whichever is correct, the conclusion that the composition shifted toward shorter wavelengths rests on the color ratios rather than on the absolute band intensities, and the authors state in their Methods that the absolute values carry the larger uncertainty because the window of the Space Station through which a given photograph was taken is not known.

The three indices, and what they are. The authors re-expressed the color maps as three indices of biological consequence, each computed from the color ratios through published

response curves. The melatonin suppression index rose from a median of 0.41 to 0.42 computed from the blue-to-green ratio and from 0.20 to 0.23 computed from the green-to-red ratio. The star light index rose from 0.64 to 0.65 and from 0.44 to 0.47 on the same two routes. A measure of the phototactic response of moths is reported as rising by at least 3 percent, and the same measure weighted by intensity by 10.9 percent, from 3.28 to 3.64 nanowatts per square centimeter per steradian. Country-by-country figures for the color ratios and for the melatonin suppression index are in the supplementary tables, which the Foundation has not obtained.

What the three indices are not. Three independent measurements. They are deterministic functions of the same two color ratios, and the paper's own statistics establish it: the Kruskal-Wallis statistic of 23,459.12 is reported three times, for the green-to-red ratio itself, for the melatonin suppression index derived from it and for the star light index derived from it, because a monotone transformation of a variable leaves the ranks on which that statistic is computed unchanged. The statistic of 1,253.44 likewise appears twice. A reader who treated the melatonin, starlight and phototaxis results as three lines of evidence would be counting one measurement three times, and this comment does not do so. The Foundation also records that the medians and interquartile ranges printed for the relative phototactic response are identical to those printed for the melatonin suppression index computed from the blue-to-green ratio, while the chi-square differs, and that a rise from 0.41 to 0.42 is 2.4 percent rather than the "at least 3%" the sentence claims. Those figures require verification against the published article before any of them is relied on.

Bats. The blue-to-green and green-to-red ratios rose across the geographic ranges of almost all bat species breeding in Europe. Range data were available for thirty-eight species; the exceptions were Plecotus kolombatovici and Rhinolophus blasii, restricted to southeastern Europe, and Myotis alcathoe; no range data existed for Barbastella caspica, Eptesicus anatolicus and Miniopterus pallidus. This is an overlay of published range polygons on the light maps. No bat was observed, nothing was measured in any animal, and the Foundation reports the result as a statement about where the lighting changed rather than as an effect on bats. For the same reason this entry is not counted among the entries at Part V.A.3 that rest on non-human subjects.

What the authors say about necessity. Two sentences, quoted at Part V.J.4 and not repeated here. The first is that the benefits of the technology do not rest principally in the ability to produce broad white emissions, which other technologies can also produce. The second is that the shift toward whiter emission was intentional and was made to improve color rendering for human vision. They add that attempts to implement light-emitting diode systems without strong short-wavelength emissions have to date been limited.

What it establishes. That the two satellite instruments on which the global record depends do not record the wavelengths at which a white light-emitting diode emits most strongly. That the resulting underestimation is progressive rather than constant, and has been measured across a continent over a decade. That the spectral composition of outdoor lighting across twenty-six European countries shifted toward shorter wavelengths between 2012 and 2020, unevenly and in a pattern that follows national policy rather than geography. And that an index weighted by the biological consequence of a spectrum can be computed from available imagery and mapped at five-hundred-meter resolution across a continent.

What it does not establish. That the measured shift caused any effect in any organism. The three indices express the potential of a spectrum to produce an effect, computed from published response curves; they are not observations of melatonin in anyone, of the visibility of stars to any observer, or of the flight of any insect. Nor does the paper establish the magnitude of the blue-band intensity increase, for the reason given above.

Considerations bearing on confidence. Against. The imagery is opportunistic: astronauts photograph what they photograph, and the authors say the images were not obtained systematically. The two periods are unequal, two years against seven. The camera has three

broad channels and is not a spectrometer, so the spectra are inferred rather than measured. The georeferencing error is about four pixels, which at five-hundred-meter resolution is roughly two kilometers, and the authors accordingly analyze continental distributions rather than change in individual pixels. Outliers were removed at stated thresholds, and the composites were masked using the Visible and Infrared Imaging Radiometer Suite product at half a nanowatt per square centimeter per steradian, so the corrective map is bounded below by the instrument whose blindness is its subject. In favor. Peer-reviewed in a journal of general science, open access, with code and surfaces deposited. The calibration pipeline is described stage by stage and was published separately. The authors state the limitation on the absolute intensities themselves and say which of their quantities is the better determined. And the figures on which this comment relies most heavily, the band limits, are not findings at all.

Competing interests, as disclosed by the authors. The declaration reads: "In the interest of full disclosure, A.S.d.M. and K.J.G. serve as uncompensated members of the board of directors of the International Dark-Sky Association." The Foundation reports this because it relies on the paper and because the disclosure is the authors' own. It bears on the interpretive passages of the Discussion. It does not bear on the band limits of the sensors, which are properties of hardware.

Relation to other entries. Two. First, the exposure variable of the breast cancer study at Appendix C.7 — International Space Station photographs at approximately thirty-meter resolution, carrying a melatonin suppression index — is the method this research group developed.7 records as an open question whether the index used there is the published index of Aubé and colleagues, who is among the authors of that study. This paper attributes its own melatonin suppression index to a numbered reference the Foundation has not yet obtained. The question is therefore closer to resolution but is not resolved. Second, Sánchez de Miguel, Bennie and Gaston are three of the ten authors of the instrument paper relied on at Part V.J.4, and Gaston and Bennie appear elsewhere in this appendix. That is relevant to the consolidated statement of recurring investigators that Part V.A is to carry, and which has not yet been written.

Bearing on the statutory question. Three. Paragraph 360ii(a)(4), the duty to study and evaluate emissions of and conditions of exposure to electronic product radiation: this paper is the clearest available demonstration that the national measurement of this emission does not record the part of it that matters, and that the shortfall grows over time. Paragraph 360ii(a)(2), the duty to support research: the remedy the field identifies is an instrument that does not exist, and the work-around is photographs taken by hand out of a window. Section 360kk, the performance-standard authority: the paper demonstrates that a spectral index is computable at scale, which is what Parts IX.G.1 and IX.J ask the Department to prescribe in place of correlated color temperature, and it supplies the answer to the objection that such a standard would be a standard against light-emitting diodes. Parts V.B.1, V.B.3, V.J.4, IX.G.1 and IX.J.

C.140 Parlin, Stratton and Guerra (2022) — a lamp switched on at night makes quiescent migratory monarch butterflies fly at once, and in a direction that shows their clock has been shifted

Citation. Parlin A.F., Stratton S.M., Guerra P.A. "Oriented migratory flight at night: Consequences of nighttime light pollution for monarch butterflies." iScience. 2022 May 20;25(5):104310. doi:10.1016/j.isci.2022.104310. Open access. The authors declare no competing interests. Raw orientation data are published as supplementary Data S1.

Why this entry is in the appendix. For four reasons and not for the headline. Because the response was immediate and nearly universal rather than graded, which no other entry in the appendix shows. Because the subject is a diurnal animal and almost every other organism in this collection is nocturnal or crepuscular. Because the study was done in the United States on a United States population while nearly all the ecological evidence here is European. And because its supplementary exposure analysis is the eleventh instance at Part V.J.4 of an exposure

variable that cannot record the wavelengths the study's own mechanism depends on, and the second that makes no admission.

THE EMITTER WAS NOT A LIGHT-EMITTING DIODE, stated before anything else. A full-spectrum halogen bulb, 120 volts, 250 watts, 4,000 lumens, R7S base, named manufacturer and model, in a named work light on a tripod, with ultraviolet A and B content. The Foundation does not offer this study as evidence about light-emitting diode products and the body at Part V.I says so twice. The investigators tied their source to the deployed stock by intensity and not by spectrum: using a manufacturer's floodlight tool they computed the illuminance their source produced at four distances against three named light-emitting diode floodlights at 3,000 kelvin, and they state that their source is orders of magnitude less bright than much of the lighting found outdoors at night.

Design. Indoor flight-simulator trials in a darkened laboratory, with one set in a planetarium. Wild fall adult monarchs (Danaus plexippus), mixed sex, were caught at the University of Cincinnati Center for Field Studies in southwest Ohio between 1 September and 26 October during the 2019 and 2020 fall migrations, housed at a 12-hour light cycle with day temperature 21 and night temperature 12 degrees Celsius, and fed a honey solution. Animals were tethered by a non-invasive method of the authors' own publication, permitting release after testing. The simulator was zeroed to geomagnetic north at the animal for every trial. Ambient temperature at the animal was 22.34 plus or minus 0.93 degrees Celsius throughout. Night handling was done under red light with under thirty seconds out of the incubator at each end and under twelve minutes total exposure.

Exposure, and what is missing. The spectral properties of the source were measured with a spectrometer and a cosine-corrected optic fiber at the animal's position, five measurements for each lamp position, converted from radiance to photon flux. Light levels were measured with a traceable dual-display light meter. None of those values appears in the body of the paper. They are in supplementary figures and a supplementary table the Foundation has not obtained, and until it does, this entry states no illuminance and no irradiance. The Foundation records that as a fact about this paper and not as a criticism: the measurement was made and deposited. It records it because a performance standard is built from exposure quantities, and an exposure quantity in a supplementary file is harder for a regulator to reach than one in a methods section.

Daytime results, which establish that the lamp substituted for the sun. Morning lamp position, azimuth 110 and elevation 29 degrees: mean heading 231 degrees, Rayleigh r 0.725, p 0.0012, n 13. Afternoon position, azimuth 245 and elevation 31 degrees: 217 degrees, r 0.747, p below 0.001, n 13. The two did not differ. Neither differed from two previously published datasets of fall monarchs tested outdoors, by disappearing bearing and by outdoor flight simulator. With the lamp at a solar-noon elevation of 53 degrees, corresponding to 15 September in southwest Ohio, orientation was maintained at 228.5 degrees, r 0.612, p below 0.01, n 12. With the lamp at 34 degrees, corresponding to 5 November and outside the 46 to 57 degree solar-noon window that an earlier hypothesis says governs oriented fall flight, orientation was lost: r 0.46, p 0.0613, n 13. Animals on a light-dark cycle delayed by six hours shifted their heading by 97 degrees, to 314 degrees, r 0.801, p below 0.0001, n 13.

Night results, which are the finding. Seventy-eight monarchs were introduced to the simulator in darkness at three points in the night cycle, with the lamp at the morning azimuth. They were quiescent in the dark. When the lamp was switched on, 75 of the 78, which is 96 percent, flew immediately. Forty-seven of the 75 met the criterion of one minute of burn-in followed by five minutes of continuous flight, and 42 of those 47 flew directionally. At the fifteenth hour of the cycle the group heading was 15 degrees with the lamp held to the right, which is afternoon behavior and a phase delay: r 0.73, p below 0.01, n 10. At the eighteenth hour it was 233 degrees with the lamp held to the left, which is morning behavior and a phase advance: r 0.64, p below 0.01, n 12; and in a second condition at the same hour with the lamp moved to an afternoon position, 296 degrees, r 0.90, p below 0.001, n 10. At the twenty-first hour, 232 degrees, r 0.67, p below 0.01, n 10.

The mechanism the authors identify, and what the study did not do about it. In the monarch antennal clock the absence of light drives transcription of cryptochrome 2, timeless and period; in the presence of light, cryptochrome 1, which the authors describe as a blue-light circadian photoreceptor, degrades the timeless protein and allows the other two to enter the nucleus and repress transcription. The light-sensitive step is therefore attributed to a blue-sensitive receptor. The study did not vary wavelength and tested nothing about it. No molecular measurement was made in this study at all: the phase shift is inferred from flight direction and matched to a published mathematical model of the clock. Part V.I states both limitations and expressly declines the available inference that a blue-rich source would do at least as much.

What it establishes. That a single artificial light source of ordinary outdoor intensity, switched on during the night phase, triggers full diurnal migratory flight behavior in an animal that is quiescent in darkness, immediately and in 96 percent of individuals. That the direction of that flight is consistent with a shifted circadian clock, delayed by light early in the night and advanced by light later. And that an artificial lamp can supply the same directional cues as the sun to an animal that navigates by the sun, the authors writing that animals like monarchs are unable to distinguish between the sun and artificial light.

What it does not establish. Nothing about human health. Nothing about light-emitting diode products, for the reason stated above. Nothing about behavior in the wild: the authors state that there are no documented reports of monarchs flying at night during the fall migration and that fall night temperatures are often too low to sustain flight, and they offer the urban heat island effect and warming nights as reasons the behavioral consequence could become real. It does not establish an effect on survival, on arrival at the overwintering sites, or on any population.

Considerations bearing on confidence. Against. Tethered virtual flight in a simulator rather than free flight. Across all trials, 39 percent of animals flew at all, 112 of 287, so the analyzed sample is a minority selected by willingness to fly; the authors state the figure and compare it to other work with the same apparatus. Group sizes are small, between 6 and 13. The clock shift is an inference from behavior matched to a model, not a measurement. The exposure level is not in the body of the paper. In favor. Wild-caught animals during two actual migrations rather than captive stock, which matters here because the authors themselves discuss evidence that captive-reared monarchs orient differently. A non-invasive tether permitting release. The daytime arm validates the apparatus against two independent published outdoor datasets and matches both. The source was characterized with a spectrometer and tied by computation to named commercial luminaires. Raw data openly deposited. The authors declare no competing interests and state the limitations of the study in a section of their own.

The vocabulary, which matches this comment's. The authors frame the study as being about light trespass, which they define as light cast where it is unwanted or not needed at night, from buildings and streetlamps, and they place it within a taxonomy of nighttime light pollution comprising glare, over-illumination, skyglow and light trespass. That is substantially the taxonomy Part I of this comment takes from CIE 150:2017 and that Part II.H.3 identifies as the subject of paragraph 360ii(a)(2) named in another vocabulary. The convergence is recorded; no authority is claimed from it.

The recommendations the authors make. That conservation efforts at habitat refuges and stopover sites should consider the location, timing, positioning and type of lights, which they gloss as wavelength and lumens. That habitat creation should take account of existing lights and avoid siting habitat such as pollinator gardens where it will be exposed. And that captive rearing for conservation or commercial release should follow best practices on light, including ecologically relevant photoperiods and the elimination of light perturbation during the subjective night. The last is concrete and implementable and is not presently used anywhere in this comment.

A fact about the species that the Foundation records and declines to use. The monarch butterfly was proposed for listing as a threatened species under the Endangered Species Act by the United States Fish and Wildlife Service in December 2024, with a proposed rule under section 4(d) and proposed critical habitat at overwintering sites in California. No final rule has issued so far as the Foundation is aware, and the determination has been deferred more than once. The Foundation does not rely on any of this and does not mention it in the body of the comment. The reasons are that the proceeding is under a different statute administered by a different Department, that its posture is contested and moving, and that nothing the Foundation asks of this Department depends on it. The fact is recorded here so that the decision not to use it is a decision on the record rather than an omission.

Bearing on the statutory question. Two. Paragraph 360ii(a)(2) on its emissions limb as Part II.D.4 construes it: this is evidence about what an emission does, and the Secretary is directed to develop techniques for minimizing unnecessary electronic product radiation, of which light cast where it is not needed is the engineering archetype. Paragraph 360ii(a)(4), the duty to study and evaluate conditions of exposure, for which the supplementary roost analysis is the eleventh instance at Part V.J.4 of an exposure variable that cannot record the wavelengths at issue. Parts V.A.3, V.B.1, V.I and V.J.4.

C.141 McMahon, Smyth and Davies (2022) — modeling three predators' color vision, the one study collected here in which a narrow-band lamp removed the modeled effect

Citation. McMahon O., Smyth T., Davies T.W. "Broad spectrum artificial light at night increases the conspicuousness of camouflaged prey." Journal of Applied Ecology. 2022. doi:10.1111/1365-2664.14146. First published 25 March 2022. Handling editor Mariana Mayer-Pinto. Supported by the Natural Environment Research Council, grant NE/S003533/2. No conflict of interest declared. Data deposited at the Dryad Digital Repository, doi 10.5061/dryad.5hqbzkh7h. The volume, issue and page range are not in the Foundation's hands.

Why this entry is in the appendix. For three reasons. It supplies a mechanism the comment did not have, in which the injury is not that there is more light but that the light carries information the night did not previously carry. It is the single qualification to the settled position on spectral mitigation stated at Part V.I, being the only study collected here in which a reduction in short-wavelength content brought an effect below a threshold of detectability. And it is the second of two entries in which the investigators modeled a visual system rather than assuming one.

Design, stated plainly. A modeling study. No animal was exposed to any light, no predation was observed, and no behavior was measured. The inputs are three: measured reflectance spectra of prey and background; published photoreceptor peak sensitivities for three predators; and measured irradiance spectra for four lamp types and two natural sources. The model is the receptor noise-limited chromatic discrimination model of Vorobyev and Osorio (1998), implemented in the pavo 2 package, with a von Kries adaptation coefficient applied for color constancy.

Materials. Sixty-seven littorinid snails, Littorina obtusata and Littorina fabalis, collected from Fucus vesiculosus using fifteen quadrats of thirty centimeters at Whitsand Bay, southwest England, in May 2020: 35 brown, 15 olive, 17 yellow, no orange found. Shell reflectance measured ex situ in sunlight with a spectrometer and a fiber optic probe at five millimeters, calibrated against a diffuse reflectance standard before each pot, shells air-dried to reduce specular reflection, standardized to one-nanometer resolution and truncated to 350 to 750 nanometers. Background from two measurements of the seaweed frond and vesicle, averaged. The morph classification was validated by multivariate analysis of variance on a Bray-Curtis dissimilarity matrix, F equals 35 on 2 and 64 degrees of freedom, p below 0.001.

The three predators and their modeled sensitivities. Herring gull, tetrachromatic, airborne, peak sensitivities 371, 447, 503 and 568 nanometers. Common blenny, trichromatic,

in water, 500, 535 and 570 nanometers. Green shore crab, dichromatic, in water and mostly nocturnal, 440 and 508 nanometers. The gull and the blenny are described by the authors as mostly diurnal predators that hunt at night under artificial light.

The illuminants. Hyperspectral irradiance at one-nanometer resolution between 350 and 750 nanometers, measured at ground level at urban lighting installations in Cornwall in earlier work by one of the authors, for low-pressure sodium, high-pressure sodium, metal halide and light-emitting diode. Sea surface solar irradiance from a buoy of the Western Channel Observatory at midday on 24 June 2014 under clear sky. Lunar irradiance from a clear full moon on 14 April 2014, obtained from a web page rather than from a peer-reviewed source, with the instrument and location stated there. For the two aquatic predators the spectra were carried through three meters of seawater at a chlorophyll concentration of 0.3 milligrams per cubic meter using a radiative transfer model, output between 400 and 700 nanometers with the remainder set to zero. The spectra are reported as relative irradiances scaled between zero and one; no absolute level for any lamp appears, so the study concerns spectral composition and not dose.

Results. Thirty-six model outputs. Color distances were computed in units of just noticeable difference, a value above one being the approximate minimum at which prey can be perceived against its background. For all three predators the light source significantly affected discriminability, each at p below 0.001. Under low-pressure sodium all three morphs fell below one just noticeable difference for all three predators, which the authors state renders the statistical differences among them ecologically meaningless. Under high-pressure sodium, metal halide and light-emitting diode lighting, and under sunlight and the full moon, the threshold was exceeded. Yellow morphs were the most conspicuous to the gull and the crab under every source except low-pressure sodium, under which they were the least. The effect on the blenny was smaller, which the authors attribute to its photoreceptors being clustered in the green.

What it establishes. That under the chromatic discrimination model used, and for this prey, this background and these three predators, a near-monochromatic sodium source leaves camouflage intact and every broad-spectrum source tested does not. That the conversion from narrow to broad spectrum outdoor lighting can restore at night a sensory capability that is otherwise confined to daylight and to the brightest part of the lunar cycle.

What it does not establish, and the authors say most of this themselves. That any predation occurred or increased. That any population changed. That conspicuousness scales with color distance, which the authors expressly deny, writing that behavioral work is needed to establish the level of just noticeable difference at which prey become conspicuous and placing that beyond the scope of the paper. And critically, that prey are safer under a narrow-band lamp: the model treats chromatic contrast alone, and the authors write that "In the absence of colour however, nocturnal predators will use luminance contrast perception," a mechanism they do not model and whose investigation they recommend as the next step.

The qualification the Foundation adds, which the paper does not dwell on. The threshold of detectability was exceeded under sunlight and under a full moon as well as under the three broad-spectrum lamps. Low-pressure sodium is the outlier in the set, not the natural baseline. What the study shows is therefore not that broad-spectrum lighting creates a condition unknown to the organism but that it reproduces nightly and everywhere a condition nature supplies for a few nights a month. Part V.I states why the Foundation regards that as the more useful of the two readings.

Considerations bearing on confidence. Against. Nothing was observed; every number is computed. No spectral sensitivity measured in a herring gull was available and the visual model was assembled from published sensitivities within its family, which the authors call the best possible approximation. The shore crab's photoreceptor proportions were unavailable and were set to one to one, which the authors state maximizes its ability to discriminate color; its Weber

fraction was likewise set to a published median because its own is unknown. The authors state that statistical comparison between the three predators cannot be made. The olive and brown morphs showed no clear separation in the ordination and the authors write that they may be a single dark morph, which bears on the differential result. Group sizes for two of the three morphs are fifteen and seventeen. The neural noise argument was set to indicate bright conditions and high photoreceptor saturation.I flags for verification because receptor noise is greater at low light levels. In favor. The reflectance data are original measurements on wild animals with the instrument, calibration and procedure stated. The illuminant spectra are measurements at ground level under real installations rather than manufacturer data. The model is standard and widely used and the implementation is named. The authors state the limits of their own approximations at each point and say what their model cannot do. Data are openly deposited. No conflict of interest is declared and the funder is a research council.

Relation to other entries. Three. It is the second entry, with Appendix C.133, in which a visual system was modeled rather than assumed, and Part V.A.3 has been corrected accordingly. Smyth and Davies are two of the ten authors of the marine review at Appendix D.7, and the handling editor of this paper is a co-author of the other marine review there, so three of the documents this comment relies on for the sea come from an overlapping group. And the sun-and-moon point above is the same shape as the finding at Appendix C.128, where the measured natural night sky had a median of 0.0168 lux and more than half the measured change occurred below full-moon illuminance.

Bearing on the statutory question. Two. Paragraph 360ii(a)(2) on its emissions limb, as Part II.D.4 construes it, this being evidence about what an emission does and not about any person. And section 360kk, for the narrow proposition that the spectral composition of an emission determines what information it carries, which is a property of the product and not of its installation. The authors close by asking that habitats be protected from unnecessary exposure to artificial light, which is the statutory phrase arrived at independently. Parts V.A.3, V.B.1 and V.I.

C.142 Boyes, Evans, Fox, Parsons and Pocock (2021) — fewer moth caterpillars where streetlights are, measured by counting the animals rather than by trapping the ones that fly to a lamp

Citation. Boyes D.H., Evans D.M., Fox R., Parsons M.S., Pocock M.J.O. “Street lighting has detrimental impacts on local insect populations.” Science Advances. 2021 Aug 25;7(35):eabi8322. doi:10.1126/sciadv.abi8322. Open access. No competing interests declared. Funded by the Natural Environment Research Council through the IAPETUS doctoral training partnership, grant NE/L002590/1, and by Butterfly Conservation through an industrial CASE studentship. Primary data deposited at the Environmental Information Data Centre of the Natural Environment Research Council. The article records that six anonymous reviewers assessed the manuscript.

Why this entry is in the appendix. Because it is the strongest evidence in this collection that this emission reduces a wild population rather than altering the behavior of individuals; because its spectral comparison is the cleanest in the appendix, the lamps differing in composition at illuminances that did not differ statistically; because the authors report that the quantity this field has measured for decades may not rank lighting technologies in the order of their effect; and because the methods section contains the tenth admission collected at Part V.J.4, which concerns the unit rather than the satellite.

Design. Matched-pairs observational study with a separate manipulative experiment. Twenty-six pairs and one triplet of sites in Oxfordshire, Buckinghamshire and Berkshire, southern England, each a contiguous linear strip of habitat with a lit and an unlit section separated by at least 60 meters, median 118, range 60 to 527. Sites were found by overlaying street-lighting datasets obtained from nine local authorities and a national highways body under freedom of information requests on satellite imagery; more than five hundred candidate locations were

assessed by street view and one hundred and fifty-three visited in person. Lit sections had carried the same lamp type for at least five years and in some cases decades, according to the authority's records. Every site was visited between two and four in the morning to confirm that part-night lighting and dimming were not in operation. Treatments were 14 high-pressure sodium, 11 light-emitting diode and 2 low-pressure sodium transects.

Why no light trap was used, which is the reason this entry leads where it does. The authors state that they avoided light traps, the standard method of sampling moths, because these "lead to biases when comparing assemblages from lit and unlit areas," and that sampling larvae shows the effect where insects live and develop rather than where they happen to fly past. Appendix C.135 and Appendix C.136 disclose that bias while using the method; this is the only entry in the appendix in which the investigators designed it out.

Sampling. Two methods for two feeding guilds. Hedgerow beating by day at 13 sites, once in mid-May 2019 and once in mid-April 2020, at three points along each 14-meter transect, using half drainpipes at box-shaped hedges and a beating tray where there was overhanging vegetation, the vegetation struck five times with a metal pole. The two dates were chosen at the end and the start of the season so that phenological artifacts would cancel. Sweep netting of grass margins by night at 15 sites from November 2018 to April 2019, on nights forecast above six degrees Celsius, at least an hour after sunset, in a continuous figure-eight motion, with the lit and unlit sections of a pair sampled within ten minutes of each other and an equal number of times. Hedgerow caterpillars were predominantly winter-flying geometrids and summer-flying micromoths, grouped into twenty taxonomic units; grass margin caterpillars were overwhelmingly overwintering grass-feeding noctuids, in sixteen units.

Exposure. Illuminance measured with a named hand-held meter of 0.1 lux resolution at five evenly spaced points per transect, on overcast nights or at the new moon, pointed upward at the height occupied by the animal: 1.25 meters for hedgerows and 0.25 meters for grass. Lit hedgerow transects averaged 1.42 to 15.84 lux with an overall mean of 5.7; lit grass transects 0.18 to 7.14 lux with an overall mean of 2.2. Unlit transects were estimated below 0.01 lux and every one read the meter's minimum. Within each habitat the mean illuminance of the sodium and the diode transects did not differ statistically, at probabilities of 0.34 and 0.85. Spectral power distributions and estimated correlated color temperatures are in a supplementary section the Foundation has not obtained.

Results, abundance. Hedgerows, from 1,656 caterpillars over 25 visits to 13 pairs, with fewer caterpillars on the lit side at every site: overall 47 percent fewer, 52 percent fewer under diodes and 41 percent fewer under high-pressure sodium, all at probabilities below 0.001. Grass margins, from 822 caterpillars over 64 visits to 15 sites: overall 33 percent fewer at a probability of 0.01; 43 percent fewer under diodes at 0.02; 24 percent fewer under high-pressure sodium, not significant at 0.20; and 11 percent fewer under low-pressure sodium, not significant at 0.78.

Results, mass and feeding. Caterpillars from lit transects were heavier, significantly so under diodes in both habitats at probabilities below 0.001 and of 0.04, mixed under high-pressure sodium at 0.007 and 0.10, and not significant under low-pressure sodium at 0.60. In the separate experiment, lighting rigs four meters high were erected in two previously unlit arable grass margins and switched on an hour before sunset, with sweep netting between 60 and 120 minutes after sunset across nine visits and generators placed 50 meters away. Fewer caterpillars were found under the diode light than under no light, effect size minus 0.44 at a probability of 0.03; the difference under high-pressure sodium was minus 0.10 and not significant at 0.58.

What it establishes. That habitat directly lit by established streetlights holds substantially fewer moth caterpillars than matched unlit habitat nearby, by 47 percent in hedgerows and 33 percent in grass margins. That the reduction was larger under light-emitting diodes than under high-pressure sodium at illuminances that did not differ statistically. That short-term exposure

to diode light in previously unlit habitat disrupts the normal nocturnal feeding ascent of these caterpillars, and that high-pressure sodium at the same sites did not measurably do so.

What the authors conclude about scale, which runs against the headline. Using the actual distribution of streetlights rather than an assumption about major roads, that 1.1 percent of the land area of the study region is directly lit above one lux once road surfaces and urban land are excluded, comprising 15.5 percent of suburban land, 0.23 percent of arable land and 0.68 percent of broadleaved woodland; and from that, that direct illumination by streetlights "has probably been a minor contributor to long-term national moth declines to date; however, our results show that it can be a very substantial local factor." The Foundation adopts that sentence whole and Part V.I reproduces it.

The admission about the unit. Quoted in full at Part V.I and taken up at Part V.J.4 as the tenth instance: that lux is based on human vision so that ecologically relevant spectral information can be omitted, that identical readings may not correspond to the same illumination as the animal perceives it, and that the unit was used because it is the SI unit and is convenient.

What it does not establish. Nothing about human health. No causal mechanism: the authors propose reduced oviposition in lit areas as the likely principal cause and offer increased top-down pressure from diurnal predators and parasitoids, and reduced host-plant quality, as contributors, none of which this study tested. Nothing about the distance over which the effect extends: the authors say they do not know how far it reaches beyond the directly lit area and call that an urgent question, while reporting that a test of their own data detected neither positive nor negative spillover at the separations used.

Considerations bearing on confidence. Against. Not randomized; the treatments are existing streetlights and the authors say so. Lit transects were often at junctions and may have carried more traffic noise, nitrogen oxides and headlight glare; the authors expect those influences to have been minor, which is an expectation rather than a measurement. The low-pressure sodium arm rests on two transects and establishes nothing. The mass result is ambiguous on the authors' own account, who offer stress-accelerated development and local acclimation as competing readings and note that it sits awkwardly with their short-term experiment. The short-term experiment used a brighter and bluer lamp than the field sites, 25.3 lux at about 5,000 kelvin against 2.2 lux at 2,700 to 4,000 kelvin, so the two arms are not matched. Provisional identifications were assigned by one author. In favor. Large spatial replication with site pairing to an explicit criterion. Lit and unlit sections sampled within minutes of each other and an equal number of times. Botanical composition, verge management and surrounding urbanization tested and excluded as explanations. Phenological artifacts designed out by the choice of sampling dates. Treatment duration established from the authorities' own records. Part-night lighting excluded by visiting every site in the small hours. Three independent measures giving the same ordering of lamp types. Six anonymous reviewers. Data deposited in a national environmental data center.

Relation to other entries. Four. It completes the argument begun at Appendices C.135, C.136 and C.137 about what a light trap can and cannot record, by supplying a population measure that does not depend on trapping. It is the tenth admission at Part V.J.4 and the only one that concerns a photometric unit rather than a satellite radiometer. Its spectral ordering supports the settled position at Part V.I without disturbing it, the low-pressure sodium nulls being underpowered rather than demonstrations of removal. And D.M. Evans is to all appearances the guest editor of the Royal Society theme issue at Appendix D.7.

Bearing on the statutory question. Two. Paragraph 360ii(a)(2) on its emissions limb as Part II.D.4 construes it. And section 360kk, for the proposition this comment most needs and has had least evidence for: that at a quantity of light held constant, a change in the spectral composition of the emission changed its effect on a population. That is a statement about a

characteristic of a product, and it is the characteristic Part IX.G.1 asks the Department to prescribe. Parts V.A.3, V.B.1, V.I and V.J.4.

C.143 Sánchez de Miguel, Bennie, Rosenfeld, Dzurjak and Gaston (2021) — twenty-five years of satellite-detectable light, and the authors' own warning that the decline over North America is probably the instrument

Citation. Sánchez de Miguel A., Bennie J., Rosenfeld E., Dzurjak S., Gaston K.J. "First Estimation of Global Trends in Nocturnal Power Emissions Reveals Acceleration of Light Pollution." Remote Sensing. 2021;13(16):3311. doi:10.3390/rs13163311. Received 8 July 2021, revised 16 August 2021, accepted 19 August 2021, published 21 August 2021. Open access under a Creative Commons Attribution license. Supported by Natural Environment Research Council grant NE/P01156X/1. The authors declare no conflict of interest. Data deposited at Zenodo, doi 10.5281/zenodo.5205656, with experimental data at 10.5281/zenodo.5222170. The article records that Sánchez de Miguel and Bennie contributed equally.

Relation to Appendix C.139. Same five authors, same research council grant, one year earlier. The later paper maps the spectral composition of Europe from astronaut photographs; this one reconstructs the magnitude of the emission globally over twenty-five years from the satellite record. The two are a pair and the comment uses them for different things.

Design. Remote sensing and reconstruction. No organism, no exposure, no outcome. Three satellite datasets were reconciled into a single country-by-country time series of emitted power from 1992 to 2017: the uncalibrated Defense Meteorological Satellite Program Operational Line-scan System archive, the radiance-calibrated subset of that archive, and the Visible Infrared Imaging Radiometer Suite Day/Night Band. Uncalibrated images were fitted to the nearest calibrated image in time by robust regression over a calibration region encompassing Italy, taking the mode of a fitted kernel density as the most likely radiance for each digital number and smoothing with a tenth-order polynomial. All data were capped at 100 nanowatts per square centimeter per steradian, the lowest saturation point among the images. The whole series was then smoothed and recalibrated against the recorded electricity consumption of municipal street lighting in seventy-five Italian provinces, iteratively until convergence, and validated against national figures for eleven other countries.

The instrument statement, which is the third in this appendix and the most specific about the lamp. That the single-channel spectral response of the older sensor "is close to zero at wavelengths of visible light below 500 nm," that "White phosphor-based LED lighting typically emits at a peak radiance of around 465 nm," and that as outdoor lighting converts to solid-state technology "an undetermined, but increasing, proportion of emitted light is undetected." Of the present sensor they write that its spectral response "is similarly low below wavelengths of 500 nm." The figure of 465 nanometers is the authors' characterization of the lamp class and not a measurement made in this paper; Part V.B.1 states the peak as approximately 450 to 470 nanometers and this paper does not supply a measured spectral power distribution.

Principal result. That satellite-detectable light increased globally by at least 49 percent between 1992 and 2017, at an approximately constant rate. For the undetected component, a projected global blue-band total of 513 megawatts in 2017, rising to 806 megawatts if forty percent of lighting were diodes at 3,000 kelvin and to 1,294 megawatts at 4,000 kelvin, from which the authors derive the estimate in their abstract that the true increase in visible radiance may be as high as 270 percent globally and 400 percent in specific regions. The Foundation relies on the 49 percent and declines the larger figures, for the reasons given at Part V.J.4.

The continental result, and the authors' warning about it. Persistent growth in Asia, South America, Oceania and Africa; a rise in Europe that levelled off around 2010; and in North America an apparent decline. The authors immediately qualify it, writing that conclusions about the levelling off or decrease in Europe and North America "should be treated with caution as the

shifting spectral distribution of light towards blue-rich LEDs is likely to mask the effects of increases." That sentence is why this entry exists. Part V.J.4 sets out the consequence.

The streetlight share, which the comment has not been able to state. That the proportion of nighttime light deriving from streetlights is "unclear and debated in the literature" and likely to vary between countries and cities, with published values ranging from 12 percent in Flagstaff, Arizona to nearly 100 percent in Spain. Recorded with Appendix C.130, where volunteers counting German streets found streetlights outnumbered five to seven times by other sources in dense urban areas, and with the observatory review at Appendix D.7, which is the source of the Flagstaff figure.

The hour of observation. That the older satellite acquired images at about 21:30 solar time and the present one between midnight and 02:00, so that the two do not measure the same night. The authors construct separate evening and post-midnight series by recalibrating each sensor against the other for 2012, the single year in which both operated. They report that the gap between the two is large in Europe, North America, Asia and Oceania and much smaller in South America and Africa, which they attribute to private lighting being switched off. The Foundation records this as the only national-scale measurement of switching-off behavior it has encountered.

What it establishes. That the measurable emission of artificial light at night grew by at least half over a quarter of a century, globally and at an approximately constant rate. That the apparent absence of growth in North America cannot be taken at face value, on the authors' own statement. And, in the abstract's words, that "there is limited evidence that advances in lighting technology have led to decreased emissions."

What it does not establish. Nothing about health, exposure or any organism. No figure for the United States: none is given, and the continental curve is expressly disclaimed by its authors as a basis for conclusions. And nothing about the magnitude of the undetected component as a measured quantity, that being a projection under assumed conversion rates and color temperatures.

Considerations bearing on confidence. Against. The entire global series is anchored to the street-lighting electricity consumption of seventy-five Italian provinces, chosen because the historical data exist there; the validation against eleven other countries is a check and not a second anchor. The older sensor has no on-board calibration, saturates at a digital number of sixty-three, has a resolution of 2.7 kilometers, suffers blooming and has poor georeferencing, all of which the authors state. Data were capped at the lowest saturation point, which discards information in the brightest places. The conversion-rate assumption comes from a Spanish lighting manufacturers' association. The blue-band conversion factors of 0.1, 0.25 and 0.5 for lamps at 2,000, 3,000 and 4,000 kelvin are taken from the same group's earlier work. And the lamp replacement assumption is a fixed 24,000 hours of operation at 4,100 hours a year. In favor. Peer-reviewed and open access with data and code deposited. The limitations of every dataset are set out at length before the results rather than after them. The validation against independent national consumption figures is reported, including where it fails. The authors qualify their own principal regional finding against their own interest. And the quantity the comment relies on, the 49 percent, is the one that does not depend on the modeling assumptions.

Bearing on the statutory question. Two. Paragraph 360ii(a)(4), the duty to study and evaluate emissions of and conditions of exposure to electronic product radiation: this is the long-run record of the emission, and its authors say it understates the trend and may invert the sign of it over this continent. Paragraph 360ii(a)(2), on its emissions limb, for the proposition that the emission has grown by at least half in twenty-five years and that the evidence for technology having reduced it is limited. Parts II.D.4, IV.G, V.B.1 and V.J.4.

C.144 Schligler, Cortese, Beldade, Swearer and Mills (2021) — twenty months in a Polynesian lagoon, and the only long-term field experiment in this comment

Citation. Schligler J., Cortese D., Beldade R., Swearer S.E., Mills S.C. "Long-term exposure to artificial light at night in the wild decreases survival and growth of a coral reef fish." Proceedings of the Royal Society B. 2021;288:20210454. doi:10.1098/rspb.2021.0454. PMID 34102892. PMCID PMC8187998. No competing interests declared. Ethical approval from the animal ethics committee of the Centre National de la Recherche Scientifique, permit number 006725. Funded by the Agence Nationale de la Recherche, the Haut-Commissariat de la République en Polynésie française and Pacific Funds. Data deposited at the Dryad Digital Repository, doi 10.5061/dryad.37pvmcvjv. Schligler and Cortese contributed equally. The volume and article number are derived from the digital object identifier and require verification.

Why this entry is in the appendix. For three things, only one of which is a finding. It is the longest field exposure in the collection, at a mean of twenty and a half months in the wild. It reports its exposure in both photometric and radiometric units, which almost nothing else here does. And it supplies a measured natural nighttime illuminance underwater of 0.03 lux, which sits within a factor of two of the 0.0168 lux median measured terrestrially at Appendix C.128 and which the Foundation regards as the most useful number in the paper.

Design. Paired field experiment. Three subtidal fringing reef sites in the lagoon of Moorea, French Polynesia, exposed to long-standing shore lighting, each paired with a nearby site of comparable depth and reef structure lit only by moonlight; one site received a second control with more similar reef structure. Forty-two territories, each a magnificent sea anemone collected from the northern lagoon and randomly distributed. Forty-two laboratory-reared juvenile orange-fin anemonefish, Amphiprion chrysopterus, one to three months old, raised from eggs collected from approximately fifty wild breeding pairs, weighed to a hundredth of a gram and measured from photographs, placed singly and at random: twenty-four control and eighteen exposed, with no difference in length, height or weight between treatments at the start. Monitoring at four points: 35 days, 70 days, 12 to 17 months and 18 to 23 months, with individuals identified photographically from the shape and length of the second and third white stripes.

Exposure. Illuminance in lux and photosynthetically active radiation in watts per square meter, measured at the depth of the anemones, 60 centimeters, with a SpectroSens2 handheld logging meter, in triplicate at one location in each of six sites, after moonrise, on twelve nights corresponding to the four lunar phases across four months: 216 measurements in total, 36 per site. Lit territories averaged 4.3 lux, controls 0.03 lux, a ratio of 143, with the same pattern in the radiometric measure. The three lit sites differed significantly from each other at 0.9, 2.3 and 8.9 lux; the control sites did not differ from each other. Variability within a site came from differences among the triplicate measures rather than from lunar phase or month. The authors state that these levels are representative of what shallow fringing reefs receive under street and hotel lighting, are considerably lower than those produced by light-emitting diode lighting used at ports, and that impacts in coastal marine ecosystems "could be greater than observed in the present study."

Results, survival. Lower in the exposed group by 36 percent, at a probability of 0.055; the authors write that survival "tends to be lower," and the abstract reports the percentage without the probability. Survival declined similarly in both groups except in two periods when the exposed group was lower: before the first monitoring, at the juvenile stage, and after about twenty months as functional adults. Site differences were significant, fish at site 2 having 51 and 55 percent higher survival than those at sites 1 and 3.

Results, growth. Specific growth rate, as percentage increase in size per day. Height 15 percent lower in the exposed group, at a probability of 0.036 and significant. Weight 51 percent lower at 0.074, described by the authors as a tendency. Length 21 percent lower at 0.251 and not significant. No interaction between treatment and exposure period. Daily growth was higher in the second period than the first. THE ABSTRACT GIVES A SINGLE FIGURE OF 44 PERCENT

for growth which the Foundation cannot reconstruct from those three values, whose mean is 29 percent.

The numbers behind the percentages. Of the forty-two fish, twenty-one were present at twelve to seventeen months, fifteen control and six exposed, with one new recruit on an exposed territory; and fifteen at eighteen to twenty-three months, twelve control and three exposed. Growth was measured on twenty-one individuals at the first of those periods and fifteen at the second. The final growth comparison therefore rests on three exposed animals. Seven fish were excluded from the survival analysis because both fish and anemone were absent.

The authors' competing explanation of the growth result. That it "may be due to phenotypic plasticity in morphology in response to ALAN and may be adaptive," representing a reallocation of resources toward length and weight at the expense of height, and that a lower rate of growth in height "may therefore be the optimal strategy for anemonefish exposed to ALAN," facilitating escape from predation by decreasing drag or by hiding in the anemone. Whether such plasticity is adaptive in the long term, they write, remains unknown. Part V.I records that the comment does not assert the growth difference is an injury, for the same reason it declines to do so with the eye-size finding at Appendix C.138.

What it establishes. That juvenile anemonefish held for a mean of twenty and a half months in territories illuminated to a mean of 4.3 lux grew less in height than those held at 0.03 lux, and that the other two measures of growth and the measure of survival pointed the same way without reaching conventional significance. That the experiment can be done in the wild, over that duration, with the exposure measured radiometrically as well as photometrically.

What it does not establish. Nothing about human health. No cause of death: the authors state expressly that their results do not allow them to distinguish physiological stress from increased predation. No mechanism for the growth difference, and the authors offer adaptation as a competing reading of it. And nothing about the spectral composition of the lighting, which is not characterized anywhere in the paper the Foundation has read; the sources are described only as street and hotel lighting.

Considerations bearing on confidence. Against. The principal survival comparison does not reach the conventional threshold. Three exposed animals carry the final growth comparison. The fish could move and absence was equated with mortality; the authors address this and cite evidence that this is the most mobile of six anemonefish species tested, with 13 percent changing host anemone within four months, and at the first site the paired territories were 8.6 meters apart. Anemone loss was substantial, at 29.1 percent of control and 38.8 percent of exposed territories, which the authors describe as an equal number, true in count and not in proportion. Lit territories were systematically closer to shore than control territories at every site. The juveniles were laboratory-reared and placed singly, and the authors note that growth in this genus is socially controlled and that their design may underestimate both growth and mortality. In favor. Twenty months in the wild, which almost nothing in this field achieves. Individuals identified photographically at every visit. Exposure measured in two kinds of unit, at the animal's depth, across all four lunar phases, in triplicate. Control sites shown not to differ from one another. Site included as a factor and its effects reported. The authors qualify their own principal finding in their Results and offer a competing explanation of their own growth result. Data openly deposited and ethical approval stated.

Relation to other entries. Three. The control illuminance of 0.03 lux is the second measured natural nighttime figure in this comment, beside the 0.0168 lux median at Appendix C.128, and Part V.I sets them together. S.E. Swearer is a co-author of the review at Appendix D.7 on temperate and tropical reefs, and the review at D.7 by Marangoni and others cites this study; the Foundation reached it through that citation and now has the primary source. And the adaptive-plasticity caution is the same move the investigators made at Appendix C.138, which the comment records in both places rather than in neither.

Bearing on the statutory question. One, and it is narrow. Paragraph 360ii(a)(2) on its emissions limb as Part II.D.4 construes it: this is evidence about what an emission does, in the field, over a period no laboratory can reproduce. The Foundation does not offer it for anything else, and the figures it relies on most are the two measurements of natural darkness rather than the effect estimates. Parts V.A.2, V.A.3 and V.I.

C.145 Kernbach, Martin, Unnasch, Hall, Jiang and Francis (2021) — West Nile virus in Florida sentinel chickens, and a curve that peaks at the faintest light

Citation. Kernbach M.E., Martin L.B., Unnasch T.R., Hall R.J., Jiang R.H.Y., Francis C.D. "Light pollution affects West Nile virus exposure risk across Florida." Proceedings of the Royal Society B. 2021;288(1947):20210253. doi:10.1098/rspb.2021.0253. PMID 33757351. PMCID PMC8059973. Previously deposited by the authors as a preprint at bioRxiv, doi 10.1101/2020.05.08.082974, 8 May 2020.

HOW THE FOUNDATION CAME TO THIS ENTRY, AND WHAT IT HAS NOT READ. Mr. Baker supplied a news release of the University of South Florida and asked that the underlying study be identified. It was identified from that release, a research center notice of the University of Georgia and a bibliographic search, and the account below is drawn from the authors' own bioRxiv deposit together with the published citation. THE PUBLISHED ARTICLE HAS NOT BEEN READ. A preprint is the authors' own text before peer review, the version of record governs, and nothing in this entry may be filed until the published article has been obtained and every figure, every statistic and the limitations section checked against it.

Design. Analysis of an existing public health surveillance program. The Florida Department of Health maintains caged sentinel flocks across the state and tests them monthly for antibodies to West Nile virus; birds that seroconvert are replaced with naive birds. The preprint describes seven counties over 2015 to 2018, restricted to June through December and to records with complete environmental data, yielding 1,126 surveillance events from 80 sites and 105 distinct coordinates, with six birds tested at 89.5 percent of observations and four at the remainder. The university release describes 6,468 antibody samples from 105 coop locations over four years. The preprint is internally inconsistent about the county and event counts between its introduction and its methods, which is one reason the published article must be obtained.

Exposure variable, which is the reason this entry joins a census at Part V.J.4. Artificial light at night taken from the published world atlas of artificial night sky brightness at one-kilometer resolution, in millicandelas per square meter, which is a modeled product derived from the Visible Infrared Imaging Radiometer Suite. It is not a measurement at the coop. It therefore inherits the band limitation that Part V.J.4 collects and adds a modeling step to it. Whether the published article discloses that limitation the Foundation does not know and must not guess; until that check is performed this entry is not counted among the instances tallied at Part V.J.4.

Other variables. Three separate measures of urbanization (impervious surface, human population density and the human footprint index), precipitation and temperature from a gridded climate product, and soil moisture, with temperature lagged by one month. Negative binomial mixed-effect models with and without spatial correlation. Artificial light at night was modeled as a second-order polynomial.

Principal results. That artificial light at night carried the largest and the only strong effect among the urbanization variables, through its log-transformed and squared terms. That impervious surface and the human footprint index showed no influence, and human population density showed mixed and small support. That the mean temperature of the previous month had a strong positive effect with a quadratic term, temperatures above 25 degrees Celsius being associated with higher seroprevalence, the lagged term receiving much stronger support than the same-month term. That monthly cumulative precipitation was negatively related to seroprevalence. And that no polynomial term for any urbanization variable was supported.

THE SHAPE OF THE RELATIONSHIP, WHICH IS THE MOST IMPORTANT THING IN THIS ENTRY. The relationship between light and exposure risk was not monotonic. In the preprint's words, at low levels of artificial light, at radiance intensities less than one, West Nile virus risk was greatest, declining toward the intermediately polluted sites. Risk peaks in the faintly lit places. The headline of the press release that brought this study to the Foundation states that light pollution drives increased risk; the curve in the paper is more complicated than that, and Part V.I sets out the three consequences the Foundation draws.

What it establishes. Subject to the caveat at the head of this entry, that in four years of state surveillance data artificial light at night was associated with West Nile virus seroprevalence in sentinel birds, that the association survived the simultaneous inclusion of three measures of urbanization which did not, and that the association is not a straight line.

What it does not establish. Any effect in a human being. Sentinel chickens are a surveillance instrument for arbovirus activity and not a model of human infection, and the study measures seroconversion in caged birds rather than disease in people. No mechanism: the study is observational and the authors offer vector behavior, reservoir competence and host mortality as candidate explanations without testing any. And nothing about the spectral composition of the lighting, the exposure variable being a broadband modeled quantity.

Considerations bearing on confidence. Against. Observational and ecological in design; the unit of analysis is a site-month and not an animal. The exposure variable is modeled from a satellite product at one-kilometer resolution and is not a measurement where the birds are. Coops were sometimes moved, usually under about a hundred meters but in some cases as far as eleven kilometers. The preprint is inconsistent about its own sample description. The Foundation has not read the published article. In favor. Four years of standardized surveillance collected by a state health department for a purpose other than this analysis, which removes one familiar source of bias. A large number of sites. Three measures of urbanization entered simultaneously, which is more than the epidemiological literature in this appendix usually manages. And the authors fitted a curve rather than comparing two groups, which is why they found a shape that a two-level comparison would have missed.

Relation to other entries. Three. Appendix C.125 reports that light at street-lighting intensity suppresses diapause in Culex pipiens, the principal West Nile vector in the northern United States, so the vector and the sentinel have now each been separately associated with this exposure. The companion paper by the same lead author on West Nile competence in a wild passerine reservoir, Proceedings of the Royal Society B 2019, remains unread and is the acquisition that would complete the set. And the exposure variable is the same family of product criticized at Part V.J.4 and relied on at Appendices C.3 and C.139.

Bearing on the statutory question. Two, both narrow. Paragraph 360ii(a)(2) and paragraph (a)(4), for the proposition that a relationship between this emission and a notifiable human disease has been reported in the surveillance record of a State health department, and that the relationship is of a shape no two-level study could have found. Section 360kk, by way of caution rather than support: a limit is a point chosen on a curve, and this is a curve whose maximum is not at its right-hand end. Parts V.A.2, V.A.3, V.I and V.J.4.

C.146 Shier, Bird and Wang (2020) — an endangered rodent responds to light at twice the distance at which a traceable spectroradiometer can detect any

Citation. Shier D.M., Bird A.K., Wang T.B. "Effects of artificial light at night on the foraging behavior of an endangered nocturnal mammal." Environmental Pollution. 2020;263:114566. doi:10.1016/j.envpol.2020.114566. Received 7 November 2019, revised 6 April 2020, accepted 7 April 2020, available online 11 April 2020. Authors at Recovery Ecology, Beckman Center for Conservation Research, San Diego Zoo Global; the University of California, Los Angeles; and the University of California, Davis. Original data deposited at Mendeley Data, doi 10.17632/g29z3rdbc6.1.

Funding and interests. San Diego Zoo Global, and a fellowship to the second author from named private donors. The paper states that the funding source had no involvement in the design, collection, analysis or interpretation of the research. No industry funding. The Foundation notes that the obtained copy was a file hosted on the Foundation's own server and that the published article has not been retrieved from the publisher.

Subject. The Stephens' kangaroo rat, Dipodomys stephensi, a nocturnal heteromyid rodent of southern California listed as endangered under the Endangered Species Act. Home ranges of 0.05 to 0.2 hectares with home range cores averaging thirty meters.

Design. Twenty linear arrays, each of ten baited foraging trays five meters apart, with a light on a three-meter pole at one end to create a gradient; arrays at least fifty meters apart. Three treatments assigned at random to each array over three nights: flood light, bug light, and an unlit control. Trays pre-baited for a week, then charged with 12.5 grams of sterilized millet; collected before dawn, sifted, oven-dried and weighed. Depletion scored as a binary, a tray with less than 0.0125 grams remaining counted as depleted, the authors stating that animals generally took nearly all or none. Conducted within three days of a new moon in 2012 and repeated in 2014 with twelve arrays under a full moon. Burrow counts along five by fifty meter belt transects as an index of local density; cottontail presence recorded as a covariate. Logistic regression clustered by array, model selection by Akaike information criterion, Holm-Sidak post hoc comparisons.

THE EXPOSURE MEASUREMENT, WHICH IS THE REASON THIS ENTRY IS AT PART V.J.4. A StellarNet SILVER-Nova Super Range spectroradiometer covering 190 to 1,110 nanometers, cooled silicon charge-coupled linear array, with a miniature ultraviolet-visible-near-infrared cosine receptor calibrated for irradiance against calibration lamps traceable to the National Institute of Standards and Technology. Mounted on a tripod eight centimeters above the ground facing the source. Three measurements averaged at each of the ten tray positions, all on one clear night, at least two hours after sunset and two hours before sunrise. Reported as vector irradiance in milliwatts per square centimeter and converted to photon flux density in nanomoles of photons per second per square meter. The authors state that they measured irradiance rather than lux because lux is weighted to human spectral sensitivity. They also converted to lux, using 555 nanometers as a single representative wavelength and a general-purpose online unit converter, expressly to allow comparison with other studies; that conversion is an approximation and the comment does not use any lux figure from this paper.

The lamps, identified by manufacturer, which is rare in this appendix. Flood: a SolarGoesGreen Super Bright Solar Flood Light of 108 light-emitting diodes, described as equivalent to a 150-watt incandescent, rated 756 lumens, emitting between 400 and 700 nanometers. Bug: a Feit Electric 13-watt compact fluorescent of yellow hue, described as equivalent to a 60-watt incandescent, rated 300 lumens, emitting between 550 and 650 nanometers, housed in an aluminum clamp surround. Spectra are given in the supplementary material, which the Foundation has not seen.

Principal results. Light treatment significantly altered foraging, chi-square 19.59 on 2 degrees of freedom, p below 0.01. Depletion was significantly greater under the control than under the flood light, z of 4.03, and than under the bug light, z of 2.70, both p below 0.01; the two lit treatments did not differ significantly from each other, with a trend favoring the bug light. Treatment interacted with distance, chi-square 9.82, p below 0.01: under the control there was no change in depletion with distance, while under both lamps the probability of depletion rose with distance from the source. Under the new moon, effects were significant to forty meters for the bug light and fifty meters for the flood light, fifty meters being the furthest tray. Under the full moon there was no treatment-by-distance interaction, chi-square 0.23; bug light and control did not differ, while the flood light remained significantly different from the control to forty meters. Local burrow density predicted foraging, z of 2.40, p below 0.02. Cottontail presence did not, z of 0.15, p of 0.88. Under the control at new moon, roughly eighty to ninety percent of trays were depleted regardless of distance.

THE FINDING THE COMMENT TAKES FIRST, IN THE AUTHORS' WORDS. That irradiance fell with distance only to twenty-five meters, "at which point light was no longer detected," while behavioral effects were significant to forty and fifty meters. The authors offer two readings without choosing: that the instrument was not sensitive enough beyond twenty-five meters, or that the effects extend beyond the point at which irradiance is measurable. They conclude that effects of skyglow on behavior may extend beyond those of irradiance and that both irradiance and radiance need to be measured. Part V.J.4 sets out the three consequences the Foundation draws and does not add this entry to the count of spectral attestations kept there, because the defect here is sensitivity and not spectral blindness.

The second finding, taken at Part V.I. That the yellow narrow-band lamp, emitting only between 550 and 650 nanometers and rated at less than half the output of the white lamp, nonetheless suppressed foraging significantly to forty meters. The authors observe that this does not bear out the prediction, which they attribute to the 2018 rapid-assessment paper at Appendix D.6, that yellow and amber sources will have less impact.

What it does not establish. Any human effect, and the authors claim none. Any fitness or population endpoint: foraging patch depletion is a behavioral proxy, and survival, reproduction, body condition and persistence were not measured, which the authors state and call for. The independent contribution of spectrum, the two lamps differing in output, spectrum, shielding and diffusion together, which the authors also state. And nothing about the far end of the relationship, which the experiment did not reach.

Considerations bearing on confidence. Against. The behavioral measure is binary and the threshold for depletion was set by the investigators. Density was indexed by burrow counts, which the authors acknowledge are not directly correlated with numbers. The two moon conditions were run two years apart, so season, cohort and year are not separated from lunar phase. Cottontail presence was not recorded for every tray and had to be tested in a separate model. And one matter the Foundation raises as a question rather than a defect: arrays were placed at least fifty meters apart, and the stated reason was the thirty-meter home range core of the species rather than the propagation of light; since the flood-light effect was significant at fifty meters, the spacing criterion and the measured effect distance are the same number, and whether lights at neighboring arrays could reach one another's trays depends on a geometry the paper does not give. In favor. A field experiment with randomized assignment of treatment to array and a repeated design. A real exposure gradient rather than a lit-against-unlit comparison, which is the design Part V.A.2 asks for. Radiometric measurement with traceable calibration at the animal's height. Named commercial lamps. Data deposited and publicly available. And the authors report the failure of their own instrument rather than omitting it.

A fact about the species recorded and not used. The subject is listed as endangered under the Endangered Species Act. The Foundation does not rely on the listing, for the reasons given at Appendix C.140 in the entry on the monarch butterfly: the statute is administered by a different Department and the comment's submission does not depend on it. The entry is used for the measurement, for the mammalian endpoint and for the failure of the yellow lamp.

Bearing on the statutory question. Paragraph 360ii(a)(4), which directs the Secretary to study and evaluate emissions of, and conditions of exposure to, electronic product radiation. This is the one study in the appendix in which the emission was characterized radiometrically at the receptor and the condition of exposure was varied systematically, and the answer it returned is that the instrument ran out before the biology did. Paragraph 360ii(a)(5), for the development of measurement procedures, because the gap this study exposes is one of sensitivity at low levels. The emissions limb of paragraph 360ii(a)(2), the exposure being two identified consumer products at stated outputs. Parts V.A.2, V.A.3, V.I, V.J.4 and IX.C.

C.147 Seymoure, Buxton, White, Linares, Fristrup, Crooks, Wittemyer and Angeloni (2025) — a global estimate of how much of the earth is lit above a natural night, and the one compilation of effect thresholds across species

Citation, and a warning that governs every line of this entry. The published article is reported to be Seymoure B.M. and others, "Global artificial light masks biologically important light cycles of animals," Frontiers in Ecology and the Environment 2025;23(4):e2832, doi 10.1002/fee.2832. THE FOUNDATION HAS NOT READ THAT ARTICLE. What it has read is the authors' own preprint of the same work under its earlier title, Anthropogenic Light Disrupts Natural Light Cycles in Critical Conservation Areas, deposited on the Social Science Research Network at doi 10.2139/ssrn.3439670 and bearing on its face the statement that it was then in review. The published citation above is taken from a National Park Service magazine summary and has not been verified against the journal. Associated data are deposited at Mendeley, doi 10.17632/jcrz5773dv, whose fifth version is dated 11 April 2025.

WHY THAT MATTERS MORE HERE THAN IN THE OTHER PREPRINT ENTRY. Because the work changed. The title changed, and the same National Park Service summary attributes to the published paper two findings the preprint does not contain: that about twenty-six percent of the earth's surface is now under perpetual moonlight, and that this could reach about fifty percent by 2052. A projection to a future year is not a refinement of a preprint; it is new work. The preprint also states that its data were not public while in review, and the deposited dataset reached a fifth version six years after the preprint. Nothing in this entry may be filed on the strength of the preprint, and the two figures above are not stated anywhere in the body of this comment.

Authors and affiliations. Colorado State University, Department of Biology and Department of Fish, Wildlife and Conservation Biology; and the Natural Sounds and Night Skies Division of the National Park Service, Fort Collins. The participation of a United States federal scientist is recorded; Part II.H collects federal involvement in this subject, and the Division named here is the same one whose all-sky mosaic technique the Australian guidelines at Appendix D.1 describe and whose Duriscoe is a co-author of the observatory review at Appendix D.7.

Method, as the preprint states it. The New World Atlas of Artificial Night Sky Brightness, which is itself modeled from satellite upward radiance, supplies zenith sky luminance. That was converted into a predicted horizontal illuminance at the ground using a radiative transfer model of skyglow, which the authors state was validated against all-sky monitoring data collected within United States National Parks. Results are expressed in millilux and binned to lunar equivalents: minimal below 0.1 millilux, new moon 0.1 to 1, crescent 1 to 10, quarter 10 to 100, and full above 100. Resolution is given as 852 square meters, excluding latitudes beyond 60 degrees south and the far north.

THE EXPOSURE VARIABLE, WHICH IS THE WEAKEST CHAIN IN THIS APPENDIX AND IS STATED BEFORE ANY FINDING. Four steps separate the emission from the number. A satellite radiometer that Appendix D.1 records as insensitive to blue light measures upward radiance. A published atlas models sky brightness from it. A radiative transfer model converts that to illuminance at the ground. And the result is expressed in lux, a quantity weighted to human photopic vision, which the same Appendix D.1 says should not be used for non-human subjects. The entry is nonetheless in this appendix and is counted at Part V.J.4 among the entries taking a satellite product as their exposure variable, because the chain is disclosed on the face of the paper and because the third step is the only one in this comment that was validated against independent ground measurement.

Principal results as the preprint states them. That anthropogenic illuminance exceeding the natural moonless level reaches 22.9 percent of the earth's terrestrial surface; 51.0 percent of Key Biodiversity Area units and 77.1 percent of Global Protected Area units, though only 6.1 percent and 9.0 percent of their total area; and about twenty percent of the most biodiverse areas for mammals, birds and amphibians. That 5.5 percent of terrestrial land experiences at least perpetual crescent-moon illuminance. That the greatest exposure among Key Biodiversity

Areas is in Europe, at about sixty percent of area, and the Middle East at about forty-three percent.

THE RESULT THE COMMENT ACTUALLY WANTS, WHICH IS THE LITERATURE REVIEW AND NOT THE MAP. A systematic review of organismal responses, compiled against illuminance up to nautical twilight, found effects reported in 117 species from 23 orders across 8 classes of arthropods and chordates. Binned: 77 species affected between 100 and 3,000 millilux; 25 between 10 and 100; 18 between 1 and 10; and 28 species altering activity, foraging or vigilance below 1 millilux, of which five were cases of elevated mortality in prey species. Examples given: new-moon levels initiate foraging in tropical sweat bees and stimulate courtship in fireflies; crescent-moon levels alter circadian rhythms in hamsters. The authors state that the studies are not evenly distributed across light levels. This is the nearest thing the Foundation has found to the species-by-threshold compilation that paragraph 360ii(a)(4) would require, and it is presently behind a citation the Foundation has not verified.

What it establishes. Nothing, until the published article is read. Subject to that, and on the preprint alone: that a majority of designated protected area units worldwide are lit above the level of a natural moonless night; and that biological effects have been reported across four orders of magnitude of illuminance, including below the natural moonless level.

What it does not establish. Any human effect, and it does not address human health. Any effect at any location: the map is a model and the biology is a review of other people's studies, so no organism was observed in this work. Anything about spectral composition, the exposure chain being spectrally blind at its first step and photopically weighted at its last. And nothing about any product.

Bearing on the statutory question. Paragraph 360ii(a)(4), for the proposition that the compilation of effect thresholds against exposure has been attempted once, by eight investigators including a federal scientist, and exists in one review. Paragraph 360ii(a)(2) on the emissions limb, skyglow being the subject. Part V.A.2, where the threshold compilation is reported; Part V.I, for the natural darkness figures; Part V.J.4, where the exposure chain is counted.

C.148 Alaasam, Duncan, Casagrande, Davies, Sidher, Seymoure, Shen, Zhang and Ouyang (2018) — two commercial lamps equalized in the wrong unit, a warmer one indistinguishable from darkness, and a manuscript in this Department's own repository

Citation. Alaasam V.J., Duncan R., Casagrande S., Davies S., Sidher A., Seymoure B., Shen Y., Zhang Y., Ouyang J.Q. "Light at night disrupts nocturnal rest and elevates glucocorticoids at cool color temperatures." Journal of Experimental Zoology Part A: Ecological and Integrative Physiology. 2018;329(8-9):465–472. doi:10.1002/jez.2168. Read as the accepted author manuscript deposited in PubMed Central under the HHS Public Access policy, available in PubMed Central from 1 October 2019. Authors at the University of Nevada, Reno (Biology, and Electrical and Biomedical Engineering); the Max Planck Institute for Ornithology; Quinnipiac University; and Colorado State University.

FUNDING, WHICH IS THE MOST DISTINCTIVE FACT ABOUT THIS ENTRY. The National Institute of General Medical Sciences of the National Institutes of Health, grant P20 GM103650, supported the senior author. A graduate fellowship of the University of Nevada supported the first author. The National Park Service Natural Sounds and Night Skies Division supported a co-author through a postdoctoral fellowship. No industry funding is declared and no competing interests statement was located in the manuscript read; one must be obtained from the published version. Because the work was funded by an operating division of this Department, the manuscript is deposited in the Department's own public access repository, which is where the Foundation read it. Part V.I states what the Foundation makes of that and Part II.H is where it may belong.

Design. Twenty-four adult zebra finches, twelve male and twelve female, habituated for thirty-eight days under a ten-hour light and fourteen-hour dark cycle before treatment, in Reno, Nevada. Three treatments, eight animals each: a night-light fitted with a strip of three diodes rated 5,000 kelvin; the same fitted with diodes rated 3,000 kelvin; and an identical fixture containing no diodes. Output attenuated by covering the diffuser with black paper to reach the required level. Endpoints: body condition by scaled mass index, food intake, locomotor activity by day and by night, and plasma corticosterone by enzyme-linked immunosorbent assay, analyzed as within-individual change from pre-treatment values. Generalized linear mixed models with treatment by day interaction and Tukey post hoc comparisons; individual as a random effect.

THE EXPOSURE, AND THE OBJECTION THE FOUNDATION MAKES TO HOW IT WAS SET. Both lamps were standardized to 0.3 lux, plus or minus 0.01, measured at perch height fifteen centimeters from the light and at the far corners of the cage, with an Extech Easyview handheld digital light meter, model EA13. Control cages measured below 0.01 lux. The figure of 0.3 lux was chosen because a published study reports that free-living birds near street lamps experience about that illuminance. The objection is not to the level but to the quantity. Lux is weighted to the human photopic response, so two lamps set to the same lux do not deliver the same radiant energy and the cooler lamp necessarily delivered more short-wavelength energy at the same reading. The experiment therefore compares two sources matched for human brightness and differing in the quantity at issue, which means the result is about spectral content at equal photopic illuminance and not about correlated color temperature as such. Two further matters: the instrument is a handheld consumer meter used at three tenths of a lux and reported to a hundredth, which is a precision that must be checked against the instrument's own specification; and the spectra of the two lamps are not published in this paper, the authors directing the reader to figures in a different paper by one of them.

Principal results. No differences between groups before treatment in corticosterone, food consumption, weight, fat, body condition, nighttime activity or total activity, all probabilities above 0.1. Under treatment, birds in the 5,000 kelvin group had higher rates of nighttime activity than both the 3,000 kelvin group and the controls, peaking after about one week and highest on days nine to thirteen. The same group showed a within-individual increase in corticosterone relative to pre-treatment, against the other two groups. No change in body condition or food intake in any group, including on day twelve when nocturnal activity was at its highest. No compensating reduction in daytime activity. The 3,000 kelvin group did not differ from the unlit controls on either measure.

What it establishes. That at a photopic illuminance of three tenths of a lux, a commercial diode strip sold as 5,000 kelvin disrupted nocturnal rest and raised a glucocorticoid in a captive diurnal bird over about two weeks, while one sold as 3,000 kelvin, set to the same photopic illuminance, did not differ from darkness on those two measures in groups of eight.

What it does not establish. Any human effect. Any fitness effect: body condition and food intake did not move, and survival, reproduction and pathology were not measured. That a 3,000 kelvin lamp is without effect, the comparison resting on eight animals a group with no power calculation reported. That correlated color temperature is the operative variable, for the reason given above. And nothing about longer exposures; the authors state that continued treatment might produce pathology, and alternatively that the declining activity peak may indicate acclimation.

Considerations bearing on confidence. Against. Eight animals a group. Captive-bred birds which the authors state had presumably never experienced light at night, natural or artificial, so the response may not represent that of a wild population. Corticosterone by a commercial immunoassay, validated by the authors for this species. Melatonin, the mediator usually proposed, was not measured, and the authors state they did not measure the non-visual photoreceptors to which they attribute the mechanism. The spectra are not in the paper. In favor. Randomized assignment with pre-treatment equivalence demonstrated on seven

measures. Within-individual change rather than between-group comparison for the hormone. Named commercial lamps at commercially available color temperatures rather than laboratory sources. An exposure chosen from a published field measurement rather than for convenience. Intra- and inter-plate coefficients of variation reported at 1.7 and 2.5 percent. And the authors qualify their own recommendation in four separate ways.

Relation to other entries. Four. It is the one entry in which a reduction in short-wavelength content removed an effect in a living animal, and Part V.I has been amended for the fifth time on account of it. It sits against Appendix C.128, where at a fixed intensity every spectrum tested produced a large effect, and against Appendix C.146, where a lamp emitting only between 550 and 650 nanometers suppressed foraging in a mammal to forty meters. Brett Seymoure is a co-author here and the first author of Appendix C.147. And the illuminance of 0.3 lux is the third appearance of that figure in this comment, after the Australian guidelines at Appendix D.1 and the source both cite.

Bearing on the statutory question. The emissions limb of paragraph 360ii(a)(2), the exposure being two commercial lamps at a stated photopic illuminance. Paragraph 360ii(a)(4), for the proposition that a standardization performed in a photometric unit does not hold the emission constant, which is the measurement argument of Part V.J made visible in an experimental design. Part I.G, for the inadequacy of correlated color temperature as a descriptor and for a recommendation expressed in it by authors who did not publish their spectra. Parts V.F, V.I, V.J.4 and II.H.

C.149 Seymoure, Linares and White (2019) — nine street lights measured and five visual systems modeled, with the finding that lamps a human cannot tell apart are told apart by birds and insects

Citation. Seymoure B.M., Linares C., White J. "Connecting spectral radiometry of anthropogenic light sources to the visual ecology of organisms." Journal of Zoology. 2019. doi:10.1111/jzo.12656. Print ISSN 0952-8369. Received 8 January 2018, revised 30 December 2018, accepted 11 January 2019. Editor Andrew Kitchener. Authors at Colorado State University, Department of Biology and Department of Fish, Wildlife and Conservation Biology. Read as a file hosted on the Foundation's own server; the volume, issue and pagination are not on the copy read and must be obtained.

Design. Measurement plus modeling, with no organism observed. In collaboration with the City of Fort Collins Utilities, the authors measured the radiance of nine street lights in service: high-pressure sodium at 70, 100, 150, 250 and 400 watts; mercury vapor at 175 and 250 watts; metal halide at 1,000 watts; and a light-emitting diode at 73 watts. Radiance was measured at twenty-five meters from each light using a StellarNet SILVER-Nova spectroradiometer with a radiance probe aligned by two laser pointers mounted in a three-dimensionally printed block, the lasers being switched off for the measurement. Output recorded as energy flux in watts per square meter per second per nanometer and converted to photon flux in photons per square centimeter per second per steradian per nanometer, with the solid angle scaled from the probe's aperture to one steradian. Spectra summarized as total brightness by integration, and as chroma and hue.

The modeling. Quantum catch computed for each photoreceptor of five visual systems from published peak sensitivities and Govardovskii templates: an ultraviolet-sensitive passerine, a violet-sensitive passerine, a human, a wolf and a hawkmoth. Four non-visual photoreceptors were included, neuropsin at 360 nanometers, pinopsin at 470, melanopsin at 484 and vertebrate ancient opsin at 490. Chromatic contrast computed as just noticeable differences by a receptor-noise model using published cone ratios, with values below one taken as physiologically indistinguishable and the authors adopting three as the conservative threshold below which two sources are unlikely to be seen as different. Color space overlap computed as a descriptive check and not tested statistically.

THE PRINCIPAL FINDING. "Most interestingly, humans see a much different nocturnal urban environment than other animals as humans see most lights as the same color, yet birds and insects are likely seeing a myriad of differently colored lights in their environment." The modeled contrasts were above threshold for most lamp comparisons in the avian and hawkmoth systems; in the two mammalian systems many comparisons fell below it, with the authors recording that a human would most likely not discriminate the two mercury vapor lamps and that all the sodium lamps would be seen as one color.

The second finding, which bears on how a standard could be written. That the same lamp technology at different powers produces different spectra. The authors state that this corroborates an earlier measurement study, that it contradicts "current doctrine" that similar light sources have the same spectral composition regardless of power, and that previous research in this field has assumed that sources within a type are the same color, naming three papers. Two of those three are recorded elsewhere in this comment as acquisitions for the spectral-descriptor argument, which is why the Foundation records the criticism here rather than leaving it to be discovered.

What the study says that does not help the Foundation, recorded because the body relies on this paper. That by the hue metric used here the metal halide had the greatest short-wavelength composition of the nine, and the diode and the sodium lamps the greatest long-wavelength composition; the single diode measured was therefore not the bluest lamp in this sample. That only the 1,000-watt metal halide was significantly brighter than the rest, and that the authors regard subtle brightness differences as probably irrelevant to an adapting eye. The objection the authors do make to the diode is that it was the least chromatic, that is the most broadband, and was accordingly "most likely to stimulate photoreceptors regardless of visual system," which is a different and more precise objection than an excess of short-wavelength content and is the one the comment adopts.

What it establishes. That nine street lights in one American city differ measurably in spectral shape by technology and by power; that on published receptor sensitivities and a standard discrimination model, avian and insect visual systems would distinguish most of them while two mammalian systems would not; and that the long-wavelength photoreceptors were predominantly stimulated under most of the sources.

What it does not establish. Any effect on anything. No organism was observed, no behavior measured and no physiological endpoint recorded; the authors say expressly that very little is known about how spectral composition alone affects visually guided behavior and physiology. Nothing about human health. And nothing about lamps outside this sample: one diode, one metal halide, two mercury vapor and five sodium lamps, all in one city.

Considerations bearing on confidence. Against. A sample of nine fixtures in one municipality, with a single example of the technology the comment is most concerned with. The authors acknowledge that fixture height, cleanliness and bulb age could introduce uncontrolled differences. Every perceptual statement is modeled, resting on published peak sensitivities, published cone ratios and three stated assumptions about how color discrimination operates. The color-space overlap analysis is descriptive and was not tested. In favor. Radiance measured on deployed hardware at a stated distance with a named sensitive spectroradiometer and a described alignment method, reported in radiometric units and converted to photon flux. A municipal utility collaborated, which is why lamps in service could be measured at all. Peak sensitivities and cone ratios are tabulated with citations for every species. And the authors criticize an assumption in the prior literature, including in work by investigators this comment otherwise relies on.

Relation to other entries. Four. It is the third entry, with Appendices C.133 and C.141, in which a visual system was modeled rather than assumed, and Part V.A.3 has been conformed. It is the second entry, with Appendix C.139, excluded from the census of non-human-subject entries because no organism was observed. Its instrument is of the same family as the one used

at Appendix C.146, which is the only other entry in this appendix to measure a real exposure radiometrically with a traceable instrument. And Brett Seymoure is the first author here, the first author of Appendix C.147 and a co-author of Appendix C.148.

Bearing on the statutory question. Section 360kk, which requires that a performance standard prescribe an emission characteristic. This entry is the Foundation's evidence that the characteristic cannot be the lamp technology, because the same technology at a different power emits differently, and cannot be a descriptor keyed to human perception, because lamps a human cannot tell apart are physically different and are discriminated by other receiver systems. Paragraph 360ii(a)(4), for a worked example of what it looks like to characterize an emission properly. Part I.G, which is written on it; Part V.A.3; Part IX.G.1 and Part IX.J.

C.150 Van Doren, Horton, Dokter, Klinck, Elbin and Farnsworth (2017) — a light switched off and on for seven years, 1.1 million birds, and an effect that ended in minutes

Citation. Van Doren B.M., Horton K.G., Dokter A.M., Klinck H., Elbin S.B., Farnsworth A. "High-intensity urban light installation dramatically alters nocturnal bird migration." Proceedings of the National Academy of Sciences. 2017;114(42):11175–11180. doi:10.1073/pnas.1708574114. Received 29 May 2017, approved 31 August 2017, edited by James A. Estes. Authors at the Cornell Lab of Ornithology, the University of Oxford, the University of Oklahoma and New York City Audubon. Visual counts archived in eBird. Read from a file hosted on the Foundation's own server; the volume, issue and page range above are partly inferred from the page footer and must be verified.

Why this entry is here, stated first. Not for its magnitudes, which concern an extraordinary installation, but for its design. It is the only study in this appendix in which a real deployed emission was repeatedly switched off and on while the biological response was measured in both states. Every standing objection recorded at Part V.A.2 — that exposure cannot be assigned, that controls are not dark, that urbanization confounds, that the dose-response is unobserved — is answered here by the operating practice of the installation rather than by any analytical device.

The exposure and how it came to be switched. The National September 11 Memorial and Museum's Tribute in Light, a pair of vertical beams in Lower Manhattan operated on the night of 11 September. By agreement between New York City Audubon and the Museum, when observers on the ground count more than one thousand birds circling in the beams, the lights are extinguished for about twenty minutes. The Foundation notes the form of that control: it is triggered by a biological observation made by a person on site and not by any measured property of the emission.

Design. Nights of 11 September, 2008 to 2016. 2009 and 2011 excluded for precipitation, which corrupts radar returns; 2014 excluded from the illumination comparisons because the lights were not shut down; seven years analyzed. Bird densities and radial velocities from the KOKX Brookhaven weather surveillance radar at about 0.5 and 1.5 degrees elevation, the installation lying 98.5 kilometers from the radar, analyzed within a 20-kilometer radius and in a cylinder of 500-meter radius and 1.7-kilometer height over the site. Baseline defined as the mean and standard deviation of density between 2 and 20 kilometers from the installation, with a standardized peak density expressed as the number of standard deviations above that baseline. Continuous acoustic recording of flight calls at the base of the installation at 32 kilohertz. A flow model simulating three behavioral parameters: the probability that the lights affected nearby birds, the distance over which they did so, and whether disoriented birds flew preferentially toward the display.

Principal results. Peak densities near the installation exceeded twenty times baseline in all seven years, sixty times in five years and a hundred and fifty times in three (2008, 2012 and 2013), while in the absence of illumination the peak never exceeded thirteen times baseline. At the lower radar elevation, maximum standardized densities were fourteen times greater when

illuminated (t equals 5.70, p below 0.0001) and maximum bird numbers 3.4 times greater (t equals 3.89, p equals 0.0003). At the higher elevation, sampling altitudes of 2.4 to 4.1 kilometers, standardized densities rose on average 3.9 times (t equals 3.25, p equals 0.002) and numbers 3.3 times (t equals 2.34, p equals 0.023). Over all observations, numbers within 500 meters averaged 3.4 times higher when lit (t equals 9.34, p below 0.0001) and standardized peak densities 6.4 times higher (t equals 3.72, p equals 0.0003), the effect reaching 46 times in 2015. An estimated 1.1 million birds, interval 0.6 to 1.6 million, were affected across seven nights. Vocal activity was intense during aggregation. The simulation could reproduce the observed concentrations only by allowing directed flight toward the light by disoriented birds.

THE FINDING THE COMMENT TAKES FIRST. That the effect ended with the emission. Removal of illumination produced dispersal, increased flight speed, reduced calling and departure from the site "in a matter of minutes," and the authors state that short-term removal "eliminated its disruptive effects almost instantaneously." Part V.I sets out what the Foundation makes of that, which is that the characteristic controlled was duration and that the remedy was a switch.

Two conditions that defeat standing objections. That the aggregations occurred under clear skies, the previous literature having associated such events with fog and low cloud; and that they occurred in Lower Manhattan, against one of the most heavily lit backgrounds anywhere. The marginal effect of a single installation on top of that background, in good visibility, was a twentyfold aggregation in every year.

THE EXPOSURE WAS NEVER CHARACTERIZED, AND THAT IS WHY THIS ENTRY IS ALSO AT PART V.J.4. The Foundation can find in this paper no lumen, candela, lux, watt, irradiance, radiance or spectrum for the light source. The word intensity appears in the title and in a comparison with an installation in Las Vegas, and nowhere as a quantity. The exposure variable is binary: the lights were on or they were off. The Foundation makes no criticism of the authors, who are ornithologists measuring birds at four kilometers and do not own the installation, and records the fact because the Department is asked to derive a prescribable number from this literature.

What it establishes. That a single ground-based vertical light installation concentrated nocturnally migrating birds at more than twenty times background density in every year observed, altered their flight speed, flight path and calling, did so at altitudes of up to about four kilometers, and that all of these effects ceased within minutes when the installation was switched off.

What it does not establish. Any human effect. Any mortality: no dead bird was counted and no collision observed, and the comment does not assert a death from this study. Any dose-response: the exposure has two states and no measured magnitude, so nothing in it identifies a threshold or a shape. And nothing transferable about ordinary street lighting, the authors stating that few installations of comparable intensity exist in the United States.

Considerations bearing on confidence. Against. A single installation on a single calendar night each year, so season, site and date are not varied. The radar is 98.5 kilometers away and its beam at that range is wide, which the authors address by restricting the analysis volume and by adjusting for birds below the beam. The shutdowns are not randomized; they are triggered by an observer counting a thousand circling birds, so periods of darkness follow periods of unusually high aggregation by construction, which tends to make the lit periods look worse and is a form of regression to the mean the paper should be checked for. Three of nine years were excluded. In favor. Repeated within-site switching of a real exposure across seven years. Two independent sensing modalities, radar and acoustic, agreeing. A simulation that tests the mechanism rather than assuming it. Effect sizes with test statistics and probabilities throughout. Publication in a journal of the first rank with a named editor. And an operating agreement with a conservation body that created the natural experiment in the first place.

Bearing on the statutory question. Paragraph 360ii(a)(5), which directs the Secretary to develop, test and evaluate the effectiveness of procedures and techniques for minimizing exposure. This is a procedure, tested, and found effective within minutes. Paragraph 360ii(a)(2) on the emissions limb. Paragraph 360ii(a)(4), for the proposition at Part V.J.4 that a well-designed study of a real installation may contain no characterization of the emission at all. Parts V.A.2, V.I, V.J.4, IX.C and IX, where the reversibility is relied on.

C.151 Pawson and Bader (2014) — six color temperatures at identical radiant power, and no difference

Citation. Pawson S.M., Bader M.K.-F. "LED lighting increases the ecological impact of light pollution irrespective of color temperature." Ecological Applications. 2014;24(7):1561–1568. Published in the Communications section. Authors at Scion, Christchurch and Rotorua, New Zealand. Read from a file hosted on the Foundation's own server; the digital object identifier is not on the copy read and must be obtained.

Why this entry is here. For one thing only: it is the single experiment the Foundation has found that varied correlated color temperature while holding radiant power constant, and measured a biological response. Part I.G is written on that comparison. Everything else in the paper is recorded and not relied on.

Design of the comparison relied on. Six white light-emitting diodes of six different correlated color temperatures, in three independent blocks, on the boundary of a dairy processing facility at Rakaia, Christchurch, with blocks on long grass or gravel surrounded by pasture and shelter belts of Pinus radiata. A control treatment used an eighteen-ohm resistor matched to the power consumption and heat output of the diodes, so that the control differed from the treatments in light and not in warmth. Flying invertebrates collected in traps.

THE MATCHING, WHICH IS THE REASON THE RESULT IS USABLE. The drive current of each diode was adjusted through a potentiometer on a commercial driver until every color temperature produced the same radiant power, 12 milliwatts plus or minus 1 by standard deviation. Power was measured by collimating the emission through a stated lens onto a thermopile sensor and averaging over ten-second intervals with a laboratory power meter. Emission spectra were measured for each color temperature and are reproduced in the paper. The authors also verified that the adhesive-coated trap surface did not alter the relative proportion of light emitted in the blue-green region. This is the only study in Appendix C in which sources of differing spectrum were equalized in a radiometric quantity rather than a photometric one.

Result. Twelve thousand eight hundred and sixty invertebrates were caught, of which 8,879 were Diptera, 1,674 Lepidoptera, 1,089 Thysanoptera, 450 Coleoptera, 379 Hymenoptera and 144 Neuroptera, with fewer than a hundred each of seven further groups. Pooling flying taxa, the lamps attracted significantly more invertebrates than the unlit controls at every color temperature. The difference between control and lamp was taxon-dependent: strong in Diptera and Lepidoptera, absent in Thysanoptera, Hymenoptera and Coleoptera. And in the authors' words, irrespective of taxa the color temperature had no significant effect on invertebrate attraction.

The second comparison, which the comment records and does not use. Separately, at an industrial wood processing site in Hawkes Bay, five replicate pairs of luminaires were operated on alternating nights over ten nights: a 360-watt high-pressure sodium lamp of a named model against a 4,000 kelvin light-emitting diode high bay luminaire of a named model. Traps at the diode luminaires caught 48 percent more flying invertebrates on average, with a significant interaction between light type and air temperature. The Foundation does not rely on that figure. The paper does not state that the outputs of the two luminaires were equalized in any quantity, and they are different products of different wattages installed on buildings, so the comparison is between two lighting installations and not between two spectra at equal power. It

is evidence about what happens when a site converts, which is a real question, and it is not evidence that the spectrum caused the difference.

What it establishes. That across six commercially available white color temperatures, at identical measured radiant power, the choice of color temperature made no significant difference to the number of flying invertebrates attracted; and that all six attracted significantly more than an unlit control of matched heat output.

What it does not establish. Any human effect. That spectrum is irrelevant, the finding being about one descriptor and not about spectral composition. Any effect other than attraction. And nothing about the three orders in which no difference from the control was detected.

THE LIMITATION THAT GOVERNS EVERY USE OF THIS ENTRY. The endpoint is attraction measured in light traps. Appendix C.142 establishes, on its authors' own evidence, that the number of adult insects attracted to a lighting technology may not serve as a suitable proxy for ecological impact, and Appendix C.135 establishes that only a small fraction of the animals affected by a lamp are caught at it. This study therefore measures a quantity this comment has twice recorded as a poor proxy. The Foundation uses it for what the proxy problem does not touch, which is the comparison between color temperatures at matched power: whatever attraction is a proxy for, it was the same proxy for all six lamps.

Considerations bearing on confidence. Against. Attraction as the endpoint, as above. Three blocks. A single site for each comparison, both in New Zealand, in one austral summer. Trapping on ten nights within a fortnight for the luminaire comparison, with the authors noting the ten occasions are not truly independent and testing for repeated measures. Invertebrates identified to order rather than species. And one night of anomalously low catch attributed to an easterly wind, which the authors report rather than exclude. In favor. Radiometric matching with a named instrument and a stated tolerance. Measured emission spectra. A control matched for heat as well as for the absence of light. Randomized assignment and alternation of the active lamp between nights in the luminaire comparison. Named commercial products. And a result that is null on the variable the authors hypothesized would matter, reported as such.

Relation to other entries. Four. It is the fourth study in this comment in which a spectral adjustment failed to deliver the expected reduction, after the moth experiment at Appendix C.128, the yellow lamp at Appendix C.146 and the modeling at Appendix C.141, and the first in which the descriptor itself was the manipulated variable. It stands against Appendix C.148, where a warmer lamp did remove an effect, and the difference between the two is the matching quantity: radiometric here, photometric there. Its proxy problem is the one stated at Appendices C.135 and C.142. And its taxon-dependence is of a piece with the divergent invertebrate result recorded at Appendix D.8.

Bearing on the statutory question. Part I.G, which is written on it, for the proposition that correlated color temperature is not the quantity in which a spectral limit should be written. Section 360kk, for the same reason: a performance standard must prescribe an emission characteristic, and this is evidence that this particular characteristic does not track the effect. The emissions limb of paragraph 360ii(a)(2). Parts V.I and IX.J.

C.152 Stone, Jones and Harris (2012) — bats avoid diode street lighting at 3.6 lux, and the authors report that they did not reach a threshold

Citation. Stone E.L., Jones G., Harris S. "Conserving energy at a cost to biodiversity? Impacts of LED lighting on bats." Global Change Biology. 2012;18(8):2458–2465. doi:10.1111/j.1365-2486.2012.02705.x. Received 13 January 2012, accepted 3 March 2012. Authors at the School of Biological Sciences, University of Bristol. Read from a file hosted on the Foundation's own server; the issue number is inferred and must be verified.

Design. A field experiment at ten sites in southwest England and Wales, near lesser horseshoe bat maternity roosts, between May and August 2009, six nights at each. Hedgerows were illuminated with two portable cool white light-emitting diode lamps, each containing twenty-

four high-power diodes of 2.4 watts, mounted 1.7 meters high on one side of the hedge and powered by a named silenced portable generator. Five treatment types: a control with detectors only; a noise treatment with the lamps installed but switched off and the generator running all night; and three lit treatments at low, medium and high intensity. Illuminance was measured below the lights: low, mean 3.6 lux, standard deviation 0.48, range 2.90 to 4.86; medium, mean 6.6 lux, standard deviation 0.93, range 4.95 to 8.60; high, mean 49.8 lux, standard deviation 4.50, from a range beginning at 38.10. The sequence of lit treatments was randomized among nights three to five across sites to control for order. Bat activity recorded as passes by detectors on each side of the hedge and identified to species or species group from call parameters. Repeated-measures general linear models; temperature and rainfall tested and found not to differ among treatment nights, and therefore excluded.

Principal results. Activity of the lesser horseshoe bat and of Myotis species was significantly reduced under the lights, including at the lowest intensity of 3.6 lux. For Myotis species the treatment effect was significant, F equals 6.28 on 5 and 30 degrees of freedom, n of 7, p equals 0.004, with no significant difference between the medium and low treatments. No effect was detected on the faster-flying Pipistrellus pipistrellus, Pipistrellus pygmaeus or Nyctalus and Eptesicus species. There was no significant difference between the control and the first noise night, so the generator does not account for the result.

The behavioral observations, which show what the detectors could not. Direct observation of the lesser horseshoe bat on twenty-nine lit nights at all ten sites: on 56 percent of observations bats flew through the lights and on 44 percent they avoided them. Of those that avoided, 53 percent flew over the hedge and out of sight, 43 percent turned around before the lights, 3 percent flew through the hedge and 1 percent may have avoided detection by flying high or wide. Activity on the unlit side of the hedge did not differ by treatment, F equals 1.202 on 5 and 30 degrees of freedom, n of 7, p equals 0.332, so the animals were not simply using the dark side instead. Measured illuminance on the unlit side was 0.59 lux on lit nights against 0.55 lux on control and noise nights, so there was no material spillover.

THE SENTENCE THE COMMENT RELIES ON. "reducing light intensity has often been advocated as a potential mitigation strategy for lighting schemes affecting bats; this assumes that there is a critical light threshold below which there are no negative effects on bat activity. However, for these species, we have shown that light levels would have to be lower than at least 3.6 lux before a potential threshold is found." Part V.A.2 sets out what the Foundation makes of that, and sets it against the entry for the same species at 51.67 lux in the table at Appendix D.7, which cites the same first author three years earlier.

The authors' own doubt about their own remedy, recorded because it runs against the Foundation. That achieving such low levels may not be practical, since public perception of safety combined with the practicality of achieving them often precludes dimming to very low levels. An experiment that fails to find a threshold above 3.6 lux does not establish that 3.6 lux can be delivered on a public road, and the comment does not say otherwise.

What it establishes. That diode street lighting at a measured 3.6 lux significantly reduced the activity of two slow-flying bat groups along hedgerows used as commuting routes; that the reduction was not explained by generator noise, temperature or rainfall; that the animals did not compensate by using the unlit side; and that the investigators did not reach an intensity at which the effect disappeared.

What it does not establish. Any human effect. Any effect on faster-flying bats, in which none was detected. Any population or fitness consequence: the endpoint is activity along a commuting route over six nights, and the authors describe long-term conservation impacts as unknown. Any threshold, which is the point. And nothing about spectrum, a single cool white source being used throughout.

Considerations bearing on confidence. Against. Ten sites but seven in the analyses that report degrees of freedom, and six nights per site. Activity measured as detector passes, which is

an index rather than a count of animals. A single lamp type at a single color temperature, so nothing in it bears on spectral mitigation. Weather recorded at four sites only, with the remainder taken from stations a mean of 17.5 kilometers away. In favor. A randomized, replicated field experiment with a real manipulated exposure at three measured intensities, which is the design Part V.A.2 says the literature lacks. A noise control, which is the only instance in this appendix of an experiment separately controlling for the disturbance created by its own apparatus. Direct behavioral observation corroborating the detector data. Measurement of the unlit side to exclude spillover and displacement. And a null result reported for three taxa alongside the positive result for two.

Relation to other entries. Four. Appendix C.153 is the first half of a matched pair with this study: the same three authors, the same species, the same region, the preceding field season, the same treatment regime and instrument and luminaire supplier, high-pressure sodium at one level instead of diodes at three. Part V.A.2 uses the pair. The table at Appendix D.7 tabulates the earlier study at 51.67 lux, which is the figure from its street survey rather than its treatment level of 53.09 lux; this study puts the same species at 3.6 lux. The taxon-dependence, with slow-flying species affected and fast-flying species not, is of a piece with the order-dependence at Appendix C.151 and the divergent invertebrate result at Appendix D.8. And the Australian guidelines at Appendix D.1 devote an appendix to bats and record species-specific spectral sensitivities, which this study does not address.

Bearing on the statutory question. Paragraph 360ii(a)(4), for the proposition that where investigators have varied intensity systematically they have not found the bottom of the effect. Paragraph 360ii(a)(5), because the mitigation whose premise the authors question is intensity reduction, which is one of the procedures that paragraph directs be developed, tested and evaluated. The emissions limb of paragraph 360ii(a)(2). Parts V.A.2, V.I and IX.C.

C.153 Stone, Jones and Harris (2009) — the earlier half of the matched pair: one intensity, a large effect, no habituation, and spillover onto the supposedly dark side

Citation. Stone E.L., Jones G., Harris S. "Street lighting disturbs commuting bats." Current Biology. 2009;19(13):1123–1127. doi:10.1016/j.cub.2009.05.058. Received 6 April 2009, revised 5 May 2009, accepted 8 May 2009, published online 18 June 2009, issue dated 14 July 2009. Authors at the School of Biological Sciences, University of Bristol. Read from a file hosted on the Foundation's own server; the original must be cited.

Why this entry exists. It is the study behind the 51.67 lux row in the reference table at Appendix D.7, and Part V.A.2 sets it against Appendix C.152 to show that a tabulated effect level is a treatment level and not a threshold. It is also the earlier half of the only matched pair of field experiments in this appendix: same authors, same species, same region, consecutive field seasons, same treatment regime, same instrument, same luminaire supplier, different lamp technology and a different number of intensities.

Design. A field experiment at hedgerows in the vicinity of eight lesser horseshoe bat maternity roosts in southern Britain between April and July 2008, seven nights at each site. Night 1 control, detectors only; night 2 noise, with the lighting units installed but switched off and the generator running all night; nights 3 to 6 lit, full illumination all night, repeated over four consecutive nights; night 7 a repeat of the noise treatment. Two portable high-pressure sodium streetlights 30 meters apart, standard units obtained from a named manufacturer under guidance from the then Institute of Lighting Engineers, powered by a named portable generator sited an average of 58 meters away. Lights an average of 269 meters from the roosts, range 91 to 791. Lights and generator switched on 30 minutes before sunset. Activity recorded as bat passes by two models of ultrasonic detector on stands about 1.2 meters high, at a stated sensitivity and division ratio, rotated between treatments to control for differences in detector sensitivity. Repeated-measures general linear models on log-transformed data. Temperature, wind speed and rainfall tested and found not to differ by treatment, and therefore excluded.

How the exposure level was chosen, which is the detail the reference table lost. In August 2007 the authors surveyed three randomly selected two-kilometer squares in North Somerset by car at night, excluding urban areas, measuring illuminance along hedgerows lit by real high-pressure sodium streetlights with a named handheld illuminance meter held horizontally at 1.7 meters, at four points per streetlight. The mean was 51.67 lux, confidence interval plus or minus 11.68, n of 26. The experimental hedges were then illuminated to a mean of 53.09 lux, standard deviation 2.73, range 47.3 to 60.2, n of 36. The figure 51.67 is therefore a survey of ordinary British street lighting and 53.09 is the experimental treatment. The table at Appendix D.7 tabulates the former as a level at which an effect was observed.

Principal results. Treatment type had a significant effect on activity, F equals 9.51 on 2.54 and 17.74 degrees of freedom, n of 8, p less than 0.02. Activity during all four lit nights differed from control. Neither noise treatment differed from control, and the two noise treatments did not differ from each other, so generator noise and the physical presence of unlit lighting units do not account for the result. The four lit nights did not differ from each other, F equals 0.390 on 3 and 12 degrees of freedom, n of 5, p greater than 0.05, and the authors report no evidence of short-term habituation.

Commencement of activity, which is the second endpoint and is reported here because the comment has few timing endpoints in animals. Activity commenced at the hedge a mean of 29.9 minutes after sunset on control nights and a mean of 78.6 minutes after sunset on lit nights, significantly later than control, F equals 6.73 on 1 and 7 degrees of freedom, n of 8, p less than 0.04, and significantly later than the first noise night, F equals 9.23 on 1 and 7 degrees of freedom, n of 8, p less than 0.02. The median time of emergence from the roosts themselves was 32 minutes after sunset. The authors note that this species forages most at dusk, in line with the peak abundance of its principal prey, so a delay of that size is a missed foraging opportunity rather than a rescheduled one.

The anomaly in the noise control, recorded because a control that detects something is doing its job. On the first noise night activity commenced significantly earlier than on control nights, a mean of 23.0 minutes after sunset against 29.9, F equals 5.90 on 1 and 7 degrees of freedom, n of 8, p less than 0.05. The authors suggest some bats may have emerged early to investigate the noise. The second noise night did not differ from control. The noise control was therefore null for the activity endpoint and not null for the timing endpoint on first exposure. The Foundation reports this because Part V.A.2 praises these two studies for having a noise control at all, and a reader is entitled to know that the control was not inert.

THE FINDING PART V.A.2 RELIES ON MOST. The unlit side of the hedge was not unlit. On lit nights the authors measured a mean of 4.17 lux there, standard deviation 7.77, range 0.07 to 24.28, n of 16, significantly higher than at the same places on unlit nights, Mann-Whitney U, W of 230.5, p less than 0.01, mean 0.03, standard deviation 0.03, n of 62. There was no significant effect of treatment on activity on the unlit side, F equals 2.71 on 3 and 12 degrees of freedom, n of 5, p greater than 0.05, so bats did not escape the lights by using it. The authors explain why, and the sentence is the one the comment uses: that it is unsurprising few bats flew along the unlit side, since even these relatively low light levels may make established routes unsuitable for commuting. Three years later the same group demonstrated a significant effect in the same species at 3.6 lux, below the spillover measured here.

Behavioral observations. On lit nights, from fourteen observation sessions: bats flew through the lights on 42 percent of observations, turned around before reaching the lights on 30 percent, flew over the hedge on 17 percent, flew through the hedge on 9 percent and flew wide or high around the lights on 2 percent. Avoidance of some kind on 58 percent of observations, against 44 percent in the later study at lower intensities. The authors could not determine whether bats returned to the roost, observed some using alternative routes, and consider it probable that most selected an alternative route.

What it establishes. That high-pressure sodium street lighting at a measured mean of 53.09 lux substantially reduced the commuting activity of a threatened slow-flying bat along established hedgerow flight routes and delayed the onset of that activity by about 49 minutes; that neither generator noise nor the presence of the unlit apparatus accounts for it; that there was no habituation over four consecutive nights; and that a spillover of about 4 lux onto the opposite side of the hedge was sufficient that the animals did not use it.

What it does not establish. Any human effect. Any threshold: one lit level was tested. Any population or fitness consequence; the authors are explicit that the consequences of route switching depend on the availability and quality of alternatives, which they did not measure, and they put the downstream effects in the conditional throughout. Anything about diodes, which were not used. And nothing about spectrum, which was not measured.

Considerations bearing on confidence. Against. Eight sites, and five of them for the unlit-side analysis. Activity measured as detector passes, which the authors state cannot be converted into a count of individuals. One lit intensity. An internal inconsistency in the reported darkness figures. In favor. A replicated field experiment with a real manipulated exposure on a threatened species in its own habitat. A noise control and a second noise control after the lit sequence. Measurement of the unlit side, of the middle of the fields and of the ambient condition. Detector rotation to control for instrument differences. Weather tested rather than assumed. A test for habituation, which almost nothing else in this appendix attempts. And publication in a journal of the first rank.

Funding, stated because the Foundation states funding both ways. The acknowledgments name as funders, among others, a trust for endangered species, an international engineering consultancy, a bat conservation body, a government conservation agency for England, a government conservation body for Wales, an environmental consultancy and the lighting manufacturer that supplied the luminaires. The detectors were loaned by another engineering firm. A manufacturer therefore both supplied the equipment and helped fund a study whose result is adverse to the product, and the result was published. The Foundation notes that in the manufacturer's favor and draws no inference against the study.

A point for Part II and Part IX. The authors observe that light pollution is rarely considered in habitat management plans and that street lighting is excluded from the light-pollution legislation of England and Wales. A jurisdiction that legislated against light pollution and carved out the largest single category of outdoor lighting is worth one sentence wherever this comment discusses the shape of existing regulation, and the Foundation flags it rather than using it, because the exclusion has not been verified against the statute.

Relation to other entries. Appendix C.152 is the second half of the pair and the two are used together at Part V.A.2. The table at Appendix D.7 tabulates this study and misstates its exposure level. Part V.J.4 treats the pair as the fourteenth instance in its census, of a fifth kind.

Bearing on the statutory question. Paragraph 360ii(a)(4), for the proposition that a single-level experiment cannot identify a threshold and that the figures circulating in reference tables are treatment levels. The emissions limb of paragraph 360ii(a)(2), because the spillover finding concerns light emitted where it was not intended. Parts V.A.2, V.I and V.J.4.

Appendix D — Assessments, Standards, and Other Documents Cited

This appendix lists the documents this comment relies on that are not peer-reviewed articles. Appendix C contains peer-reviewed articles and nothing else; the documents below are of three other kinds, and the Foundation separates them because they carry different weight and should be read differently.

The distinction matters more in this field than in most, because documents of these three kinds are routinely cited as though they were research findings. An expert committee opinion is an assessment of a literature by a constituted body, and its authority comes from the body and its procedure. A standard is a technical instrument that prescribes how a measurement is made and how a product is classified, and its authority comes from the consensus process that produced it; it reports no findings at all. A publication of a manufacturer or a testing laboratory is neither, and is cited here only for what its author is in a position to know about its own products and practices.

Federal instruments – the United States Code, the Code of Federal Regulations, Federal Register notices and agency guidance – are cited in full where they are discussed, principally at Parts II and IV, and are not duplicated here.

D.1 Expert assessments and policy opinions

Listed in order of adoption. Part V.K treats the three on which reliance was placed, and Part V.K.9 treats the two predecessor Opinions.

D.1.1 SCENIHR, Light Sensitivity (2008). Scientific Committee on Emerging and Newly Identified Health Risks, European Commission. Adopted at the 26th Plenary on September 23, 2008. Working group: Jung (chair), Mattsson (rapporteur), Bridges, with external experts Ferguson, de Gruijl, Krammer and Moseley. Addressed whether energy-saving lamps aggravate the symptoms of light-sensitive people. Identified ultraviolet and blue light as the only candidate risk factor, found no evidence implicating electromagnetic fields or flicker, and called for additional experimental and epidemiological study. Does not mention light-emitting diodes. Treated at Part V.K.9.

D.1.2 SCENIHR, Health Effects of Artificial Light (2012). Same committee. Adopted at the 17th Plenary on March 19, 2012. Working group: Mattsson (chair and rapporteur), Jung, Proykova, with external experts Behar-Cohen, de Gruijl, Ferguson, Hansen, Moseley and Zissis. The direct predecessor of the 2018 Opinion. Source of the age-resolved ocular transmittance figures at Part V.C.2.g. States that light-emitting diodes were under-represented in its own analysis of lamps, that the risk classification of high-power diodes needs further consideration, and that the Exempt Group classification should not be taken to imply protection of the general population against long-term effects. Treated at Part V.K.9.

D.1.3 SCHEER, Opinion on potential risks to human health of light-emitting diodes (2018). Scientific Committee on Health, Environmental and Emerging Risks, European Commission, the successor to the committee above. The Opinion on which the Foundation's analysis at Part V.K principally turns. Its safety conclusion is stated three times and each time conditioned on compliance with the exposure limits of the International Commission on Non-Ionizing Radiation Protection. Treated at Part V.K.1 through K.8, and its optical conventions are relied on at Part V.B.2.

D.1.4 ICNIRP, Guidelines on Limits of Exposure to Incoherent Visible and Infrared Radiation (2013). International Commission on Non-Ionizing Radiation Protection. Health Physics, volume 105, number 1, pages 74 to 96, July 2013. Published by the Commission on its own site and read in full. This is the governing instrument for the exposure limits on which the photobiological safety standard and the three assessments at Part V.K rest, and it supersedes the guidelines of 1997 for that purpose. The comment relies on it for six things: the minimum angular subtense of 1.5 milliradians corresponding

to a retinal spot size of 25 micrometers, at Part V.B.2; the relation between source radiance and retinal irradiance given as its equation 2, with the focal length of 17 millimeters attributed to the Gullstrand schematic eye, also at Part V.B.2; the two assumed pupil diameters, 7 millimeters for the dark-adapted eye and approximately 3 millimeters for bright light conditions, likewise at Part V.B.2; the averaging field of view for the retinal photochemical hazard, 11 milliradians for exposures of 100 seconds or less and 110 milliradians at 10,000 seconds, with the stated basis that 11 milliradians represents the minimal eye movements associated with fixating a point, at Part V.C.2; the statement that these guidelines do not protect against glare and do not preclude light-induced modulation of physiological rhythms, at Part V.C.3; and the revision of the retinal thermal weighting function, the Commission having concluded that values of that function above unity "were indeed unjustified" and having multiplied the values from 385 to 440 nanometers by one tenth.

D.1.5 ICNIRP, Guidelines on limits of exposure to broad-band incoherent optical radiation (1997). The predecessor instrument, retained in this appendix rather than removed. It is retained for two reasons. It is the instrument the framework table at Part I.E has cited, and that citation is being corrected. And the 2018 Opinion examined at Part V.K appears to describe the 1997 values rather than the 2013 ones, as Part V.K.8 now records, so the earlier document is needed to establish what the Opinion was describing. The 2013 guidelines state that the aphakic and blue light hazard functions were carried over from 1997 unchanged.

D.1.6 ICNIRP, Light-Emitting Diodes: Implications for Safety (2020). Same Commission. The statement addressed specifically to this emitting technology. Treated at Part V.K.1.b. Postdates the United States transition to light-emitting diode illumination described at Part IV.G, and the Commission has no authority in the United States.

D.1.7 National Collaborating Centre for Environmental Health, Health Effects of Large LED Screens on Local Residents (2013). Canadian body funded by the Public Health Agency of Canada. January 2013. The only assessment of a light-emitting diode product class by a public health body that the Foundation has located in North America. Concludes that the lack of exposure and population data, combined with limited evidence, precludes a risk assessment. Treated at Part VI.J and Part II.E.4. It is an organizational publication and not a peer-reviewed article, which is why it is here and not in Appendix C.

D.1.8 IEA 4E Solid State Lighting Annex, Solid State Lighting: Review of Health Effects (2024). International Energy Agency, 4E Solid State Lighting Annex. October 2024. Authors at the Centre Scientifique et Technique du Bâtiment, the National Research Council of Canada, the Australian Radiation Protection and Nuclear Safety Agency and Monash University. Reports that independent teams have found retinal damage below the current exposure limit since 2012, that no consensus exists on revising that limit, and recommends that photobiological safety committees undertake a systematic review of it. Treated at Part V.C.2.f and Part V.K.

D.1.9 Joint Statement on Lights and Siren Vehicle Operations on Emergency Medical Services Responses (2022). Kupas D. F., Zavadsky M., Burton B., Baird S., Clawson J. J., Decker C. and others. Prehospital Emergency Care 2022;26(3):459 to 461. doi:10.1080/10903127.2022.2044417. Received 4 February 2022, accepted 16 February 2022, published online 10 May 2022. Free access; full text read. The document states that it updates and replaces a 1994 position statement of the National Association of EMS Physicians and the then National Association of State EMS Directors.

Why it is in this subsection, and what kind of instrument it is. Because it is an opinion adopted by constituted bodies, which is the criterion of this subsection. It is a joint position statement of fourteen organizations: the Academy of International Mobile Healthcare Integration, the American Ambulance Association, the American College of

Emergency Physicians, the Center for Patient Safety, the International Academies of Emergency Dispatch, the International Association of EMS Chiefs, the International Association of Fire Chiefs, the National Association of EMS Physicians, the National Association of Emergency Medical Technicians, the National Association of State EMS Officials, the National EMS Management Association, the National EMS Quality Alliance, the National Volunteer Fire Council, and the Paramedic Chiefs of Canada. It is accordingly the adopted position of the emergency medical and fire services themselves, and the Foundation relies on it as such and not as research.

What it concerns, and what it does not. The Foundation states the limit of the document before its contents, because the limit governs every use the comment makes of it. The statement concerns the operational decision when to switch lights and siren on. Its safety concern throughout is the risk of collision, and the harms it quantifies are crashes, injuries and deaths arising from vehicle operation. It says nothing about the optical characteristics of the lamps, nothing about intensity, modulation depth or flash rate, and nothing about any effect of the light itself on any person who sees it. It is not cited anywhere in this comment for any proposition about optical radiation or photic effect. It is cited for one thing: what the emergency services say about whether the devices are needed.

The time saved. "Over a dozen studies show that the average time saved with L&S response or transport ranges from 42 seconds to 3.8 minutes". And in the closing paragraph: "In most settings, L&S response or transport saves less than a few minutes during an emergency medical response, and there are few time-sensitive medical emergencies where an immediate intervention or treatment in those minutes is lifesaving".

The qualification the sponsors themselves state, which the Foundation records first among the findings. "In selected time-sensitive medical conditions, the difference in response time with L&S may improve the patient's outcome". The statement does not say the devices are useless. It says their use should be confined: lights and siren "should only be used for situations where the time saved by L&S operations is anticipated to be clinically important to a patient's outcome. They should not be used when returning to station or posting on stand-by assignments".

How often the use is clinically consequential, and how often it occurs. On consequence: "only a small percentage of medical emergencies have better outcomes from L&S use", and of responses to medical calls, "few (6.9%) of these result in a potentially lifesaving intervention by emergency practitioners". On frequency: "L&S continue to be used in 74% of EMS responses, and 21.6% of EMS transports, with a wide variation in L&S use among agencies and among census districts in the United States".

The finding the Foundation regards as the most consequential. "Some agencies have used an evidence-based or quality improvement approach to reduce their use of L&S during responses to medical calls to 20-33%, without any discernable harmful effect on patient outcome". Agencies that cut the practice by half to two thirds observed no discernible harm. That is not a projection or a recommendation; it is reported experience.

The countervailing risk, which is of collision and not of light. "EMS vehicle operations using L&S pose a significant risk to both EMS practitioners and the public". The statement records that "most EMS vehicle crashes occur when driving with lights and siren", that "L&S response increases the chance of an EMS vehicle crash by 50% and almost triples the chance of crash during patient transport", and that one survey found "approximately four 'wake effect' collisions (defined as collisions caused by, but not involving the L&S operating emergency vehicle) for every crash involving an emergency vehicle". On occupational exposure: "Traffic-related fatality rates for law enforcement officers, firefighters, and EMS practitioners are estimated to be 2.5 to 4.8 times higher than the national average among all occupations".

What it establishes. That fourteen organizations of the emergency medical and fire services have adopted the position that lights and siren save on average between 42 seconds and 3.8 minutes; that few responses involving them produce a potentially lifesaving intervention; that they are nevertheless used on about three quarters of responses; that agencies which reduced their use to between a fifth and a third of responses observed no discernible harm to patient outcome; and that the sponsors recommend confining their use to situations where the time saved is anticipated to be clinically important.

What it does not establish. Anything about the light. It reports no measurement of any lamp, no optical quantity, and no effect on any person who sees one. Its recommendations are addressed to emergency medical services and the sponsoring bodies are of emergency medicine, fire and ambulance services and emergency dispatch; law enforcement is named in one occupational statistic but no police organization is a sponsor and the statement is not addressed to police practice. Nor does it support any claim that the devices should be removed: it states expressly that in selected time-sensitive conditions they may improve outcome.

Where it bears. Part VI.C.1, which is written on it. Part IX, for the proposition that the operational necessity of these devices is a matter on which the services themselves have adopted a position.

D.1.10 Longcore and Rich, Artificial Night Lighting and Protected Lands (2017). Report of a United States federal agency, obtained in discharge of an acquisition recorded the same day, and the only American government document in this comment that sets out a lighting mitigation framework.

Citation. Longcore T. and Rich C., with illustrations by DelBusso L. Artificial night lighting and protected lands: ecological effects and management approaches (revised August 2017). Natural Resource Report NPS/NRSS/NSNS/NRR–2017/1493. National Park Service, Fort Collins, Colorado. The publisher's own prescribed citation gives the year as 2016 with the August 2017 revision in parentheses, and that form should be used. NPS 999/139639. Approximately seventy pages. Authors at The Urban Wildlands Group, Los Angeles, and at the School of Architecture and the Spatial Sciences Institute of the University of Southern California. Read from a file hosted on the Foundation's own server; the published file is available from the Natural Resource Publications Management website and must be retrieved from there.

What this document is, stated first because it governs its weight. A report published by the Natural Resource Stewardship and Science office of the National Park Service, an agency of the United States Department of the Interior, in a series the Service describes as disseminating comprehensive information and analysis about natural resources on lands it manages. The Service states that the report received formal peer review by subject-matter experts not directly involved in the work and of comparable technical standing to the authors. The authors are not employees of the agency. The report carries the Service's standard disclaimer that views, statements, findings, conclusions, recommendations and data in it do not necessarily reflect the views and policies of the Service or the Department, and that mention of trade names does not constitute endorsement by the United States Government. It reports no original research; it reviews effects by habitat type and sets out management approaches.

Why it is in this subsection, and why it matters where it is published. Because it is guidance published by a government body and states that body's published position subject to the disclaimer above, which is the criterion this subsection applies to the Australian guidelines. Its significance to this comment is not only its content. Part II.H records federal engagement with this exposure largely as absence. This is a federal agency publishing a peer-reviewed seventy-page treatment of the ecological effects of artificial light and a framework for mitigating them, nine years before this comment. It is the fourth federal item recorded in this appendix in a single day, with the grant and the fellowship at Appendix C.148 and the Park Service authorship at Appendix C.147, and Mr. Baker should decide whether Part II.H's account now needs revising.

THE FIVE-WAY FRAMEWORK, WHICH IS THE PRINCIPAL REASON THE COMMENT USES IT. Mitigation is said to be guided in five ways, in this order. Need: creative solutions are often available to avoid lights where they are not absolutely necessary, and managers should exercise discretion in limiting lighting infrastructure; in the body, that the first question is whether light is in fact needed, and that only when need is demonstrated and necessary for visitor experience, safety or security should lights be installed. Spectrum: no color is benign in all situations, but avoid ultraviolet and blue and in general use red and yellow hues. Intensity: reducing intensity can improve human visibility by reducing contrast, and industry guidelines should not be followed. Direction: shield so light falls only where needed and never upward. Duration: timers and motion detectors reduce the time a light is on and curfews can enhance visitor experience. Part V.I sets out what the Foundation makes of the order.

The two statements about professional standards. "Guidelines for lighting intensity from the lighting industry should not be followed when trying to reduce impacts to wildlife, because they are usually higher than necessary for human vision and do not take into account impacts to wildlife." And: "Land managers should not rely on standards promulgated by professional societies to guide lighting levels for natural areas because these are generally developed for urban/suburban areas with little to no regard for wildlife." Both are addressed to managers of natural areas and the comment reads them narrowly, as Part V.I states.

Numerical and definitional content. A full cutoff fixture is defined as one emitting little or no light above the horizontal plane and less than ten percent within ten degrees below it. Correlated color temperatures are given for lamp classes, at second hand from two cited sources: incandescent 2,600 to 2,700 kelvin; metal halide 2,900 to 4,200; high-pressure sodium about 2,100; low-pressure sodium 1,740 to 1,800; full-spectrum diodes offered from 2,700 to 6,500; direct sunlight 3,000 to 30,000 and usually 5,200 to 6,000. Those are the only numbers in the document the Foundation has identified as potentially useful and each is second hand.

Statements that run against a simple reading, recorded in full. That no universal spectral solution exists and that it is tempting to believe otherwise. That the only wholly wildlife-friendly light is one switched off or never installed. That shielding to full cutoff greatly reduces but does not eliminate skyglow, because light still reflects off the ground and scatters, so intensity reduction must be combined with shielding. That downward-directed light may still attract insects and the animals that feed on them. That reducing duration may itself harm species sensitive to a changing light environment, and that lights switching at irregular intervals may disrupt nocturnal behavior. And that diodes have no ultraviolet emission and therefore attract fewer insects than comparable lamps that do.

What it establishes. That a United States federal agency published, with peer review, a treatment of the ecological effects of artificial light at night and a five-part mitigation framework beginning with the question whether light is needed at all. That is a fact about the federal record. It establishes nothing about any organism of its own, being a review, and the disclaimer prevents it from being read as the policy of the Service or the Department.

What it does not establish. Anything about human health, which it does not address. Any measured effect, no original data being reported. Anything about products, its addressee being a land manager. And nothing that is the position of the United States government, the disclaimer being explicit.

Where it bears. Part V.I, which is written on the framework, on the two statements about professional standards and on the four qualifications. Part II.D.4, for the full cutoff definition and for the statement that shielding does not eliminate skyglow. Part IX, for the ordering of the five approaches. Part II.H, for the fact of federal publication, which is a decision for Mr. Baker.

D.1.11 Longcore, Hazard or Hope? LEDs and Wildlife (2018). Signed essay in a lighting trade magazine, catalogued for one field result about two lamps of the same rating, for a numerical recommendation, and for four concessions in favor of the technology.

Citation. Longcore T. "Hazard or Hope? LEDs and Wildlife." LED professional Review, issue 70, 2018. Published by Luger Research e.U. Approximately two thousand seven hundred words across four pages with five figures. The author is given as Assistant Professor at the University of Southern California School of Architecture. Read from a file hosted on the Foundation's own server; page numbers on the copy read are 52 to 57 and the original must be obtained.

What this document is, stated first because it governs its weight. A commissioned essay in a trade magazine of the lighting industry, addressed to lighting professionals and written to reconcile their view with that of conservation biologists. It is not research, is not peer reviewed, and reports no work of its own; every empirical statement in it is at second hand from eighteen numbered references, several of them the author's own. It is catalogued in this subsection on the ground used for the trade article already here, that no other category in this appendix fits it.

THE RESULT THE COMMENT RELIES ON. A field comparison, reported at second hand from the author's reference 18, in which prototype tunable lamps built from red, green and blue diodes were configured using bee and moth spectral response curves to reduce insect attraction, two of them rated at 2,700 kelvin and one at 3,000, and compared against an off-the-shelf 2,700 kelvin lamp and a 2,700 kelvin fluorescent. The tuned lamp is reported to have attracted twenty to twenty-one percent fewer insects than a similar lamp not designed with that objective, with the effect large for moths. Part I.G uses this for one proposition only: that two lamps of the same correlated color temperature differ in a measured biological response, so that a limit written in that quantity cannot distinguish them.

WHAT IT SAYS AGAINST THE COMMENT, WHICH IS SET OUT IN THE BODY AND NOT ONLY HERE. That correlated color temperature "is not a perfect predictor of effects on wildlife, but it is a reasonable rule of thumb that lower CCT will be less disruptive to wildlife"; and that "As a rule of thumb, CCT can be used as an indicator of wildlife effects, but this may not hold true across all applications." The essay also reports modeled results in which lower correlated color temperatures had lower predicted effects on average and for each species group. Part I.G states what the Foundation accepts in that and why it does not answer the comment's point.

FOUR CONCESSIONS IN FAVOR OF THE TECHNOLOGY, RECORDED BECAUSE THE FOUNDATION WILL NOT CITE THIS ESSAY WITHOUT THEM. On direction, that light-emitting diode street lights as currently deployed tend to be quite directional and can be an improvement over lamp types with drop lenses, and that with microlens arrays the focus on the street and adjacent pedestrian zones could be nearly perfect; qualified by the author himself, that bulb-type diode lamps offer no such benefit and in unshielded fixtures present the same challenges as previous technologies. On duration, that diodes can be extinguished and relit without delay or warmup, which suits them to timing and motion controls. On intensity, that they are readily dimmable. And on insects, that both warm and cool diodes compared against metal halide and mercury vapor lamps were found to attract fewer than a tenth as many insects, which the author attributes to the difference in ultraviolet emission. The Foundation does not dispute any of the four and notes that the first and the fourth bear directly on Part II.D.4 and Part V.I respectively.

What the essay says against the technology. That most broad spectrum diodes used outdoors have a potential to disturb the perception of daylength in plants, because the peak sensitivity of the phytochromes that detect daylength lies in the range of diode peak emission for most full-spectrum products. And the rebound effect: that the tendency is to use more light because it is efficient, that diodes represent an era of cheap light, and that "cheap light has the

potential to result in unnecessarily bright nights." The Foundation notes the adjective and makes no argument from it; the essay is not using the statutory term.

The framework it adopts, which is the one Part IX uses. The essay organizes everything under four attributes identified as important to reducing environmental effects: direction, duration, intensity and spectrum. Those are the four characteristics Part IX asks the Secretary to characterize, named independently in a trade publication by a wildlife scientist writing for the industry. The Foundation records the convergence and claims nothing from it.

A ranking the comment does not presently use. The essay reproduces from its reference 14 a ranking of light sources weighing four things equally: modeled wildlife response, melanopic response, astronomical light pollution expressed as a Star Light Index, and color rendering index. Low-pressure sodium ranks poorly on it because of extremely low color rendering, while phosphor-converted amber and filtered diodes rank highest. That is a worked example of a multi-criteria ranking that includes a human-use criterion alongside biological ones, which is the structure section 360kk requires when it directs that a standard be technically achievable and that practicability be taken into account. Whether it enters the comment is a decision for Mr. Baker.

What it establishes. Nothing of its own. Subject to verification of the underlying studies: that a field comparison has found two lamps of the same correlated color temperature to differ by about a fifth in insect attraction; and that a wildlife scientist writing for the lighting industry in 2018 recommended color temperatures at or below 2,200 kelvin as feasible and desirable.

What it does not establish. Anything about human health; the essay does not address it. Any effect of any lamp, no measurement being reported. And nothing about the primary studies beyond what the author says of them in a paragraph each.

Where it bears. Part I.G, which is written on the tuning result and on the two rule-of-thumb sentences. Part IX.J, for the 2,200 kelvin recommendation and for the contrast with American instruments. Part IX.C, for the statement of what is unknown. Part II.D.4 and Part V.I, for the concessions on direction and on insect attraction.

D.1.12 Zhu, Consider digital billboards a contributing outdoor light source (2023). Trade publication article, catalogued because the comment relies on it at Part VI.J.6.

What this document is, stated first because it governs its weight. A short article by a lighting practitioner in Buildings, a trade publication, dated 28 July 2023, and described by the publisher as a six minute read. It is not an expert assessment, not an adopted opinion, and not research. It reports no measurement and conducts no study. It is catalogued in this subsection because none of the categories in this appendix accommodates trade press.J.6.

Why the comment uses it. Because it identifies numerical temporal criteria for digital billboards that exist in guidance outside the United States, and names the instruments carrying them. The only operative American brightness criterion for this product class expressly excludes changing images, message movement and motorist attention, and this article is the Foundation's evidence that those excluded questions have been reduced to numbers elsewhere.

What it reports. A minimum dwell time of eight seconds, described as widely accepted by the industry; a finding that images with dwell shorter than seven seconds attract drivers' attention more than road signs do; transitions between successive displays of 0.5 to 2 seconds without other visible effects; a limit of 30 percent on fluctuation of average luminance between images; restrictions on the number of displays in a driver's field of view, given as two or three in the United States; and placement rules, the example being a New Zealand district plan requiring fifty meters separation from a signalized intersection and no direct visibility from a residential zone.

What it does not establish. Anything of its own. Every criterion above is reported at second hand from documents the Foundation has not read, principally guidance of the New Zealand Transport Agency of 2022. It reports no health endpoint and makes no claim about injury. On crashes it states that research has not proven an effect of digital billboards on motor vehicle crash rates, while reporting effects on driver speed, lateral control, mental workload, ability to follow road signs, and eye movements and fixations. None of the criteria it reports limits the luminance of the emitting surface.

Where it bears. Part VI.J.6, which is the only place the comment uses it, for the existence of numerical temporal criteria and for the careful formulation of the crash question. Part VI.J.8, where the ask it supports is stated.

D.1.13 Dark Sky Consulting, The thorny problem of lighting and crime. Signed commentary by a lighting consultancy, catalogued because Part V.M relies on it for two propositions and for two quotations.

What this document is, stated first because it governs its weight. A post on the weblog of Dark Sky Consulting, LLC, a consultancy working in the field of light pollution. It is signed commentary, not research. It reports no original data and establishes nothing of its own. It carries eleven references and the Foundation uses it principally as a route to those. The consultancy's field of work is an interest and the comment discloses it.

Why the comment uses it. For three things. The proposition, taken from an experimental study it cites, that feelings of safety rise fastest from no light to low intensity and then level off, which bears on the strongest form of the argument for high outdoor light levels. The proposition, taken from a further study, that removing lighting may displace offending in time or space rather than preventing it. And two direct quotations of the author of the study at Appendix C.118.

What it does not establish. Anything of its own. Every proposition the comment takes from it is at second hand from sources the Foundation has not read.

Where it bears. Part V.M, which is the only place the comment uses it. Possibly Part V.G, if the perceived-safety material is relocated there.

D.1.14 Monash XYX Lab, Plan International Australia and Arup, reported in The Conversation (2019). Explanatory article by researchers describing their own unpublished work, catalogued because Part V.M relies on it for the spectral and uniformity findings.

What this document is, stated first because it governs its weight. An article published in The Conversation on 28 May 2019, written by researchers describing their own research, and co-authored by a lighting leader at the engineering consultancy Arup. It is explanatory journalism, not a research report. It gives no statistical detail: no sample description beyond a count of more than eighty sites, no measures of uncertainty and no account of method. The underlying research has not been obtained.M requires it.

The research described. An analysis by Plan International Australia, the XYX Lab at Monash University and Arup of more than eighty locations in Melbourne identified by young women as unsafe, with lighting measured at those locations and compared with sites identified as safe.

What the comment takes from it. Three propositions about the character rather than the quantity of light: that consistent and layered lighting across surfaces of differing reflectance is reported to reassure most, by reducing the floodlit effect, the sharp drop-off of light beyond the path, and the potential for glare and contrast to blind and disorientate; that warmer correlated color temperatures are perceived as safer, with urban diodes reported as mostly 4000 kelvin or above; and that the women nonetheless preferred high-quality diode light to sodium lamps because sodium rendered color poorly. Also the authors' statement that illuminance is the only

metric required by the relevant Australian standard and that luminance should be considered too.

A finding the comment records but declines to rely on. That sites with higher measured light levels were more likely to be perceived as unsafe, the average level at unsafe sites being twice that at safe sites. The comparison is between places rather than within a place before and after a change, and the places women identify as unsafe are disproportionately the busy central locations that cities light most heavily. The comment applies to this the same objection it makes to the correlations at Appendix C.119.

What it does not establish. Anything, on its own. It reports no data and no analysis. It is used as a signpost to research that must be obtained, and as the only source the Foundation has identified that addresses correlated color temperature against perceived safety.

Where it bears. Part V.M, which is where it is used. Part V.C and Part VI.B.1, for glare and contrast. Part V.B.2 and Part VI.J.6, for the observation that illuminance is the quantity standards require and luminance the quantity that governs what the eye receives.

D.1.15 Essex Police, 108/16 Update on Part-Night Lighting (2017). Operational report of a police force to its oversight body, catalogued because Part V.M relies on it for the force's own conclusion and for an absence in its reporting structure.

Citation. Essex Police. "108/16 Update on Part-Night Lighting v.2.4." Report to the Office of the Police, Fire and Crime Commissioner for Essex, Performance and Resources Scrutiny Programme 2017/18. Date of meeting 30 November 2017; date of approval 16 November 2017. Chief officer Dr. Victoria Harrington; author Matt Robbins. Marked official.

What this document is. Not research. An operational analysis prepared by a police force for the authority that oversees it, comparing raw counts of crime, anti-social behavior and killed-or-seriously-injured collisions between two periods in the twelve Essex districts that switched street lights off between one and five in the morning and two districts that did not.

Its conclusion. That there is no evidence of a relationship between part-night lighting and levels of crime, anti-social behavior or serious collisions when compared with control areas, and that this supports previous analyses by the same force and a national independent study to which the force contributed data. The report records no plans for further analysis given the findings from multiple analyses over different periods.

Why the comment takes no figure from it. There is no regression, no adjustment, no confidence interval and no test of significance; two unmatched districts serve as controls; the two comparison windows point in opposite directions and are not reconciled; the collision counts are too small to bear percentages, as the report itself twice notes; the force cannot determine from its records which offenses occurred outdoors, so that offenses committed inside premises are in the figures; and it does not know which streets within each district were switched off.

What the comment does take. The force's own operational position, as the kind of body most likely to assert a link between lighting and crime, stated in a document written for internal purposes. And the entry under the report's health and safety heading, which reads in full that there are no identified implications with regards health and safety.

Where it bears. Part V.M, which is where it is used. Part II, for the proposition that decisions about the optical environment are taken by authorities with no health remit and no body to refer the health question to.

D.1.16 WRIA 8, Artificial Lighting Impacts to Salmon in WRIA 8 Briefing Memo (2020). Interim staff briefing memorandum of a governmental watershed forum, catalogued for one regulatory citation and for what it shows about how this subject is summarized for decision-makers.

What this document is, stated first because it governs its weight. A four-page memorandum dated March 10, 2020, headed Artificial Lighting Impacts to Salmon in WRIA 8 Briefing Memo, on the letterhead of the Lake Washington, Cedar and Sammamish Watershed, Water Resource Inventory Area 8, at 201 S. Jackson Street, Suite 600, Seattle, Washington. The file as published is named for the Salmon Recovery Council, which appears to be the body it was prepared for. It carries no named author and no signature; the contact given is the WRIA 8 Salmon Recovery Manager, at a King County address. Published at govlink.org, an interjurisdictional site administered through King County. It is not research, reports no measurement of its own, and says of itself that it is preliminary and interim and that a synthesis was then being prepared.

Why it is in this subsection. Because none of the other categories in this appendix fits it, which is the ground on which this subsection has taken in documents before. It is not an opinion adopted by a constituted body in the sense of the assessments at the head of this subsection, and the Foundation does not describe it as one. It is a staff briefing memorandum of a governmental forum.

The one thing in it the comment relies on. Its citation of the lighting provisions of the Washington hydraulic code, Washington Administrative Code sections 220-660-140 and 220-660-400. The Foundation did not take that from the memorandum. It read section 220-660-140 and relies on the regulation, which is set out at the end of Part V.I. Nothing else in this document is relied on for any proposition of fact.

What the document asserts, recorded without adoption. That artificial light pollution is identified as a priority limiting factor in the governing salmon conservation plan. That direct lighting attracts juvenile salmon, slows or stops migration and increases vulnerability to predators. That skyglow increases predation risk. That predation in Lake Washington has shifted from twilight to throughout the night over thirty years. That analyses in the Lake Washington Ship Canal suggest skyglow has produced a sevenfold increase in nighttime predation risk for juvenile salmon against pre-electric conditions. And that between 2014 and 2019 an average of 9 percent and 11 percent of tagged juvenile Chinook from two streams reached Puget Sound.

THE PROVENANCE PROBLEM, WHICH IS THE REASON NONE OF THAT IS ADOPTED. The two most arresting assertions in the memorandum — the sevenfold increase in predation risk and the shift from twilight predation to predation throughout the night — are both cited to the same source, and that source is an unpublished presentation by a single investigator to the forum's own technical committee on October 9, 2019. The survival percentages are cited to a second unpublished presentation to the same committee, on November 13, 2019. Neither is a paper. Neither has been peer reviewed, neither states a method, and neither can be checked by anyone outside that committee. A figure of that size, resting on a conference talk, is exactly the kind of number this comment asks the Department not to accept from others, and the Foundation does not use it.

THE CLAIM IN IT THAT THIS COMMENT HAS DECLINED. The memorandum states that light pollution is spectrally dependent and that shorter blue wavelengths are more prone to scattering and radiating back down, contributing to increased skyglow. Part II.D.4 declines that formulation, on the authority of the people who measure skyglow and against the Foundation's own interest: within about ten kilometers the additional Rayleigh scattering of a blue-rich source is roughly cancelled by its additional extinction, and beyond that extinction dominates. The reason white light-emitting diode sources worsen the visual experience of skyglow is principally the Purkinje shift in the dark-adapted eye, not greater scattering. The Foundation records the sentence here for two reasons. It is the reason this document cannot be quoted on

skyglow physics. And it is evidence for a proposition the comment makes elsewhere, that the simplified version of this claim has propagated into official and quasi-official guidance, where it will be relied on by people drafting local codes.

A second-hand chain the Foundation also declines. The memorandum rests its color temperature recommendation on the guidance adopted by the American Medical Association in June 2016, and cites it not to the Association but to a report hosted by an advocacy organization. It then adopts, in full, the five lighting principles of that organization and the Model Lighting Ordinance it published jointly with the Illuminating Engineering Society. The Foundation takes none of that at second hand. Its own treatment of the 2016 guidance is at Part II.E, its position on the publications of advocacy organizations is stated at Appendix D.9, and the Model Lighting Ordinance is catalogued on its own terms.

An internal tension worth recording, because it runs the Foundation's way. Having recommended warmer sources, the memorandum states that since all spectrums of light can penetrate shallow nearshore habitats used by juvenile salmon, minimizing the amount and intensity of any overwater lighting is critical. That is the memorandum conceding, in its own voice and immediately after making a spectral recommendation, that the spectral recommendation does not answer the problem in the habitat that matters most. It is consistent with the position settled at Part V.I, that reducing short-wavelength content reduces some effects and not others; that position records one study in which a warmer source was indistinguishable from darkness on the endpoints measured, with the limits of that finding stated there.

THE FOLLOW-ON RESEARCH, WHICH COMPLICATES THE MEMORANDUM AND IS RECORDED FOR THAT REASON. The memorandum promised a synthesis within a year. The Foundation has not located one. It has located a final report delivered to the same forum in April 2025 by a university wetland ecosystem team, reporting day and night snorkel surveys at eight sites near the mouth of the Cedar River in a two-by-two design crossing high and low artificial light at night with the presence and absence of residential docks. On the description the Foundation has of it, and it has only a description, juvenile salmon densities were highest at the brightly lit residential sites with docks and at the dark reference sites without them, and lowest at the brightly lit commercial sites without docks; water depth was more important to distribution than either lighting or docks; and no significant effect of docks was detected. That is not the straightforward attraction gradient the 2020 memorandum describes. The Foundation states it because an entry that recorded the memorandum without it would be presenting a five-year-old interim staff summary as the state of the evidence in a watershed whose own commissioned research has since reported something more complicated.

And what that report appears to concede about its own instruments. Three statements are attributed to it, and if they are accurate they belong with the attestations collected at Part V.J.4 rather than here: that the quantum sensor used for daylight surveys is not accurate at low light levels underwater at night; that the spectrometer used was intended for photography and high light conditions, which limited its utility; and that the night-time instrument produced unitless data which had to be converted. A single figure in lux is said to appear in the executive summary with no stated conversion. The Foundation asserts none of this. It is set out so that whoever obtains the report knows what to look for.

What it establishes. That a governmental watershed forum with salmon recovery responsibilities has concluded in writing that artificial lighting at night, including skyglow, is an adverse exposure warranting reduction, and has said so to the local governments it advises. That is a fact about the state of official opinion. It is not evidence of effect and the Foundation does not offer it as any.

What it does not establish. Anything about any organism. It reports no study, no measurement, no instrument, no illuminance, no radiance and no spectrum. Every empirical claim in it is second-hand, and the two largest are second-hand from unpublished talks. It

concerns a fish, which is further from a human being than any subject in Appendix C except the invertebrates, and the grounds of indirectness at Part V.A.3 apply to it with full force. And its organizing purpose is the recovery of species listed under the Endangered Species Act, a statute administered by a different Department, which the Foundation does not rely on here for the same reasons given in the entry on the monarch butterfly at Appendix C.140.

A usage the Foundation notes and does not overstate. The memorandum three times describes the effects it is concerned with as non-target, unintentional and often unnecessary impacts of light pollution. The word unnecessary is doing ordinary English work there and is not a reference to the statutory term in paragraph 360ii(a)(2). The Foundation records the usage as an instance of a governmental body reaching for the same word unprompted, and makes no argument from it.

Where it bears. Part V.I, at the end, which cites the Washington regulation this document led the Foundation to and states the limits of that regulation. Nowhere else.

D.1.17 DCCEEW, National Light Pollution Guidelines for Wildlife (2023). National government guideline, obtained in discharge of a recorded acquisition, and the principal source for Part V.J.4 on the state of the measurement art.

Citation. Department of Climate Change, Energy, the Environment and Water, National Light Pollution Guidelines for Wildlife, version 2.0, Canberra, May 2023. Commonwealth of Australia. Published under a Creative Commons Attribution 4.0 International license, excepting third-party content, logos and the Coat of Arms. The prescribed attribution is DCCEEW 2023, National Light Pollution Guidelines for Wildlife, Department of Climate Change, Energy, the Environment and Water, Canberra, May, CC BY 4.0. Approximately one hundred and seventy pages with eleven appendices. Read in full as supplied, in the publisher's word-processing format.

Why it is in this subsection, and what kind of instrument it is. Because it is guidance issued by a national government department and states that government's position, which is the criterion of this subsection. It is not research and reports no original measurement; it is a technical guideline for assessors and developers, supporting the administration of the Environment Protection and Biodiversity Conservation Act 1999. The Foundation treats it as evidence of the state of expert and official opinion and of the state of the measurement art, and not as primary evidence of any biological effect.

How it came to be obtained. It was named in this comment before it was read. The marine review at Appendix D.7 cites a 2020 Commonwealth of Australia document for a fuller treatment of the measurement problem.J. Mr. Baker supplied it. The version in hand is version 2.0 of May 2023; the version the review cites is the 2020 edition, which the Foundation has not seen and which was adopted in some form by the Convention on Migratory Species. Whether the two differ materially is not known.

Authorship, and two names that recur. The acknowledgements state that the guidelines are based on a draft written by Kellie Pendoley, Catherine Bell, Chris Surman and Jimmy Choi, with contributions from eight further named persons, and that named appendices derive from drafts by two others. Technical reviews of sections are attributed to eleven named persons. Two of those names recur in this comment: Andreas Jechow, whose imaging work is relied on at Part V.J and in Appendix C, and Dan Duriscoe, a co-author of the observatory site-protection review at Appendix D.7 on which Part II.D.4 is written. Kellie Pendoley is also a co-author of the marine review at Appendix D.7 and is the person credited with the figure in that review which the Foundation had identified as the best available illustration of its measurement argument. Funding is attributed to a Western Australian State conservation program and to an Australian Government science program.

WHAT THE COMMENT TAKES FROM IT, AND IT IS ALL IN TWO APPENDICES. Part V.J.4 is written on its Appendix B and Appendix C, which treat the measurement of light for

non-human subjects. The propositions relied on are set out in the body at Part V.J.4 and are not repeated here: that satellite products are not an appropriate exposure variable and that the common instrument is insensitive to blue; that commercial lux and luminance meters are not appropriate for this purpose at all; that the sky quality meter is not truly photopic and that a calibration study of a group of them found errors from negative sixteen to positive twenty percent; that no globally recognized standard method exists; that of eight tabulated techniques one measures the relevant quantity directly and its prototype is no longer in operation; that correlated color temperature does not disclose the blue content of a lamp; and the specification of what an adequate method would have to do. The glossary entry stating that the footcandle is not appropriate for understanding how animals perceive light is taken for Part VI.J.6.

Three quantitative figures taken for other parts. That the full moon typically provides below 0.2 lux. That light levels below 0.03 lux may be required to induce normal hatching in reef fish whose hatching is timed to avoid visual predators, which is the same figure as the measured control illuminance at Appendix C.144 and is reached in a document that does not cite that study. And that effects on birds have been observed at 0.3 lux. All three are reported by this document at second hand from named primary sources and the Foundation treats them accordingly; the first two are used at Part V.I only to show the convergence of independent estimates of natural darkness.

WHAT IT SAYS AGAINST THE FOUNDATION, WHICH IS SET OUT IN THE BODY AND NOT ONLY HERE. That it is not possible to set prescriptive limits on lighting, and that an outcomes approach is taken instead; and that it is not possible to objectively estimate how much artificial light will cause an impact on a particular species or age class over a given distance under variable conditions. Those sentences are quoted in full at Part V.J.4, where the Foundation answers them and states what survives the answer. They are the most serious thing said anywhere in the materials collected in this comment against the request it makes, and an editor who moves them out of the body has made the comment less reliable and not more persuasive.

A second thing in it the Foundation declines. Its statement that short-wavelength light scatters more readily than long-wavelength light, contributing more to skyglow. Part II.D.4 declines that formulation for reasons given there. This is the third document in the comment to carry the simplified claim and the point the Foundation makes of that is stated at Part V.J.4.

What it establishes. That a national government, advised by practitioners in this field, has concluded in a published guideline that the instruments in general use cannot measure the quantity that matters to a non-human receptor, that no agreed method exists, and that the development of one is needed. That is the proposition Part V.J.4 exists to establish and no other document in this comment states it with the same authority or in the same operational detail.

What it does not establish. Anything about human health. Its subject throughout is wildlife, its statutory frame is Australian, and nothing in it concerns a person except as a source of light or a beneficiary of safety lighting. Its biological statements are second-hand summaries of a literature, not findings. And its conclusions about instruments are as of 2023, in a field it repeatedly describes as developing rapidly; the document says of itself that the appendix will be updated as more information becomes available.

Where it bears. Part V.J.4, which is now written on it and which is the principal use. Part V.J.1, for the limitations of commercial modeling software. Part V.I, for the two natural-darkness figures and for the free availability of this guidance against guidance that must be purchased. Part VI.J.6, for the footcandle. Part IX.G.1 and Part IX.J, for the proposition that correlated color temperature is not a sufficient descriptor and that the spectral curve is. Part II.D.4, where the scattering claim it carries is declined.

D.1.18 ANSES, Opinion on the consideration in the regulatory framework of the effects on children's health of LEDs contained in toys (2024). Agence nationale de sécurité sanitaire de l'alimentation, de l'environnement et du travail, the French agency for

food, environmental and occupational health safety. Opinion of July 8, 2024, request number 2022-SA-0193, related to earlier requests 2014-SA-0253 and 2019-SA-0139. Adopted by the expert committee on physical agents and new technologies on April 30, 2024 and signed by the director general. Published in French and in an English translation by the agency.

Why it is in this subsection, and what kind of instrument it is. Because it is an opinion adopted by a constituted body, which is the criterion of this subsection. It is the formal answer of a national health agency to a question referred to it by two directorates of its own government on October 25, 2022. It is not a research article and is not offered as one. Its weight is the weight of an official act.

The question referred. Whether the 2020 revision of the standard for the safety of electric toys met the agency's earlier recommendation against placing on the market toys containing diodes above the low risk group, and whether the revision sufficiently accounted for the greater transmission of the lens in children.

What it found, which is unusual enough to state plainly. That the eye safety limits of the 2020 standard derive from a single journal article of 2012 and that the article contains three errors which the standard inherited. The errors concern the choice of exposure scenario, the conversion of a luminance threshold into a limit on luminous intensity, and a unit conversion. The stated magnitudes are a factor of about four on the photochemical limits, a factor of the order of one thousand on the luminous intensity limit for a diode of about 2 millimeters, and a factor of about ten on the radiant intensity limits. The opinion states that the limits as written permit emission at luminances of the order of 10 to the seventh candelas per square meter.

What it recommended. Suspending the application of the current version of the standard; using the 2005 version provisionally to assess conformity with the essential safety requirements; beginning revision of the ocular safety sections without delay and with greater attention to the biology and physiology of children; informing parents and childcare professionals of the potential hazards of light-emitting diode toys; and examining the scope for better regulation of other luminous devices given to children.

The finding on conformity. That for toys which pass the 2020 version but fail the 2005 version, ocular safety is not demonstrated, and that there is a strong presumption of non-conformity with the requirements of the European toy safety directive.

The products it identifies as falling outside the toy standard. Night lights, torches, illuminated clothing and decorative lamps. The opinion records that these may be intended for children without being covered by the toy standard, and the expert committee recommends that they undergo the same ocular safety assessment as toys. Part VI.M is written on that boundary.

Its own measurements. The agency funded measurements on nineteen diodes in ten toys, and the market surveillance directorate supplied test reports. Eleven of the nineteen were compliant under the 2005 version and eighteen under the 2020 version. Those are the same ten toys and nineteen diodes reported as the paired subsample at Appendix C.59, approached from the other side.

What it establishes. That a national health agency, asked by its own government whether a standard protecting children from optical radiation was adequate, concluded that it was not, identified the derivation of the limits as the defect, and asked for the standard to be suspended. That is a documented instance of the proposition this comment advances throughout Part V.C.2: that conformity with a photobiological standard is not the same thing as a determination that an emission is safe.

What it does not establish. That any child has been injured. The opinion reports no health outcome and does not claim one. It does not establish that the three errors are correctly identified, which is a matter between the reviewing agency and the authors of the 2012

article and on which this comment has heard one side. It establishes nothing about the United States, where neither this standard nor any comparable federal limit on optical emission from toys applies. Part VI.M sets out what applies here instead.

Where it bears. Part V.C.2.k, which is written on it and which is the principal use. Part V.K.5, against the 2018 Opinion's treatment of the European toy standard. Part VI.M, for the product class. Part IX.E.4, for the liaison request concerning the agency that regulates toys in the United States.

D.2 Standards and technical specifications

The instruments below limit flashing in content presented on displays. They are grouped together because Part V.E.1 relies on them as a set, and because the Foundation's argument there concerns the domain they occupy rather than the values they contain. None of them governs a physical light source. Each is described from the analysis at Appendix C.81.

D.2.1 United Kingdom broadcast guidance. Guidance limiting flashing and patterned content in broadcast television, originating in the 1990s following an advertisement broadcast in 1993 which caused seizures in at least three viewers. Administered latterly through the broadcast regulator. Obtain the current instrument and its issuing body, and state the version relied on.

D.2.2 Japanese broadcasters' joint guidance. Joint guidance of the Japan Broadcasting Corporation and the Japan Commercial Broadcasting Association, last updated in 2020, following the broadcast in 1997 of a cartoon sequence after which 685 children were taken to hospital. Appendix C.81 records that the Japanese thresholds are expressed in percentage brightness rather than in candelas per square meter, and reports a published comparison finding them more tolerant of flashes with high average intensity and low relative contrast and less tolerant of the converse.

D.2.3 ISO 9241-391. International Organization for Standardization standard governing image content, including video, on display screens. Its red flash thresholds were harmonized with those of the Web Content Accessibility Guidelines in 2023.

D.2.4 International Telecommunication Union guidance. Guidance of the International Telecommunication Union addressed to the broadcast domain. Identify the recommendation number and version.

D.2.5 Web Content Accessibility Guidelines 2.x. Recommendations of the World Wide Web Consortium. All three versions of the 2.x series remain simultaneously active. Two success criteria address photosensitive epilepsy: Success Criterion 2.3.1, which sets thresholds on luminance, color, flash rate and area, and Success Criterion 2.3.2, which prohibits any flashing more than three times per second without qualification. The original thresholds were set in consultation with Dr. Harding and Cambridge Research Systems. Adopted also as ISO/IEC 40500:2012.

D.2.6 Section 508 of the Rehabilitation Act, and EN 301 549. These are not content guidelines but the instruments by which the guidelines above were made binding on government procurement, in the United States and the European Union respectively. Section 508 is a federal instrument of the United States and is accordingly the most important entry in this subsection for the purposes of this comment: Part V.E.1 relies on it for the proposition that a quantified federal flash limit exists in one domain and not in another. It must be cited to the Code of Federal Regulations rather than to Appendix C.81, and the citation must establish which version of the Web Content Accessibility Guidelines is incorporated and whether the seizure success criteria are among the provisions incorporated.

These documents prescribe measurement methods, classification schemes and product requirements. None of them reports a research finding, and none of them is mandatory in the

United States except where a federal performance standard adopts it. Part V.C.2.k sets out what that means in practice.

D.2.7 IEC 62471:2006, Photobiological safety of lamps and lamp systems. International Electrotechnical Commission, first edition July 2006, published as a dual-logo document with CIE S 009 of the International Commission on Illumination, whose text it adopted. The governing instrument for the blue light hazard assessment of incoherent sources, including light-emitting diodes, by its own scope. Recognized by the Food and Drug Administration as a complete consensus standard, recognition 12-249, entered August 20, 2012, keyed to thirteen Class II medical device product codes. Treated at Part V.C.2.2 and Part II.E.4.

D.2.8 IEC 60825-1, Safety of laser products, Part 1, Edition 2.0 (2007-03). The laser safety standard. This edition removed light-emitting diodes from its scope, replacing the first edition of 1993 and its two amendments, and directed their assessment to lamp safety standards. Recognized by the Food and Drug Administration as a complete consensus standard, recognition 12-273, entered July 9, 2014. Conformity with Edition 3 is accepted as an enforcement alternative to 21 C.F.R. §§ 1040.10 and 1040.11 under Laser Notice No. 56. Treated at Part V.C.2.k and Part II.E.4.

D.2.9 IEC/TR 62778, Application of IEC 62471 for the assessment of blue light hazard to light sources and luminaires, Edition 2.0 (2014-06). A Technical Report rather than an International Standard, first published in 2012. It carries the reference measurement conditions this comment relies on: general lighting service lamps assessed at the distance producing 500 lux but not closer than 200 millimeters, and all other sources, including pulsed sources, at 200 millimeters. By its own account, product safety standards for high-intensity discharge and light-emitting diode products refer to it. The Foundation has located no recognition of it by the Food and Drug Administration. Treated at Part V.C.2.k.

D.2.10 CIE S 026:2018, CIE System for Metrology of Optical Radiation for ipRGC-Influenced Responses to Light. International Commission on Illumination. Defines melanopic equivalent daylight illuminance and the related quantities, which are the measurands apt to the circadian question. Treated at Part V.F and Part V.J.4, and discharges a question raised at Appendix C.41.

D.2.11 ANSI/IES RP-27 series, Photobiological safety for lamps and lamp systems. American National Standards Institute and Illuminating Engineering Society. The American counterpart to IEC 62471. Voluntary and non-federal. Treated at Part V.C.2.2.

D.2.12 SAE J595, Directional flashing optical warning devices. SAE International. Addresses the intensity of flashing warning lamps on vehicles. Voluntary and non-federal, though referenced in State equipment codes. Relevant to the product class at Part VI and to the request at Part V.C.2.k.

D.2.13 Federal Motor Vehicle Safety Standard No. 108, 49 C.F.R. § 571.108, Lamps, reflective devices, and associated equipment. National Highway Traffic Safety Administration. The Foundation lists the standard here because the comment describes it at Part VI.B as the only federal standard setting numerical limits on the output of any product this comment concerns, and it should appear in the appendix of standards rather than only in the body. Read in the current edition on the electronic Code of Federal Regulations. The provisions relied on are these. Activation, at S6.1.5: "Each lamp must be activated as specified, in the combinations specified, and in response to the inputs specified in Table I and Table II". Impairment, at S6.2.1: no additional lamp, reflective device or other motor vehicle equipment is permitted to be installed "that impairs the effectiveness of lighting equipment required by this standard". The standard also treats steadiness as the normal condition of required lighting in three places the Foundation has

read: the definition at S4 provides that "Taillamps are steady burning low intensity lamps used to designate the rear of a vehicle"; S6.1.1.4 requires certain lamps to operate "in a steady burning state as daytime running lamps (DRLs)"; and S6.2.3.1 addresses obstructions "When activated in the steady burning state".

What the Foundation has not established about this standard, stated here because the comment relies on the point at Part VI.C.1. Whether, and in what terms, Tables I and II specify steady burning operation for the required lamps. The position has improved but is not closed. The agency's letter of 13 February 2024, listed below, states that the steady burning requirement is located in Tables I-a and I-c and that steady burning means light that is essentially unvarying in intensity. That is the agency's characterization of its own tables and not the tables themselves, and the Foundation has still not read them. The activation requirement at S6.1.5 routes to those tables. The comment therefore does not assert that the standard contains a general steady-burning clause in its prose, and relies for the requirement on the agency's statements of what the tables contain.

D.2.14 NHTSA interpretation letter of 6 May 2019 to M. Haas, Haas Design Concepts. Letter of the Chief Counsel of the National Highway Traffic Safety Administration, signed Jonathan C. Morrison, concerning supplemental turning lamps, reference 15-4155. Published on the agency's interpretations database. The Foundation relies on it for the agency's own statement of how the standard treats lamps it does not require: "Non-required (or 'auxiliary') lamps, while still regulated under FMVSS No. 108, are not required to meet specific performance requirements in the same way that the required lamps are". And on the operation of the impairment test: "The question of whether an auxiliary lamp impairs required lighting equipment is usually decided on a case-by-case basis". An interpretation letter is not a regulation and binds no one; it is the agency's statement of its own reading of its own standard, and the Foundation uses it as that and nothing more.

D.2.15 Soft Lights Foundation, Denial of Petition for Decision of Non-Compliance Order, 87 Fed. Reg. 75,327 (Dec. 8, 2022). National Highway Traffic Safety Administration. FR Doc. 2022-26658, filed 7 December 2022, published 8 December 2022. Docket No. NHTSA-2022-0109. Signed by the Associate Administrator for Enforcement. Disposes of three petitions filed by the Foundation under 49 U.S.C. § 30162(a)(2) and 49 C.F.R. part 552 on 5 August, 11 August and 9 September 2022. A published decision document of a federal agency, read in full. Treated at Part IV.C.3.

Why it is relied on, given that it denied the Foundation's petitions. For four statements of the agency, not for its disposition. That the Food and Drug Administration has authority to regulate certain aspects of these products as radiation-emitting devices and that there is at present no performance standard for them in part 1040. That the standard is not limited to point sources because its photometry requirements are for the lamp rather than for the light source. That flicker is addressed by a requirement of perceived steady burning drawn from an interpretation letter of 5 November 2005. And that a light-emitting diode cannot be entered in the part 564 docket because it has neither filament, discharge arc nor filament capsule, with the consequence that it may not be used in a replaceable bulb headlamp.

The deferral. The notice states that the agency, as one focused on automotive safety, recognizes the expertise of its sister agencies that are health-focused, such as the Food and Drug Administration. This is the first of the two deferrals set out at Part II.H.5.

What is adverse in it, recorded here as well as in the body. The agency rejected the point-source proposition; recorded that its Office of Vehicle Safety Compliance has found evidence that light-emitting diode headlamp assemblies can meet the standard, citing two compliance test reports; stated that it believes current research supports that the standard

contains the appropriate requirements to address glare, non-uniform luminance, peak luminance and flicker; and relied for the glare conclusion on a 2007 report to Congress titled Nighttime Glare and Driving Performance, which the Foundation has not read.

D.2.16 NHTSA interpretation letter of 13 February 2024 to Mark Baker. Letter of the Office of the Chief Counsel of the National Highway Traffic Safety Administration, signed John Donaldson, Acting Chief Counsel, answering a letter of 27 June 2021 and an email of 31 October 2021. Four pages. Read from a scanned copy; every quotation in the comment was verified against the page images rather than against the recognized text layer. Treated at Part IV.C.9 and relied on at Part II.H.5, Part V.B.8, Part V.D.4 and Part VI.C.1.

What it establishes. That the standard contains no performance requirement for a light source that is part of an integral beam headlamp, and specifies requirements for the complete headlamp only. That it does not directly regulate peak luminance as measured in nits or the spectral power distribution of the light source, which the agency states are regulated indirectly through photometry and chromaticity. That flicker is regulated through the requirement that lower beam headlamps be steady burning. That steady burning, in the agency's own definition, means light that is essentially unvarying in intensity, the requirement being located in Tables I-a and I-c. And that the permissible boundary of white includes colors perceived as white with a yellow tint and white with a blue tint.

A caution on how the comment uses it. The letter restates the inquirer's own characterization of light sources as spherical emitters and as non-uniform luminance flat-source emitters. Those are the words of the letter the agency was answering and not the agency's own, and the comment does not attribute them to the agency. The agency's position on emitter geometry is the contrary one stated in the Federal Register notice above.

The four interpretation letters it depends on, none of which the Foundation has read. Berndt to United Sidecar Association, Inc. (9 February 1982), the source of the definition of steady burning. Rice to Abernathy, Idea's Inc. (7 September 1990), applying it to tail lamps. Womack to De Sousa (10 March 1994), the source of the perceived-steady-beam gloss, given in the context of a modulating motorcycle headlamp. Seales to Hodson (4 July 2000), on the white boundary. Each is cited in the comment as quoted in the 2024 letter, and none is cited as if read.

D.2.17 IEEE Std 1789-2015, IEEE Recommended Practices for Modulating Current in High-Brightness LEDs for Mitigating Health Risks to Viewers. Sponsored by the Standards Committee of the IEEE Power Electronics Society. Approved 26 March 2015 by the IEEE-SA Standards Board. Eighty pages. The P1789 Working Group was formed in December 2008; Brad Lehman, Chair; Michael Poplawski, Vice Chair; Howard Wolfman, Secretary. The Foundation has read the full document. It is the only technical document that states numerical limits on temporal light modulation from light-emitting diode products, and the comment therefore sets it out at length rather than by reference.

Status, which governs everything that follows. It is a recommended practice. It is not a standard within the meaning of 21 U.S.C. § 360kk, it imposes no obligation on any manufacturer, and no federal regulation requires compliance with it. The document's own notice states that IEEE Standards documents "are not intended to ensure safety, security, health, or environmental protection," and that implementers are responsible for determining and complying with all applicable safety and health practices and all applicable laws and regulations. Its stated purpose records the position the Foundation asks this Department to notice: "Presently, there are no standards on safe modulating frequencies for high-brightness LEDs." That sentence was published in 2015 and remains accurate in 2026.

Scope, stated so that the comment does not overclaim. The scope is expressed in four parts, each referring to LED lighting: to define the concept of modulation frequencies for

light-emitting diodes and discuss their application to LED lighting; to describe LED lighting applications in which modulation frequencies pose possible health risks; to discuss the dimming of LEDs by modulating driving current or voltage; and to present recommendations for modulation frequencies for LED lighting and dimming applications. The document is addressed to flicker as an artifact of driving electronics in illumination products. It does not address signaling or warning devices, in which modulation is the intended function rather than an artifact, and the Foundation does not assert that its drafters had such devices in view. The significance of that limitation is developed at Part V.D.4.

The quantity it regulates. Modulation, also called percent flicker, peak-to-peak contrast, Michelson contrast or modulation depth, defined as Mod% = 100 × (Lmax – Lmin) / (Lmax + Lmin), where Lmax and Lmin are the maximum and minimum luminance. A source that extinguishes completely between pulses has Lmin of zero and therefore a modulation of 100 percent, whatever its peak luminance.

The three recommended practices, quoted. Clause 8.1 states them in ascending order of stringency. Recommended Practice 1, for limited biological effects: below 90 Hz, modulation less than 0.025 × frequency; between 90 Hz and 1250 Hz, below 0.08 × frequency; above 1250 Hz, no restriction. Recommended Practice 2, the no-observable-effect level, which is Recommended Practice 1 reduced by a factor of 2.5: below 90 Hz, modulation less than 0.01 × frequency; between 90 Hz and 3000 Hz, below 0.0333 × frequency; above 3000 Hz, no restriction. And Recommended Practice 3, which is the one that matters here.

Recommended Practice 3, and why its form is different. In full: "Recommended Practice 3: (seizure prevention) For any lighting source, under all operating scenarios, flicker Modulation (%) shall satisfy the following goal: Below 90 Hz, Modulation (%) is less than 5%." The document distinguishes it expressly from the other two. Recommended Practices 1 and 2 begin with the words "If it is desired." Recommended Practice 3 does not, and the commentary at 8.1.1.2 states: "Recommended Practice 3 is a strict rule for seizure prevention and should be adhered to at all times for all operating conditions. This recommended practice does not begin with the phrase 'If it is desired.'" Its terms are "any lighting source," "under all operating scenarios," and "shall."

The basis of the five percent figure. Clause 7.4.1.4 attributes it to the Working Group's own expert opinion: expert opinion within the IEEE P1789 Working Group suggests that 5 percent modulation depth, expressed as Michelson contrast, can serve as a frequency-independent low-risk level. Clause 7.4.1.3 records the underlying assessment for photosensitive seizure: that solid data and expert opinion exist; that susceptible subgroups have been identified as individuals aged 5 to 24 years; and that estimated prevalence of seizures ranges from 1 per 100,000 to 1 per 4,000. The risk assessment follows the method of the Eurosafe Working Group on Risk Assessment and is described by the document as similar in form to the SCENIHR scientific opinion on light sensitivity, which is at Appendix D.1.

Three features of its construction that bear on Part V. First, the practices are expressly independent of luminance, spectral content and exposure duration. Clause 8.2.3 states that in practice there are few circumstances where exposure duration is readily controlled and that exposure should in general be regarded as prolonged, and a note records that the recommended practices are accordingly independent of all three variables. A brief exposure is therefore not exempt under this document. Second, the practices apply to the assembly and not to its parts: clause 8.1.1.3 provides that they "describe the boundary functions of operation for the entire LED light source and not for the individual modulation of a single LED within the light source," which bears on the composite-waveform argument at Part V.J.3 and on the arithmetic at Part V.D.4. Third, the practices are deliberately not application-specific; clause 8.1.1.2 explains that because the flicker

characteristics of future LED products are unknown, the document "does not make application-specific recommended practices that are different for each lighting scenario."

The seizure clause, which is constructed differently from the practices and which the Foundation sets out because Part VI.I turns on it. Clause 7.4.1 contains a separate risk assessment for photoepilepsy, and it is not luminance-independent. Clause 7.4.1.1 lists the factors on which the risk of seizures is known to depend: the flicker frequency; the light intensity; the change in light intensity over time, which it equates with modulation depth; the spectral composition of the light; and neurological factors including whether one or both eyes are stimulated, the area of the retina receiving stimulation, and whether the central or peripheral retina is stimulated. It then adopts the expert consensus of the Epilepsy Foundation of America working group, quoted in the document as: a flash is a potential hazard if it has luminance of at least 20 candelas per square meter, occurs at a frequency of at least 3 hertz, and occupies a visual solid angle of at least 0.006 steradians, with a transition to or from saturated red also considered a risk.

Figure 19, the decision tree. Three gates taken in order. Visual field: below 0.006 steradians, medium risk; at or above, proceed. Luminance change: below 20 candelas per square meter, medium risk; at or above, proceed. Frequency: below 1 hertz or at or above 65 hertz, medium risk; between 1 and 65 hertz, high risk. The figure's frequency band of 1 to 65 hertz does not match the 3 to 65 hertz stated at clause 7.4.1.4 or the at-least-3-hertz of the consensus statement it adopts, and the comment notes the discrepancy wherever it relies on the gate. The third gate is labeled luminance change in the figure and modulation depth in the text at clause 7.4.1.2, which is a second discrepancy of the same kind.

What the document says about a source that meets some gates and not others, which is the case of every product this comment concerns. Clause 7.4.1.2: "No information on the probability of seizure has been located for flicker that meets zero, one, or two (but not all three) of the flicker hazard criteria (solid angle, flash rate, modulation depth)." Such cases are assigned medium risk on the stated assumption that the probability is low or very low, and the document records that the decision tree is based on that assumption and that a different assumption would require a more complicated tree with more risk levels.

Where the five percent figure comes from, which is not where a reader would assume. Clause 7.4.1.1 states that the consensus definition of a flash as a luminance change of at least 20 candelas per square meter combines light intensity and its variation over time, that as the time-averaged luminance increases lower and lower modulations may be capable of inducing a seizure, and that the statement was designed for use with displays having a typical luminance of about 200 candelas per square meter, for which a flash of 20 candelas per square meter provides about 5 percent modulation depth. The seizure-prevention figure in Recommended Practice 3 is therefore a ratio calculated for one display luminance, and the document states that the admissible modulation falls as luminance rises.

The assumption that permits the practices to be stated in modulation alone. Clause 7.4.1.5: it is assumed that the solid angle requirement will be met in general interior lighting applications, that the mean luminance requirement of 20 candelas per square meter will also be met, and that the modulation depth of more than 5 percent may or may not be met. The practices are expressed in modulation alone because the document assumed the other two gates away for its own application domain. The assumption is stated, it is confined to general interior lighting, and whether it transfers to a small high-luminance source viewed outdoors at night is not addressed.

Prevalence and susceptible group, as the document states them. Clause 7.4.1.3: susceptible subgroups identified as individuals aged 5 to 24 years; estimated prevalence of seizures ranging from 1 per 100,000 to 1 per 4,000.

What it expressly does not cover. Clause 7 states that "Other possible negative lighting features, including those associated with wavelength (e.g., blue light hazard, ultraviolet), glare, and periodic arrays or patterns of lights are not considered." The Foundation asks the Department to hold that sentence against the framework at Part V.B. The only technical document addressing the temporal characteristic excludes the spectral characteristic and excludes glare and spatial patterning. No instrument before this Department addresses all three, and the document that addresses one of them says so in terms.

The effects it assesses, including two the comment treats elsewhere. Clause 7 risk-assesses photosensitive seizure; the stroboscopic effect, including apparent slowing or stoppage of rotating machinery; migraine or severe paroxysmal headache; increased repetitive behavior among persons with autism; and asthenopia, including eyestrain, fatigue, blurred vision, conventional headache and decreased performance on sight-related tasks, with brief treatment of panic attack, anxiety and vertigo. Two of these are treated in this comment and should be cross-referred. The autism finding belongs with Part V.E.3, and the Foundation notes that the effect this document identifies, increased repetitive behavior, is the same construct as the subscale which Appendix C.82 found associated with altered pupillary response, reached by an unrelated route. On the stroboscopic effect, clause 7.4.2 records that experts appear to agree it may be associated with hazards that could be severe or catastrophic in severity, while "no published studies of injury epidemiology or potentially susceptible subgroups have been located," and that further research is needed to establish a low-risk level. That is the substance Part V.D.2 requires.

Where it bears. Part V.D.3, which sets it out. Part V.D.1, for modulation depth and frequency. Part V.D.2, for the stroboscopic effect. Part V.D.4, for the application to warning beacons. Part V.E.3, for autism. Part V.J.3, for the whole-source rule. Part IX.B, for the ask.

D.2.18 ITU recommendation on flashing images in broadcast content. International Telecommunication Union. Source of the criterion of 20 candelas per square meter for a flash, which the Canadian evidence brief at D.1 applies by analogy to large displays while noting that the recommendation addresses broadcast content and not outdoor signage. Treated at Part VI.J.

Decreto 37/2025, de 11 de febrero (Andalusia, Spain). Decreto 37/2025, de 11 de febrero, por el que se aprueba el Reglamento de protección frente a la contaminación lumínica en Andalucía. Published in the Boletín Oficial de la Junta de Andalucía, number 31 of 2025. Binding regional law of an autonomous community of Spain, replacing the regulation of 2010 that is analyzed in the spectral index paper discussed at Part V.B.3.e. Cited for the form of its provisions and not as authority. It regulates four distinct emission characteristics in one instrument: spectral content, through a minimum value of the índice espectral G defined in article 3.c and set by lighting zone in Anexo I; quantity, through a required reduction of at least fifty percent in luminous flux for installations of one hundred kilolumens or more that must remain lit at night, article 9.3.d; direction, through limits on installed upward hemispherical flux referred to Anexo I by article 12.2, a requirement that sign lighting be directed downward by article 11.2, and a requirement in the first transitional provision that existing luminaires inclined above the horizontal be reaimed within two years; and duration, through a night period of 23:00 to 06:00 defined by article 9.1.a during which installations are to remain off unless necessary for an activity or for safety, article 9.3.b. For the surroundings of astronomical observatories the authority's technical description of the index requires amber sources to have G not less than 3.5, an effective wavelength between 585 and 605 nanometers and a spectral width not exceeding 25 nanometers, which is a narrow-band specification stated in wavelength and bandwidth rather than in correlated color temperature. The Foundation has read the operative articles of the decree and the environmental authority's published description of the index; it has not read Anexo I, and the zone values stated at Part V.B.3 are taken from the authority's current portal and require verification against that annex. Where it bears: Part V.B.3, for the proposition that a

numerical limit on spectral content exists in law and is enforced; Part IX.H, for the form such a limit takes.

D.3 Publications of manufacturers and testing laboratories

These are cited for what their authors are positioned to know about their own products, their own test practice, and the regulatory environment they operate in. They are not independent assessments and the Foundation does not present them as such. Where a statement in one of them is adverse to the Foundation's position it is reported as well, and where a numerical value is taken from one it is identified as a manufacturer figure requiring verification against the standard.

D.3.1 Underwriters Laboratories, Assessing the Photobiological Safety of LEDs (2012). White paper of a testing and certification laboratory. Cited for four statements: that compliance with photobiological safety requirements in the United States and elsewhere was at that date voluntary; that single indicator light-emitting diodes are typically not evaluated under the current standards; that the exposure limits are not intended to strictly separate safe from unsafe levels and may not accurately reflect risk for more susceptible people, including those with increased photosensitivity or lens transplants; and that IEC 62471 is a horizontal standard that does not address end-product manufacturing, labeling or user safety requirements. Treated at Part V.C.2.k.

D.3.2 Killeen J., A ten-point tool kit for effective warning lights, Ambulance Visibility (2011). The third in a series on emergency vehicle markings and warning lights, circulated to the Colorado Emergency Medical Services Association community and stated by the author to make available information presented at the third annual EMS Safety Summit of October 2010. Eight pages. Full text read. Treated at Part VI.C.1.

What it is, and the weight it carries. Practitioner advocacy writing, not research and not peer reviewed. The author gives no affiliation, credentials or competing interest in the text. Several of its central propositions are attributed to research that is not named, including work said to be of the University of Michigan on synchronization. The Foundation cites it for what a practitioner audience was told, for the recommendations it makes, and as a route to the primary sources it names. It is cited for no effect and for no health claim.

The proposition the comment most wants substantiated. That flashing lights are not perceived as quickly as steady-burn lights, and require higher light output to compete with steady lighting. No source is given. If correct it reverses the premise underlying the product class, and it is recorded at Part VI.C.1 and at Part V.L as a research priority rather than as a finding.

The recommendations the comment uses. To add steady-burn lights, on the ground that exaggerated flashing displays do not necessarily increase scene safety and may contribute to the accident rate; to switch flashing white lamps off at night; and to avoid side lamps at the eye level of other drivers, with a recommended maximum height of thirty inches.

Figures it gives for dark adaptation, all uncited. That a short exposure to bright flashing white lamps can obliterate night adaptation within seconds; that a driver glancing at a side lamp will lose night adaptation in less than a second with secondary after-flash effects; that recovery may take up to twenty minutes; and that older drivers are particularly susceptible.

Two claims recorded but not relied on. The account of the National Fire Protection Association process, that information was submitted warning that an optical warning device between 18 and 62 inches above ground may cause temporary blindness, and that the draft standard nevertheless places waist-height lamps at seated-driver eye level. And the statement that most warning lamps are delivered with a written warning that eye damage will occur if the lamp is viewed at close range. Neither has been verified by the

Foundation. The second is capable of verification by obtaining any product manual and would be material to Part VII, Part VIII and Part IX.F if confirmed.

Where it conflicts with better evidence, recorded so that no part of the comment relies on the weaker source. It asserts the Moth Effect. The controlled experiment at Appendix D.4, conducted under contract to the United States Fire Administration, found no evidence of a moth-to-flame effect or its opposite. The comment follows the controlled experiment. The article is itself candid that the related Wake Effect has proven difficult to quantify in research despite large amounts of anecdotal evidence, and that its acceptance rests on being widely accepted rather than demonstrated.

Two primary sources it points to, both worth more than the article. Berkhout (1979), reported as finding that a stationary vehicle displaying a flashing red lamp led more than fifty percent of test subjects to believe it was moving away, and that twenty-six to thirty-one percent believed a vehicle displaying flashing blue was approaching. If that is real experimental data on motion misperception induced by flashing emergency lighting, it belongs in the comment directly. And Stephen Solomon, whose maxim the article quotes and who appears to have a body of work on emergency vehicle lighting and conspicuity.

D.3.3 ams-OSRAM, Application Note AN002, revision of September 16, 2025. Manufacturer application note on the photobiological classification of light-emitting diode components. Source of the risk group boundary radiances, the characterization of the 200 millimeter evaluation distance as a worst-case assumption, the 11 milliradian small-source criterion and its 2.2 millimeter equivalent at that distance, and the statement that Risk Group 2 devices are regarded as presenting no risk under accidental glances because the aversion reflex usually acts. Treated at Part V.C.2.k. Every value taken from it is flagged there for verification against the standards themselves.

D.3.4 Cree Lighting, Is Street Lighting Damaging Our Health? (March 3, 2022). White paper of a light-emitting diode luminaire manufacturer, twenty-four pages, issued from its European organization and contributed to by named employees together with outside lighting designers and advisers. The Foundation cites it for five propositions, each of which is adverse to the interest of the party publishing it. First, on the standards: that when the general lighting standards were updated in 2008 to include light-emitting diode lighting, “the previous calculation methods were simply transferred over to the new standards”; and that the research used to revise the roadway standards in 2013 “did not consider the luminance differences introduced by using LED technology.” Second, on the present state of knowledge: that “Scientific evidence has proved that the colour spectrum and luminance of LEDs has and still is causing impacts on health, safety, quality of life, and the environment.” Third, the critique of the five outdoor glare metrics reproduced at Part V.C.4.f, including the statements that the Threshold Increment “assumes point source optics”, that the G-star classes are “ineffectual”, that the D-star index is “ineffective”, and that the CIE 112 Glare Rating rests on “a highly inaccurate assumption.” Fourth, the pixelation material reproduced at Part V.J.3, that photometry “cuts down the luminaire’s details to one pixel of information.” Fifth, and most directly, its closing warning: “Without a speedy agreement on metrics for measuring LED intensity, spectrum, photometry and LED spacing, we will be installing millions of LED luminaires for street lighting purposes that are not suitable for use, could even be described as dangerous, and that will be costly to replace.” The document also supplies scale figures the Foundation has not otherwise sourced: a market study estimate of 315 million streetlights worldwide in 2016 rising to 359 million by 2026, with light-emitting diode streetlights projected to reach 89 percent of that market by 2026, and an estimate that about 70 percent of United Kingdom street lighting had undergone or was contracted for diode conversion.

D.3.5 Luminus Devices, High-Luminance LEDs for Directional Lighting Applications (February 3, 2023). White paper of a light-emitting diode component manufacturer, by Tom Jory, Paul Sims and Yi-Ying Lai, thirty-one pages. Cited for five

things. First, for the design principle stated at Part V.C.4: that what matters is "not only flux, but flux per emitting area, called lumen density," and that the first and third of the five attributes the document calls critical are a small light emitting surface and a small emitting angle. Second, for the worked figures at Part V.C.4 and Part V.B.8: a 1.2 square millimeter emitter supplied with 500 lumens, giving on-axis intensities of 84,153 and 112,940 candelas for square and round emitting surfaces behind the same dome lens, beam angles at half maximum of 3.13 and 2.77 degrees, and beam distances to one lux of 290 and 336 meters. Third, for the document's own list of applications, which includes roadway lights for highways, roads and intersections, streetlamps for public sidewalks, parking lots and pedestrian walkways, professional flashlights for military and police use, weapon-mounted lights, bicycle and helmet lights, architectural spotlights and track lighting, work lights, surgical and dental lighting, and outdoor digital signage. Fourth, and adverse to the industry position generally, for a statement the Foundation did not expect to find in a document of this kind: that "streetlights need to limit the amount of blue wavelengths so they don't interfere with human and animal circadian cycles." That sentence appears in a technical paper addressed to lighting engineers, not to regulators, and the Foundation relies on it as evidence of what is understood within the industry rather than as a scientific finding. Fifth, for the definitional material on luminance, luminous intensity, luminous flux and illuminance, and for the lens efficiency or K factor, expressed in candelas per lumen, which the document defines as the maximum luminance divided by the total luminous flux.

D.3.6 Osram Opto Semiconductors, The Influence of LED Emission Characteristics on the Efficiency of Lighting Systems (July 1, 2016). Article by Dr. Roland Schulz, application engineer in the Solid State Lighting division of the manufacturer, published in the trade journal LED professional. Addressed to luminaire designers choosing components. Cited for five statements, of which the first and the last are the ones this comment relies on. First, that the information a component data sheet carries is not sufficient to predict what a device will do, and that the quantity in which emission is conventionally reported does not describe brightness: "This information is not sufficient, however, as the basis for selecting an LED because the half width specifies only a single point along the LED emission curve, and the luminous intensity distribution is not an accurate measure of the brightness of the LED in a luminaire." Second, that a surface-emitting chip produces a Lambertian distribution by design, the converter layer being about 50 micrometers thick: "The result is what is known as a surface emitter that emits light only in the front half-space of the LED with a lambertian emission curve. The maximum possible emission angle here is 90 degrees." Third, that a volume-emitting chip does not, because the converter must surround the chip; with chip heights of 100 to 150 micrometers, "emission surfaces of 200 µm and more are easily generated", producing "significant intensity at angles greater than 90 degrees." Fourth, that two devices reporting the same half width may distribute their output differently: of two LEDs both specified at 120 degrees, "Both curves are almost identical at low angles but at more than 60° there are significant differences – despite the same value for the half width," one of them emitting about ten percent of its light beyond 90 degrees and offering about ten percent lower cumulative flux at 60 degrees; and of a named product, the Oslon Square, that "the half width corresponds to that of many LEDs and is 120°. Within the half width the luminous intensity is greater than that of a lambertian emitter, and smaller outside the half width." Fifth, and most consequential for Part V.J, that the near-field characterization this comment reports to be absent from the regulatory record is measured as a matter of commercial routine: designers are told to "use ray files of the LEDs which contain near field information," and the manufacturer states that it "offers measured ray data for all LEDs and all standard programs."

What this appendix does not contain

The Foundation states its exclusion criteria, because an appendix of this kind is as much defined by what is kept out of it as by what is admitted.

Press reporting is excluded, including reporting published in the news sections of peer-reviewed journals. Where such an item is used in the body of this comment it is identified in the text as journalism, and the one instance is at Part II.E.6.

Submissions, position papers and petitions by individuals and advocacy organizations are excluded, including the Foundation's own. A submission to a consultation is not an assessment by the body consulted, and the Foundation does not cite documents of that character as though a committee had adopted them. Where the Foundation relies on its own filings they are identified as its own and are collected at Appendix E.

Documents that rest on unpublished data are excluded, whatever their source, and so are documents whose principal authority is an appeal, resolution or declaration circulated for signature. The Foundation holds itself to the standard it asks the Department to apply: a claim is worth what the record behind it is worth.

D.3.7 Gigahertz-Optik GmbH, Flicker measurement (Temporal Light Artefact) of LED lighting (undated). Knowledge-base article of Gigahertz-Optik GmbH, a German manufacturer of photometric and radiometric instruments, published on the company's website in support of its BTS256-EF, PFL-200 and BTS2048-VL flicker meters. Read in full. The page carries no author, no date and no version; it refers to the European eco-design requirement as having come into force in September 2021 and to a tightening "expected" in 2024, so it was written between those dates and has not been revised since. The citation must give the date of access.

What this document is. Product literature. It explains the flicker metrics, then describes what the manufacturer's own instruments measure and under what conditions. It is in this subsection for the reason the subsection exists, which is what the author is positioned to know: an instrument maker knows the limits of its instruments, and states them here because a purchaser needs them. The Foundation relies on it for those limits and not for its account of the science, which is secondary throughout and in places loosely edited. The page contains at least two internal inconsistencies, citing the Assist metric to volume 3 issue 3 in its summary and to volume 11 issue 3 in its reference list, and naming a "BTS2556-EF" which appears nowhere else and is evidently the BTS256-EF. Those errors do not touch the measurement specifications, which are given in tables, but they bear on how much weight the prose carries.

First matter: the frequency ceiling of the instruments. The summary states that "The meters are designed for the detection of flicker frequencies up to 5 kHz". The specification tables bear that out and show that the ceiling falls as the measurement time lengthens. In handheld use the upper cut-off frequency is 5 kilohertz at sensor measurement times of 50 and 100 milliseconds, then 2.5 kilohertz at 200 milliseconds, 1.2 kilohertz at 500, 0.6 kilohertz at 1,000, 150 hertz at 3,000, 75 hertz at 6,000 and 33 hertz at 12,000. The page also notes that the amplifier range governs the attainable speed: "3dB Range 0 to 5 = 10 kHz, Range 6 to 8 = 200Hz". So the instrument reaches 5 kilohertz in ordinary use and 10 kilohertz only in part of its range, and the operator trades frequency ceiling against frequency resolution by choosing the measurement time.

Second matter, and the one the Foundation regards as most important: the illuminance the instrument needs. The page states a condition for a valid flicker measurement. "Basically, the signal to be measured should be strong enough (e.g. at least 100lx are recommended). Only then is it possible to guarantee a good signal to noise ratio for the flicker measurement". And on what happens below it: the error in calculating both frequency and flicker parameters "thereby increases greatly", and while a large amplitude may be detectable in noise, "small flicker signals can be below the noise level and are

thereby cannot be detectable". The illustration given is of a reading at 78.11 lux, described as a bad signal-to-noise ratio. The Foundation accordingly records that the recommended minimum illuminance for a field flicker measurement with this class of instrument is about 100 lux.

Third matter: the European requirement, with a qualifier the comment did not previously have. "In September 2021, the Eco-design directive has come into force. It states the requirement that non-dimmed LEDs and OLEDs must abide to the limits Pst less than 1.0 as well as SVM less than 0.9. The SVM limit is expected to be tightened in 2024 to an even lower maximum value of 0.4". That corroborates the account at Appendix C.91, which gives the same two values in the same order, and it supplies the dates. It also introduces the word non-dimmed, which the Foundation flags rather than interprets, because the phrase will bear either of two readings: that the limits apply only to products which cannot be dimmed, or that they apply to any product measured at full output. The second is the more likely and the difference matters either way, because dimming is the condition under which modulation is reported to worsen.

Fourth matter: the stated frequency domains of the metrics. The page gives domains the comment did not previously have in explicit form. Of the flicker severity metric: it "is now proposed in CIE TN006 for the assessment of perceived light flicker for frequencies up to 80 Hz". Of the Assist perception metric: it "mainly deals with signals below 80Hz and which do not interact with moving objects or observers (stroboscopic or phantom array effect)". Of the stroboscopic measure: it "considers effects on appearance of moving and rotating objects when illuminated with light modulation typically up to 2 kHz" and "is appropriate when the average light level is > 100 lx and the fastest movements are moderate speed hand movements of <= 4 m/s". The three metrics in use therefore cover, between them, below 80 hertz and up to 2 kilohertz, and the second of those requires more than 100 lux.

Fifth matter: the definitions, which are the cleanest statement the comment has found. The page reproduces the three definitions of CIE TN 006:2016 and the Foundation records them because the distinguishing variable is the same in each and is easy to lose. Flicker is "perception of visual unsteadiness induced by a light stimulus the luminance or spectral distribution of which fluctuates with time, for a static observer in a static environment". The stroboscopic effect is "change in motion perception" from the same stimulus "for a static observer in a non-static environment". The phantom array effect is "change in perceived shape or spatial positions of objects" from the same stimulus "for a non-static observer in a static environment". Observer still and world still; observer still and world moving; observer moving and world still.

What the manufacturer says about non-visual effects. "Much research has reported that non-visual TLAs might also have various physiological and psychological effects such as migraines, seizures, autistic behavior, vertigo, reduced performance, emotional changes among others", with eleven references given and IEEE Std 1789:2015 cited as providing a summary of known effects. The Foundation records the sentence because of who publishes it, which is a manufacturer of measuring instruments addressing purchasers, and not because a trade page establishes any of the effects it lists.

What it establishes. That a commercially available field flicker meter of current design is built to detect modulation up to 5 kilohertz, and up to 10 kilohertz only in part of its amplifier range; that the manufacturer recommends a minimum of about 100 lux for a reliable flicker measurement and states that small modulations below the noise floor cannot be detected; that the European requirement came into force in September 2021 at a stroboscopic limit of 0.9 with a tightening to 0.4 expected in 2024, expressed as applying to non-dimmed sources; and that the flicker severity and perception metrics are stated by the instrument maker to apply below about 80 hertz and the stroboscopic measure up to about 2 kilohertz and above 100 lux.

What it does not establish. Anything about health, exposure or injury. Nothing about any other manufacturer's instruments, and the Foundation does not assert that these specifications are representative of the field, although it notes that the page describes three of its own products as sharing one amplifier design. Nothing about what any lighting product actually emits, the page reporting no measurement of any lamp. And nothing about the European regulation beyond a trade summary of it.

Where it bears. Part V.D.1, which is written on it, for the instrument ceiling, the illuminance floor, the metric domains and the non-dimmed qualifier. Part V.D.2, for the definition of the phantom array effect by the motion of the observer. Part VI, for the consequence of the illuminance floor outdoors at night.

D.3.8 Potter S., Police Vehicle Warning Signals — An Innovative Approach to Officer Safety, Police Chief Magazine (2018). Published by the International Association of Chiefs of Police as a bonus online article, 2 May 2018. Read in full from the publisher's site. Treated at Part VI.C.1.

Who wrote it, stated first because it governs the weight. Scott Potter, identified in the byline as Managing Partner of Patriot Fleet Group, LLC, a fleet equipment business. The article recommends adaptive warning systems, which are products of the industry its author works in. Of its six source notes, four are interviews with a police lieutenant and a state police sergeant, and one is an interview with an inside sales manager of Whelen Engineering Company, cited for a technical proposition about flash patterns. Whelen is the same manufacturer that supplied the test lights for the study at Appendix D.4. This is trade writing by an industry participant and the Foundation cites it as that.

Why it is relied on despite that. Because the facts it reports are operational rather than scientific, and because they are the only facts of their kind the Foundation has found. An American state police agency tested its own warning lighting and changed it. What it tested, what it adopted and at what scale are matters of record about which the officers interviewed are the people in a position to know.

The account it gives. That the Massachusetts State Police had eight serious rear-end collisions in the summer of 2010, one fatal; that it assembled a team including its own personnel, civilians, manufacturers' representatives and engineers; that testing at a closed airfield in daylight and at night found the intensity of the lights at night far more distracting to the majority of drivers, some looking away and some unable to look away; that the range tested extended as far as removing the flash entirely and evaluating steady non-flashing light; and that the hybrid pattern adopted was distinguished by test subjects just as quickly and from the same distance as the fast bright pattern, without the distraction.

The parameters adopted, which are the most useful particulars in the document. In nighttime park mode the lower perimeter lamps were reduced to sixty flashes per minute, which is one hertz, with intensity greatly lowered; and the light bar went to a pattern named Steady-Flash, a low intensity blue glow with a flicker every two to three seconds, which is between a third and a half of a hertz. Rear light bar colors changed from red and blue by day to blue and amber at night. As of April 2018 the agency reported more than one thousand vehicles so equipped.

What it says about the standards. That four bodies set the requirements: the Society of Automotive Engineers, the Federal Motor Vehicle Safety Standards, the Federal Specification for the Star of Life Ambulance (KKK-A-1822) and the National Fire Protection Association. That all are built around a minimum light output level. That a five-inch fixture can now emit intensity comparable to that of an entire vehicle of earlier years, so that ten or twenty of them on a vehicle parked at night may create a condition less safe than the equipment they replaced despite being compliant. And that none of the intensity requirements takes ambient light into account, the author proposing a standard that varies with it. The Foundation has found no other source naming KKK-A-1822 in this connection.

What it does not establish. That bright flashing lamps cause rear-end collisions, and nothing about health of any kind. The Massachusetts testing is reported qualitatively with no protocol, sample size, measurement or published report. The reduction in collisions is reported in an interview as dramatic, without figures or analysis, and the comment treats it as a claim rather than a finding. The previous studies the team is said to have relied on are not named. Two small errors suggest the register: the Federal Motor Vehicle Safety Standards are listed as one of four organizations when they are a body of regulation issued by an agency, and the National Fire Protection Association is given as an Administration.

Where it bears. Part VI.C.1, which is written on it, for operational feasibility, for the adopted parameters and for the minimum-only criticism. Part IX, for the proposal of an ambient-light-dependent requirement.

D.4 Commissioned research reports

Studies commissioned by a client and published by the consultant or the client rather than in a peer-reviewed journal. They report original research and are cited for their findings, which distinguishes them from the publications at D.3. They have not been through journal peer review, which distinguishes them from Appendix C. Where this comment relies on one, it states who commissioned it and for what program, because the identity of the client bears on what questions were asked and what questions were not.

D.4.1 Heschong Mahone Group, Daylighting in Schools: An Investigation into the Relationship Between Daylighting and Human Performance (1999). Dated August 20, 1999. Prepared for Pacific Gas and Electric Company on behalf of the California Board for Energy Efficiency Third Party Program, under contract 460 000 8215. Directed by Lisa Heschong; statistical analysis by RLW Analytics; field work by Cascadia Conservation and Architectural Energy Corporation. Draft reports were circulated for review, organized by Steven Selkowitz, which is not journal peer review and the Foundation does not describe it as such. More than 21,000 students in grades two through five and more than 2,000 classrooms across three school districts. Treated at Part VI.E.3, where the Foundation states why it does not rely on the report's headline associations and what it does rely on: the association between one uncontrolled skylight configuration and lower reading progress, which the authors attribute to glare, and the report's own inability to obtain either spectral measurements or the type of electric lighting equipment installed.

D.4.2 Heschong Mahone Group, Windows and Classrooms: a study of student performance and the indoor environment. Later work by the same firm for the California Energy Commission, revisiting student performance against a broader set of indoor environmental variables, and reported in the proceedings of the American Council for an Energy-Efficient Economy summer study in 2004. The Foundation has not yet obtained it. It is listed here because Part VI.E.3 commits this comment to reading it before any figure from the 1999 report is filed, and the obligation should be visible in the appendix as well as in the text.

D.4.3 Lewin I., Digital Billboard Recommendations and Comparisons to Conventional Billboards (2008). Lighting Sciences Inc., 7826 East Evans Road, Scottsdale, Arizona. Twenty-five pages, signed by the author and dated November 26, 2008. The author is given as Ian Lewin, Ph.D., Fellow of the Illuminating Engineering Society, Lighting Certified. The report states its own provenance: "This report has been prepared for the Outdoor Advertising Association of America (OAAA) under the contract issued to Lighting Sciences Inc. for the development of luminance (brightness) recommendations for digital billboards under nighttime conditions." Read in full. The copy read was supplied by the Foundation and carries a previous reader's highlighting; the citation is to the report itself.

Why it is in the comment. Because it is the technical basis of the criterion by which the brightness of digital billboards is actually controlled in the United States. Part VI.J.6 records that the Foundation can identify no federal requirement governing the optical output of this class and that such control as exists is municipal. This is the document the municipal criterion derives from, and it is therefore the operative instrument for the class whatever its status in law. It is also, on its own terms, a document which states that it does not address the question most people would assume a brightness limit addresses.

The criterion. A limit of 0.3 footcandles above ambient conditions, measured with a footcandle meter held at a height of 5 feet facing the display at a standardized viewer distance, the standard distance being 250 feet for a 14 by 48 foot bulletin of 672 square feet. The method is derived from the practice of the Illuminating Engineering Society of North America for light trespass, and the report presents its simplicity as a virtue, the enforcement procedure requiring "only a footcandle meter".

The measured luminances of a real display, which the report supplies. A Prism electronic display of 20 millimeter pixel spacing, commercially produced in November 2006 by Young Electric Sign Company, was measured in Scottsdale on a model 6440 goniophotometer by the approved methods of the Illuminating Engineering Society. At the 100 percent luminance setting the report gives the following measured values.

Color at the 100 percent setting	Measured luminance (cd/m^2)
White, 6,800 kelvin	7,000
Green	5,100
Red	1,500
Blue	700
Implied by the recommended criterion	about 300

The conversion, and the arithmetic is the Foundation's. The report supplies the relation between its illuminance criterion and the luminance of the display, as its equation A5: luminance in candelas per square meter equals 10.76 multiplied by the illuminance in footcandles multiplied by the square of the distance in feet, divided by the area in square feet. Applying the recommended 0.3 footcandles at the standard 250 feet to the standard 672 square foot bulletin gives a luminance of about 300 candelas per square meter. Set against the measured white value of 7,000, the recommended nighttime criterion is therefore about 4 percent of what the hardware was measured to produce. The computation uses the report's own formula and its own figures; the result is not stated in the report.

The exclusion the report states on its face. This is the statement for which the comment principally relies on the document. "The investigations and this report do not cover factors related to changing images and billboard message movement. Issues that may be related to motorist attention are beyond the scope of the work and use of the proposals in this study should be based on that understanding."

The choice between two bases, recorded as a chronology. The report considered two methods. The first was a specification founded on driver glare; the second on environmental impact, under the heading of light trespass. Of the first the report states that the procedures of the Illuminating Engineering Society "can, in theory, be used to produce limitations on digital billboard luminance that will ensure that any glare problems created for drivers will be relatively minor, in the order of glare often produced by a street lighting installation", and that of the two methods "the first method has disadvantages." The second was recommended. The report also sets out the three requirements the analysis had to satisfy, of which the third is: "The needs of OAAA members, who require

effective use of digital billboards, which in turn requires adequate brightness for clear visibility."

What the report says that tells against the Foundation. Three things, and the Foundation records them because a comment that omitted them would be unreliable. That the luminance figures rest on "a worst-case scenario of an all-white display, which is unlikely to happen, save for a malfunction." That "Since displays are generally viewed at an angle, the luminance (glare) is substantially reduced." And that on a comparison with measurements of conventional billboards by the Lighting Research Center of Rensselaer Polytechnic Institute, "The digital billboards will be brighter, but only slightly brighter, than the maximum luminance of conventional billboards." The Foundation notes as to the last that the comparison is drawn against the maximum of the conventional class and not against its typical value.

What it does not establish. It is not a health study, reports no biological endpoint and no exposure of any person, and makes no claim about either. It was commissioned by the trade association of the industry whose product it concerns, for the purpose of developing recommendations that industry could adopt, and the preamble to this subsection states why the identity of the client matters. Its measurements are of one display of one make tested in 2006.

Where it bears. Part VI.J.6, which is written on it. Part V.B.2, for an operative American criterion expressed in illuminance at a stated distance rather than in source luminance. Part V.C.3, for the setting aside of a glare-based basis in favor of a nuisance-based one.

D.4.4 Walczak K., The Assessment of LVT Mobile Surveillance Units: Regarding potential lighting issues (2026). Night/Light Consulting, LLC. Dated 10 September 2026. Twenty-five pages. Signed by the author, identified as a board member of DarkSky International and a member of the Illuminating Engineering Society. Commissioned by the Soft Lights Foundation, which is recorded here and at Part IV.E.3 and Part VI.I because the Department should weigh the document knowing it. Treated at Part VI.I and relied on at Part V.B.3, Part V.C and Part V.D.1.

Why it is in the comment. Because it is the only complete independent photometric characterization of a deterrent lighting product in American service that the Foundation has been able to obtain, and because its existence is itself the finding: the measurements exist because a private party paid for them, there being no federal body that measures these products and no federal convention to which a measurement could refer.

What was measured, and under what conditions. An Abrams Manufacturing TG-300-B lamp as fitted to LiveView Technologies mobile surveillance units. Laboratory photometry was performed on a purchased unit powered at 12 volts direct current from a calibrated supply and stabilized for at least five minutes, with the lamp in its steady setting. Field surveys were conducted by day and by night in July 2026 at three Chicago sites. A fourth site, a Walmart parking lot in Woodland, California, was assessed remotely from geographic information system data and eyewitness accounts rather than in person.

Instruments. Sper Scientific 840022 illuminance meter; Hopoocolor HPCS-330P spectrometer; Sekonic Speedmaster L-858D-U luminance meter; Canon EOS M6 Mark II camera in manual mode at a fixed white balance; iPhone 17 Pro Max for high-speed video. The report does not state the accuracy or uncertainty of any instrument and does not map each instrument to each reported reading. It does state, to its credit, that photographs cannot fully represent the human visual experience at night.

The measured values the comment relies on. Luminance in the direction of the central peak of emission, 700,000 candelas per square meter. Total emission area of the three diodes, 10.4 square centimeters, giving a derived average peak luminous intensity of 728 candelas. Illuminance at one meter, photopic corrected, 145 lux. Peak spectral emission at

456 nanometers with more than 80 percent of output in the blue. Flicker at 100.1 hertz, 63.9 percent, flicker index 0.24. Strobing at 20.9 hertz, 77.4 percent, flicker index 0.385, in the default pattern of five pulses at about 20 hertz followed by a gap of 0.2 seconds.

Three internal inconsistencies the Foundation has found, recorded so that no part of this comment is read as quoting selectively. Correlated color temperature. At page 18 the report states that there is no equivalent correlated color temperature because the source is near monochromatic and does not fall within any black body standard. At page 23 it states that the correlated color temperature was calculated to be greater than 12,000 kelvin, adding that the measure is not a practical one for monochromatic sources. These cannot both stand. The comment relies on neither and uses the peak wavelength and the blue fraction instead. The glare figure. The summary at page 2 gives 45.8 at nine meters; the body at page 22 gives 45.9 at four meters. The comment uses the body figure and states the distance. The acceptable distance. Page 22 gives the minimum acceptable distance as 194 meters and states in the following sentence that any direct visibility closer than 190 meters is unacceptable.

What the comment does not take from it. Its characterization of the measured values as violations of IEEE Std 1789-2015. That document is a recommended practice which binds no one, as Appendix D.2 sets out, and the comment says so expressly at Part VI.I. Its statements of health risk, which are the opinion of a lighting consultant rather than findings of a health study; the report contains no biological endpoint and no exposure of any identified person. And its Woodland figures on the same footing as the Chicago ones, for the reason given above.

Where it bears. Part VI.I, which is written on it. Part IV.E.3, for the fact of the commissioning. Part V.B.3 and Part V.F, for the spectrum. Part V.C, for the glare figures and for the blue light hazard conversion which this report does not yet permit. Part V.D.1, for a measured pulse-width modulation frequency and depth in a product in service. Part II.F, for what it shows about who measures these products.

D.4.5 Bullough J. D., Parr S. A., Sblendorio A. and Hiebner E., Effects of Emergency Vehicle Lighting Characteristics on Driver Perception and Behavior: Study Report (2021). Emergency Responder Safety Institute, December 2021. Twenty-four pages. Produced under a contract between the United States Fire Administration and the Cumberland Valley Volunteer Firemen's Association's Emergency Responder Safety Institute, which subcontracted the research to the Lighting Research Center at Rensselaer Polytechnic Institute and to Embry-Riddle Aeronautical University. Additional funding from the Embry-Riddle Office of Undergraduate Research and from the Dwight D. Eisenhower Transportation Fellowship Program within the United States Department of Transportation. Full text read. Treated at Part VI.C.1 and relied on at Part VI.I and Part II.H.6.

Why it is in this subsection rather than Appendix C. Because it is a commissioned study report published by the contracting organization rather than a peer-reviewed article, which is the criterion of this subsection. The Foundation does not treat it as less reliable for that reason; the lead author is a published authority on flicker and signal lighting whose work is cited in the recommended practice at Appendix D.2.

A provenance point the Foundation records on the face of the entry. The test lights used in the experiment were provided by Whelen Engineering Company, a manufacturer of emergency vehicle lighting, whose personnel are acknowledged by the authors. The Foundation does not suggest that this affected the conduct or the findings, which include conclusions adverse to the sale of brighter equipment. It records the fact because a reader is entitled to it.

Design. A human factors field study. Twenty licensed drivers, seven female and thirteen male, mean age 32 years with a standard deviation of 15 and a range of 19 to 61, drove a closed

course at not more than 30 miles per hour at night past a simulated incident scene with a full-scale black silhouette of a firefighter in a reflective vest. Lights were mounted on two tripods representing the rear corners of a large fire truck. Five independent variables were tested in fourteen combinations: intensity at two levels, color at four, modulation at two, flash rate at two, and presence of reflective chevron markings at two. Outcome measures were a five-point rated visibility of the lamps, a nine-point discomfort glare rating, a five-point rated visibility of the road scene, lateral offset from the lamps, and the distance at which the firefighter silhouette was detected. Approved by the institutional review boards of both universities.

The intensity conditions, which govern how the principal finding should be read. The high level was approximately 33 percent above the minimum optical power specified by National Fire Protection Association Standard 1901 for large fire trucks. The low level was approximately one-third to one-half of that minimum. No condition approached the output of the brightest equipment in service, and the study therefore says nothing about the upper end of the market.

Principal findings. Higher intensity produced significantly more discomfort glare and only marginally greater rated visibility, both intensity levels being rated between 1.5 and 2 on a scale whose maximum is 2. Color had a larger effect than intensity on both measures: blue and red were most visible, blue and white most glaring, red and yellow least glaring, with the range across colors on the glare measure about twice the range across intensity levels. The authors attribute the glare result to short-wavelength spectral content. They conclude that lamps meeting existing minimum intensity requirements may be brighter than needed at night, that lower intensities would reduce glare without reducing visibility, and that whether maximum limits to intensity would benefit responder safety should be investigated.

Null and adverse findings, recorded here as well as in the body. No evidence of a moth-to-flame effect or its opposite: participants drove no closer to or farther from the lamps at any intensity or color. Flash rate and modulation had no statistically significant effect on any outcome measured. No variable affected the rated visibility of the overall road scene. High-reflectivity chevron markings appeared to reduce rather than improve the distance at which responders were detected, by about 25 feet, non-significant alone but producing a significant interaction with intensity.

What it does not establish. Anything about health. It reports no biological endpoint, no clinical measure and no exposure of any person to anything but a rating scale. Its subject is the occupational safety of emergency responders and the perceptions of drivers passing them. Its flash-rate null is a null on subjective discomfort among twenty people and bears on nothing at Appendix C.98 or Appendix D.2.

The statement the comment relies on most. That the standards defining minimum photometric performance for these lamps set no maxima and have not changed substantially since light-emitting diode sources became widespread, and that the lamps have increased in intensity as the efficacy of those sources has increased. Part VI.C.1 and Part VI.C.2 are written on that asymmetry and this is the Foundation's best source for it.

D.5 Reference works and book chapters

Authoritative secondary literature published as a chapter in an edited reference work. Such a chapter is reviewed by the volume's editors rather than through journal peer review, so it does not belong in Appendix C; it reports no original research of its own, so it is not a commissioned research report under D.4; and it is not the product of a constituted expert body, so it is not an assessment under D.1. The Foundation cites a chapter of this kind for the state of knowledge in a field as a specialist in that field set it out, and identifies it as such wherever it is used.

D.5.1 Martinsons C., Photobiological Safety (2015). Chapter in Karlicek R and others, editors, Handbook of Advanced Lighting Technology, Springer International Publishing, pages 1 to 31, ISBN 978-3-319-00295-8, doi:10.1007/978-3-319-00295-8_51-1. The author's version is deposited in the French national open archive at hal-04691337, under a Creative Commons Attribution-NonCommercial licence, and is dated July 28, 2014. Single author, Lighting and Electromagnetism Division, Centre Scientifique et Technique du Bâtiment. The same author is lead author of the 2024 intergovernmental review at D.1 and a co-author of the market surveillance study at Appendix C.59, which is why this comment treats the chapter as evidence of what was known to the field, and when.

What this comment takes from it. Four things. Its section 4.6, Limitations of the CIE/IEC blue light hazard assessment, with subsections on low-level chronic exposure, long-term exposure and sensitive populations, used at Part V.C.2.c. Its reproduction of French agency measurements of luminance and risk group for single-chip white emitters, used at Part V.C.2.k. Its account of the averaging field of view and of the effect of viewing distance on the maximum permissible exposure duration, which corrects and narrows an argument the Foundation makes at Part V.B.2 and Part V.C.2.k. And its criticism of the reference viewing distance of IEC 62471 as ambiguous and not realistic in the context of real usage conditions.

What tells against the Foundation in it, recorded here as well as in the text. The chapter concludes that at a viewing distance of one meter the maximum permissible exposure duration rises to thousands or tens of thousands of seconds, and that this provides a reasonable margin for asserting that there is virtually no possible blue light retinal damage from light-emitting diodes at longer viewing distances. It also states that Risk Group 3 is highly unlikely to be reached by any artificial white light source. Part V.C.2.k sets out both, and what the Foundation does and does not conclude from them.

D.6 Technical papers of standards-body participants and conference proceedings

This category exists because the comment has come to rely on a literature that none of the five above accommodates, and the Foundation states the reasoning by elimination as it did at D.5. A paper presented at a conference and published in its proceedings is not an article in a peer-reviewed scholarly journal, so it is outside Appendix C. It is not the product of a constituted expert body, so it is not an assessment under D.1. It is not a standard, although it may be an account of one, so it is not D.2. It is not the publication of a manufacturer or testing laboratory about its own products, so it is not D.3. It reports no commissioned research, so it is not D.4. And it is not a chapter of an edited reference work, so it is not D.5.

The Foundation cites a paper of this kind for one of two purposes. The first is the account its author gives of the technical basis of an instrument, where that author participates in writing the instrument. The second is a measurement reported in a proceedings volume and nowhere else, which arises in this field because the metrology of these sources is presented substantially at conferences. The third is an account of the state of a technology given in a proceedings volume by a specialist who develops it, which is admitted for the same reason a manufacturer publication is admitted at D.3, namely what its author is positioned to know, and which is weighed the same way. Where an entry rests on the second or third ground the Foundation has searched for a journal version of the same work and records that it found none, and every entry in this subsection is read with the lesser review a proceedings paper receives in mind. Authority of that sort is not the authority of research and the Foundation does not treat it as such. It is closer to the authority of an explanation given by a draftsman of what a provision was intended to do and what it was not. Where a paper in this category states a matter of general physics, the Foundation prefers a journal article or a reference work and cites this literature only where the account is not available elsewhere. Wherever an entry here is used in the body of the comment, the text identifies both the status of the paper and the role of its author.

D.6.1 Schulmeister K., The radiance of the sun, a 1 mW laser pointer and a phosphor emitter (2013). Paper P107 in ILSC 2013: Proceedings of the International Laser Safety Conference, Orlando, Florida, 18 to 21 March 2013, pages 371 to 378, published by the Laser Institute of America. doi:10.2351/1.5056816. Author at Seibersdorf Laboratories, Austria, described in the paper as a laser, light-emitting diode and lamp safety test house and consultancy. Full text read.

The author's roles, which are the reason this paper is in the comment at all. The paper's author biography states that he is a member of Standing Committee IV of the International Commission on Non-Ionizing Radiation Protection; a member of the bioeffects technical subcommittee of the American National Standards Institute accredited committee Z136; the secretary of Working Group 1 of International Electrotechnical Commission Technical Committee 76, which it identifies as "the working group responsible for IEC 60825-1"; and associated division director of Division 6 of the International Commission on Illumination, "which is responsible for CIE S009/IEC 62471." It further states that research in his group "provided the basis for amending the spot size dependence of the retinal thermal limits." He therefore holds office in the body that writes the laser standard and in the body that writes the lamp standard, and sits on the commission whose exposure limits both rest on. Part V.C.2 is an argument about the relationship between those two standards. This is an account of that relationship by a person who helps draft both.

First matter: the radiance threshold that routes a product from the laser standard to the lamp standard, and what the author says it is not. The paper explains an amendment introduced for the third edition of IEC 60825-1, permitting light produced by a laser striking a phosphor to be assessed under IEC 62471 instead, provided its radiance stays below one megawatt per square meter per steradian divided by the angular subtense in radians, that subtense being bounded at 0.005 and 0.1 radian. The author identifies the emission mechanism as the one at issue in this comment, describing the phosphor principle as "the same principle used to produce white LEDs based on blue LED chip." For a source of 5 milliradians the threshold works out at 200 megawatts per square meter per steradian. He gives the broadband retinal thermal exposure limit for the same source size at a quarter-second exposure as 5.7 in the same units, notes that the ratio of 35 between them is preserved at every source size because both vary as the inverse of the angular subtense, and then states the conclusion: "This clearly shows that the value given in IEC 60825-1 of (1 MW m-2 sr-1)/α … is not a safety limit; thus the products that approach that value will be RG3 under the current as well as under the upcoming edition of IEC 62471." On the consequence for a real eye he writes that for a 2 millimeter pupil the risk remains negligible, but that for a pupil of 5 millimeters at a factor of 35 above a limit built on 7 millimeters, "the injury threshold for retinal injury might be exceeded also for the human case."

Second matter: the exposure limit measured against the sun. The author computes the effective radiance of the sun by weighting the spectral irradiance of the ASTM G173-03 reference spectrum with the corrected retinal thermal action spectrum, obtaining an effective irradiance of 520 watts per square meter and dividing it by the solid angle of 7.2 × 10 to the minus fifth steradian subtended by a disc of 10 milliradians. The result is 7.2 megawatts per square meter per steradian. Against a limit of 2.8 in the same units for that source size at a quarter second, he states: "The sun exceeds the exposure limit for 0.25 s exposure duration by a factor of 2.5." He records that the old guidelines of the same commission and the threshold limit values of the American Conference of Governmental Industrial Hygienists are exceeded as well, and gives the explanation: the limit assumes a 7 millimeter pupil, prudent for pulsed sources and over-restrictive here, and "When a pupil diameter of 4.5 mm is assumed for the determination of the effective ocular exposure, the exposure limit is not exceeded for the new ICNIRP exposure limits."

Third matter: the relations on which Part V.B.2 and Part V.B.8 rest. The paper states, as settled radiometry, three things this comment has had to assemble. That radiance is the quantity governing retinal exposure, being "a measure of the irradiance level in the image plane of a system that images the source (such as the human eye)". That the photometric counterpart is luminance: "In the field of lighting, radiance is referred to as brightness (more correctly, luminance) when it is weighted with the luminous efficiency function". And that radiance is invariant with distance and under optical systems, which he illustrates for the sun seen from different planets: irradiance falls as the inverse square while the solid angle subtended falls in step, so that "the sun has the same brightness from all planets when one looks into the sun, but the size of the sun changes. However, the 'lighting level' (irradiance) of the surface of the planet changes with distance." He names the underlying conservation, that the product of area and solid angle is constant in a lossless system, and records that "This quantity $A \times \Omega$ is referred to as etendue or throughput." He also gives the Lambertian relation on which the arithmetic at Part V.B.8 depends, that the radiance of a Lambertian emitter is its exitance divided by pi steradians, and the retinal relation, that retinal irradiance is the radiance multiplied by the solid angle subtended by the pupil and reduced by transmission losses.

Fourth matter: a conflict with a constant used throughout Part V.B.2. The paper gives the minimum angular subtense as 1.5 milliradians, corresponding to a retinal image of 25 micrometers, and states it twice: of a star, that "it is assumed that a point source such as a star produces a retinal image of 25 μm, or 1.5 mrad angular subtense", and of the revised broadband limits, that "the smallest α to be input into the new exposure limit is also set to 1.5 mrad, as for the laser exposure limits." Part V.B.2 uses 1.7 milliradians throughout, including in two tables, and attributes it to the 1997 guidelines. The Foundation records the conflict and does not resolve it on this paper. If the figure for the governing instrument is 1.5 milliradians, every distance in the table at Part V.B.2.c lengthens by a factor of about 1.13 and the argument of that subsection is strengthened rather than weakened, because a smaller minimum subtense extends the regime in which retinal exposure does not fall with distance.

Fifth matter: corroboration of the averaging analysis at Part V.C.2. The comment establishes at Part V.C.2, from a reference work and from its own arithmetic, that the blue light weighted radiance of a source smaller than the averaging field is reduced by the ratio of the two solid angles, and that the averaging has a physiological basis rather than being an artifact. This paper states both from inside the committee. On the deliberateness: "In some cases, this is intended, such as when the field of view represents the angular extent of eye movements for the photochemical retinal limit." And on the consequence: "For the case that the source is smaller than the averaging field of view, the measured radiance is correspondingly smaller than the actual radiance of the source, and the analysis is less restrictive."

Sixth matter: the amendment of the retinal thermal weighting function. The author records that the retinal thermal action spectrum was amended so that "the new $R(\lambda)$ has a maximum of 1 in the blue wavelength range, where the old one had a maximum value of 10, overweighting the blue component", that for a pure blue source the difference is a factor of ten, and that the effect on a white source is larger for a high correlated color temperature than for a low one. The Foundation notes that this concerns the retinal thermal weighting and not the blue light hazard function treated at Part V.C.2, and the two must not be conflated.

The laser pointer figures, recorded for completeness. Averaged over a 7 millimeter aperture and the solid angle of a 1.5 milliradian image, a 1 milliwatt collimated beam gives 14.7 megawatts per square meter per steradian, which the author notes is about twice the radiance of the sun and a factor of 1.3 below the broadband limit of 19 in the same units at that subtense. Using the actual 1 millimeter beam diameter instead would raise the figure

by a factor of 49, which he states would be as incorrect as comparing an unaveraged irradiance with the laser limit. He resolves the apparent paradox that the sun exceeds the limit while a brighter pointer does not by the source size: the sun is 6.6 times larger than the minimum subtense, and the limit varies as the inverse of subtense.

What it does not establish. It is not a study of light-emitting diode products and reports no biological endpoint, no exposure of any person, and no measurement of any product in commerce. Its subject is laser-produced light and the standards that govern it. The Foundation relies on it for the author's account of how the two standards divide and of what the quantities in them mean, and not for any proposition about the products at Part VI. Its status is that of a conference paper, reviewed as such and not through journal peer review.

Where it bears. Part V.C.2, principally, for the routing threshold and for the corroboration of the averaging analysis. Part V.B.2, for the radiometric relations and for the conflict over the minimum angular subtense. Part V.B.8, for the Lambertian relation. Part V.K.3, for what a conclusion conditioned on an exposure limit is worth.

D.6.2 Velázquez J. L. and others, Angular distribution of the averaged luminous intensity of low power LEDs transfer standards (2013). Velázquez JL, Ferrero A, López M, Pons A, Villamarín A, Campos J, Sperling A. Proceedings of SPIE volume 8785, article 87858W, pages 1 to 8, 2013. doi:10.1117/12.2027039. Presented at the 8th Iberoamerican Optics Meeting and 11th Latin American Meeting on Optics, Lasers and Applications. Authors at the Institute of Optics of the Spanish National Research Council and at Working Group 4.12, Photometry, of the Physikalisch-Technische Bundesanstalt. Full text read. A search of the bibliographic record located no journal version of this work, so the entry rests on the second ground stated in the preamble above.

Why a metrology paper is in a comment about health. Because it measures the quantity the rest of this comment argues about, at the two institutions whose business is to establish what a measurement means. The Spanish council and the German federal institute are national metrology institutes. The paper reports an instrument built to characterize the angular distribution of the averaged luminous intensity of light-emitting diodes, measurements of four transfer standards, and a comparison of those measurements against the same devices measured at the other institute. The authors state the reason the work was needed in terms this comment adopts: "New methods of measurement are required, because these sources have different emission characteristics than traditional lighting sources."

What was measured, and how. Four low-power light-emitting diode transfer standards of 7 millimeter shell diameter supplied by one manufacturer, identified as F107 blue, F108 red, F126 green and F132 polar white, together with a further standard used for stability. Each was driven at 20.00 plus or minus 0.02 milliamperes with the chip held at 32.0 plus or minus 0.1 degrees Celsius. Measurement was at 316 millimeters, which the paper identifies as condition A of the International Commission on Illumination, with a temperature-stabilized photometer of 100 square millimeters circular area, the polar angle stepped across the full range to 90 degrees and the azimuth sampled at 32 uniformly distributed positions for each polar angle. Data were normalized to the average at zero degrees and the stated relative uncertainty is 0.2 percent.

The finding the comment relies on. The authors fitted each measured distribution to a cosine raised to a power g, the exponent that equals one for a true Lambertian emitter, and reported the fitted value from each laboratory. Not one of the four devices is Lambertian. The closest is the red at 1.38 and 1.31; the blue departs furthest, at 3.64 and 3.54. The two institutes agree to within about six percent on every device and exactly on one.

LED transfer standard	g, CSIC	g, PTB	Anisotropy, CSIC	Anisotropy, PTB

F107, blue	3.64	3.54	0.052	0.047
F108, red	1.38	1.31	0.069	0.065
F126, green	1.86	1.76	0.016	0.015
F132, polar white	1.62	1.62	0.014	0.015
A Lambertian emitter	1	1	not applicable	not applicable

What follows arithmetically, and the arithmetic is the Foundation's. An exponent greater than one describes a distribution narrower than Lambertian, which is to say more concentrated about the axis. For a source of given total luminous flux the on-axis intensity follows from integrating the fitted form over the hemisphere, and the result is that the on-axis intensity exceeds that of a Lambertian source of the same flux by a factor of one plus the exponent, divided by two. On the measured values that factor is 1.19 for the red device, 1.31 for the white, 1.43 for the green and 2.32 for the blue. The Foundation states the consequence for its own arithmetic rather than for anyone else's: where this comment computes a peak luminance by assuming a Lambertian distribution, as it does at Part V.B.8 from a manufacturer's published flux and emitting area, the assumption is conservative for a packaged device of this kind and the true on-axis figure is higher. The integration and the four factors are the Foundation's and are not stated by the authors.

A second finding, reported because it cuts against a tempting inference. The authors also computed the anisotropy of each device, as the relative standard deviation of the on-axis intensity across azimuth, and found that it does not track the departure from Lambertian form. The red device is the closest to Lambertian and the most variable with azimuth; the white is the least variable. The authors state the conclusion: "This indicates there isn't a correlation between lambertianity and anisotropy of the source." So a device may be well described by a simple angular law and still emit unequally in different directions around its axis, and the two defects of a single reported number are independent of one another.

What it does not establish, and three cautions. It is not a health study and reports no exposure of any person. The devices are low-power transfer standards of 7 millimeter package diameter selected for metrological stability, not products in commerce, and no inference about any product at Part VI follows from them. The association between color and departure from Lambertian form is an observation on four devices from one supplier and is not evidence that blue emitters are generally more concentrated than red ones; the Foundation states that expressly because the temptation to draw that inference is obvious and the sample will not bear it. And the discussion section of the paper contains an internal inconsistency, which the Foundation resolves in favor of the tabulated values.

Where it bears. Part V.B.8, which is written on it, for the departure of real devices from the Lambertian form that Appendix C.86 derives for a bare flat emitter and that the manufacturer at Appendix D.3 states it designs for. Part V.J.1, for what a single reported figure does not determine. Part V.B.2, for the identification of 316 millimeters as the reference distance of the averaged-intensity geometry.

D.6.3 Epstein A., Tessler N. and Einziger P. D., Electromagnetic Radiation from Organic Light-emitting Diodes (2009). PIERS Online, volume 5, number 1, pages 75 to 80, 2009. doi:10.2529/piers080803140549, published by the Electromagnetics Academy as the online proceedings of the Progress in Electromagnetics Research Symposium. Authors at the Department of Electrical Engineering, Technion, Israel Institute of Technology. Full text read from the copy published by the second author on his institutional page. Listed in this subsection because the venue is a symposium proceedings whatever the bibliographic record calls it.

What the title means, and what it does not. The title is capable of misleading a reader of this comment and the Foundation disposes of the point at once. The electromagnetic radiation of which the paper treats is the visible light the device emits, analyzed as an electromagnetic boundary-value problem: a line source embedded in a layered stack, solved by asymptotic evaluation of the radiation integral with a one-dimensional Green function built from the reflection and transmission coefficients of the layers. The prototype radiates at about 600 nanometers. The paper is not about radiofrequency emission, electromagnetic interference, or anything emitted by the drive electronics, and nothing in it bears on those subjects.

Why it is in the comment. For one proposition only, and it is the proposition at Part V.C.2: that the coherence of these sources is a graded quantity rather than a category. The paper carries the coherence of the source explicitly through a rigorous calculation and shows that its value determines what the device emits. The authors claim that combination as novel, stating that the incorporation of both rigorous electromagnetic analysis and coherence effects is addressed in their report, to the best of their knowledge, for the first time.

The general statement of the principle, which the authors take from Wolf. The paper sets out the relation between coherence and the emitted pattern in terms the Foundation adopts: "sharp interference patterns in emission angular distribution as well as interference fringes on a distant screen are caused by some consistent phase difference between two sources. As temporal or spatial coherence decrease this phase difference is no longer consistent in time or space, thus averaging on a large ensemble of sources diminishes these effects dramatically." Coherence on that account is a quantity which decreases, and whose observable consequence diminishes as it does. It is not a property held or not held.

The two kinds of coherence, which the paper keeps separate and the standards do not. The authors state that "coherence effects must be considered when analyzing OLED device", and then make the division the comment needs: "Since spatial coherence can, in general, be neglected when considering OLEDs, we take into consideration only the temporal coherence effect on the power relation." They neglect spatial coherence for organic devices on the authority of a dedicated measurement of organic electroluminescence, cited as Saxena and others, 2006. The Foundation draws attention to the structure of that sentence rather than to its conclusion: there are two coherence quantities, a device may be negligibly coherent in one sense and not in the other, and which is meant must be said. The literature at Part V.C.2 measured the spatial quantity in inorganic devices and found it measurable; these authors set the spatial quantity aside for organic ones and model the temporal.

The definition that makes the quantity computable. The authors define the coherence length as the square of the wavelength divided by the spectral width, L(c) = λ squared over delta λ, the width being that of the normalized photoluminescence spectrum, which they represent by a Gaussian. That is the relation which permits a coherence length to be computed for any emitter whose spectral width is known, and spectral width at half maximum is a published specification for components of this kind. Their simulations span coherence lengths of 5, 15 and 150 micrometers.

The finding relied on, and the regime in which a Lambertian pattern appears. Radiation patterns were computed for four device thicknesses at fixed coherence length and for three coherence lengths at fixed thickness. The result turns on the ratio of the two: "for device thickness (represented by the dominant glass thickness) much smaller than the coherence length, interference effects are noticeable whereas the reversed situation results in a quasi-Lambertian radiation pattern." The authors then identify what each regime reflects: "the two extremes correspond to radiation patterns which reflect either the device properties, i.e., thickness dependent interference, or the source characteristics, leading to

spectral broadening dominated pattern." So the Lambertian form is what emerges in the incoherent limit. A device that is not in that limit emits a pattern governed by the thicknesses of its internal layers.

What it does not establish, and one inference the Foundation specifically declines. It is a model and not a measurement. The configuration is two-dimensional and the authors say it was chosen "for the sake of simplicity and clarity." No efficiency value or other numerical output is tabulated, and the comparison with experiment is qualitative: the authors say their two limiting cases agree well with measurements taken in those limits and report no quantitative comparison. The devices are organic, which is not the technology principally at issue in this comment. And the Foundation declines the inference that lies closest to hand: the measured departures from Lambertian form recorded at Part V.B.8 for four packaged inorganic devices are not attributed to coherence, because those devices carry integral lenses and a lens is the obvious alternative explanation. This paper establishes that coherence is one route to a non-Lambertian pattern. It does not establish that it was the route in any measurement reported elsewhere in this comment.

Where it bears. Part V.C.2, for the distinction between temporal and spatial coherence and for the computability of the first from published spectral data. Nowhere else.

D.6.4 Krames M., Light-Emitting Diode Technology for Solid-State Lighting (2010). Chapter in Frontiers of Engineering: Reports on Leading-Edge Engineering from the 2009 Symposium, pages 67 to 76, National Academies Press, Washington, 2010. doi:10.17226/12821. The volume's suggested citation credits the National Research Council and attributes the chapter to its author, who is given as Mike Krames of Soraa, Inc., Goleta, California. Read in full from the publisher's own open text.

What this document is, and what it is not, which the Foundation states first because the imprint invites an error. It is a paper delivered by an individual engineer at a symposium, published in the symposium's proceedings volume by the National Academies Press. It is not a consensus study report of the National Academies, it is not the finding of any committee, and it has not been through the review a consensus report receives. No part of this comment may describe it as a finding of the National Academies, of the National Academy of Engineering, or of the National Research Council, and no part of this comment may introduce it as what the National Academies concluded. It is the account of one specialist, published under that imprint, and the Foundation cites it as such. The distinction is material in a filing to a federal department, because the weight the imprint carries is precisely the weight the document has not earned.

The author's position, which bears on weight in both directions. The author is an industry technologist in solid-state lighting, identified with a company in that industry. That tells against the document in the ordinary way: a specialist writing about the technology he develops is not an independent assessor, and Appendix D.3 states the Foundation's practice for such sources. It tells for the document on the one statement this comment relies on, which is a statement that a body of research did not exist. An assertion that nobody has studied a question is against the interest of the industry developing the product, because it is the industry that would be asked to wait for the answer.

The statement the comment relies on. Discussing the smooth emission spectrum produced by blue-pumped phosphor conversion, and comparing it with the sharply peaked spectrum of a fluorescent lamp, the author writes: "One might assume that this provides a more natural appearing light, compared to the high-intensity peaks of the FL spectrum, but as of this writing the author is aware of no studies of the effects of smooth vs. spiked spectra on human perception."

The projections, recorded because they are now testable. The chapter states the theoretical ceilings and a forecast. For the smooth phosphor-converted spectrum the

maximum luminous efficacy is given as 310 lumens per watt, reduced to about 250 by the Stokes loss of some 20 to 25 percent in a blue-pumped device, which the author describes as 60 to 70 percent above fluorescent lamps and more than fifteen times incandescent. The forecast is attributed to a report commissioned by the Department of Energy in 2009: "Future LED performance is projected to be ~ 160 lm/W by 2018." The Foundation records these without evaluating them.

What it does not establish. Nothing about health, exposure or injury, and the chapter addresses none of those subjects. It is a technology review. Its efficacy figures are an energy metric and bear on this comment only through the trajectory described at Part IV.G. The one statement relied on is a statement about the state of a literature in 2009 by one author, offered as evidence of what that author was aware of and not as proof that no such study existed anywhere.

Where it bears. Part V.B.3, which is written on it, for the question the descriptor discards and whether the discarded quantity was ever studied.

D.6.5 Gaertner A. A., LED Measurement Issues (2002). Lecture 15 in a series of lectures given at a measurement course on Photometry, Radiometry and Colorimetry, 9 to 12 April 2002, at the Institute for National Measurement Standards of the National Research Council of Canada, Ottawa. The lecture states that it is posted on the website of Optronic Laboratories by permission, and that information concerning the complete monograph may be obtained from the Institute. The author is of that Institute, which is the national metrology institute of Canada.

What this document is. Teaching material, and the Foundation says so rather than presenting it as a paper. It is one lecture of a course for measurement practitioners, it cross refers to other lectures in the same course, and it is written in the first person plural of instruction. It is not peer reviewed and reports no original experiment. It is in this appendix for the reason this appendix exists: it is an account, by a specialist at a national measurement institute, of the state of a measurement problem at a date, and the comment relies on it for what the measurement community understood and decided rather than for a new result.

First matter: the properties of a point source that these devices do not have. The lecture introduces intensity by way of a point source and then states that "point sources have several inherent implicit properties which can mislead us when we apply our ideas of intensity to other sources such as LEDs which do not possess these properties." Three properties are named: the intensity of a point source is the same in all directions, it is the same at all distances, and measurements of it are independent of the detector aperture, the last stated as "it means that the intensity measurements we make do not depend on the particular size (or shape) of the input aperture of our detector." The lecture gives the two respects in which other sources depart as the angular distribution of output flux at a specified distance and the variation of output flux with distance.

Second matter: what the lecture says the angular distribution of a real device looks like, and what it declines to say. Of real parts: "the intensity is quite nonuniform in the angular variation, and is often not even symmetric with respect to any angle in this planar view." The cause is attributed to the package: "The problem can be worse for LEDs since the packaging introduces many components which act as reflectors and concentrators of the light which is emitted from the small source itself." The Foundation records what the lecture does not say, because the point is contested in the comment. The lecture presents the point source and the Lambertian source as two idealizations, each with its intensity equation and its polar plot, and applies neither to a light-emitting diode. On the Foundation's reading of the whole lecture, the word Lambertian is applied to no light-emitting diode anywhere in it, and is used of a real surface only of the wall coating of an integrating sphere. This is accordingly a measurement lecture about these devices that does not describe them as Lambertian.

Third matter: that the measurement is forced close in. "The small size and low output of typical LEDs demands that we place our detectors at small distances from the LED. This will aggravate most of the problems indicated above." And on why proximity matters: "These considerations show that even at constant solid angle Ω the intensity output of extended sources will change with distance from the source."

Fourth matter, and the one the comment principally relies on: the stated reason an accurate representation was not required. The lecture sets out that the intensity of one of these devices changes with the distance, the angle and the solid angle of the measurement, and then: "If all these conditions can be specified exactly, it is possible to present an accurate representation of the intensity (distribution) of the LED. However, this is too demanding of experimental accuracy, and too much of a burden for efficient comparison of LEDs during the manufacturing process, or comparison of LEDs between manufacturers, or selection of LEDs for any specific purpose." The three purposes named are comparison during manufacture, comparison between manufacturers, and selection of a part for an application. None is the assessment of exposure or the protection of health.

Fifth matter: the quantity adopted instead, with its figures. Because such a measurement is "an average which is dependant on the measurement configuration used", the quantity defined is the Averaged LED Intensity, written with a subscript for the condition and a further subscript for whether the value is photometric, in candelas, or radiometric, in watts per steradian. The reference point is the front tip of the device; the reference axis is the mechanical axis; the detector aperture is a circular acceptance area of 100 square millimeters. Condition A sets the tip to aperture distance at 316 millimeters, giving a solid angle of 0.001 steradian. Condition B sets it at 100 millimeters, giving 0.01 steradian. The spelling of dependant in the quotation is the source's.

Sixth matter: the date, and what was still unsettled at it. As of April 2002 the two conditions were a proposal. The lecture states that the Commission "is working on a standard which proposes (it is not yet accepted) two defined geometrical configurations for measuring the luminous intensity of LEDs", and the figure showing the two conditions is captioned as proposed. Three technical committees are named as then at work: committee 2-45 on the revision of report 127 of 1997, to include improved definitions and methods for total and partial flux and to re-evaluate the spectral and color parts, chaired by Kathleen Muray; committee 2-46 on a joint standard with the International Organization for Standardization on intensity measurement based on report 127, chaired by John Scarangello; and committee 2-50 on the measurement of the optical properties of clusters and arrays, chaired by Georg Sauter. Three methods of calibration were then under consideration by committee 2-46. This bears on the edition question raised at Part V.B.8 and in this appendix: report 127 of 1997 existed, and a revision of it was in progress when this lecture was given.

Seventh matter: three findings on the spectral side, which the comment does not yet use. The Foundation records these because they are strong and because the subsections they belong to are not yet written on them. First, that the calibration inheritance from the previous technology fails: photometers are calibrated against incandescent sources, the output of these devices is narrow band at typically 20 to 40 nanometers, the narrow band samples the instrument's response only where it fits the luminous efficiency function poorly, and the author states that "Photometric errors of 20%, when measuring red or blue LEDs, are not uncommon for good photometers." Second, that the expectation carried over from the older technology is expressly disclaimed: experience with incandescent lamps leads practitioners to expect that small spectral changes will not matter much, and of that expectation the author writes, "However, this is not true for LEDs." Third, and most consequential for this comment, that the spectrum is not constant across the beam: "It has been observed that the relative spectral output of LEDs, particularly white LEDs, changes with the direction of the output from the LED."

What it establishes. That the properties implicit in treating a source as a point are absent in these devices, stated by a national metrology institute; that their measured angular distribution is nonuniform and frequently asymmetric, and that the package is the cause; that the measurement must be made at distances where the quantity is still varying; that an accurate representation of the distribution was considered achievable and was set aside as too burdensome for three named commercial purposes; that the quantity adopted in its place is an average over a stipulated geometry and is named as such; that as of April 2002 that quantity was a proposal not yet accepted; and that the spectral output of a white device varies with the direction of emission.

What it does not establish. Nothing about health, exposure, injury or any biological endpoint. It reports no measurement of any person and no measurement of any named commercial product. It is a lecture and not a study, its figures are illustrative, and the devices it describes are those of 2002, when the typical operating current is given as 10 to 20 milliamperes against 200 to 300 for the then new high power parts. The Foundation does not rely on it for any proposition about present hardware except where a later source in this comment states the same thing.

Where it bears. Part V.B.8, which is written on it, for the point-source properties, the measured asymmetry, the stated reason an accurate representation was not required, and the character of the averaged quantity. Part IX.F, for what the measurement community itself considered achievable. Part V.B.3 and Part V.K, for the three spectral findings, which are not yet built. Part V.J.3, for the committee on clusters and arrays.

D.6.6 Wilkins A., Veitch J. and Lehman B., LED Lighting Flicker and Potential Health Concerns: IEEE Standard PAR1789 Update (2010). Paper presented at the 2010 IEEE Energy Conversion Congress and Exposition, Atlanta, 12 to 16 September 2010, and published in its proceedings at pages 171 to 178. Arnold Wilkins, Department of Psychology, University of Essex; Jennifer Veitch, National Research Council Canada; Brad Lehman, Department of Electrical and Computer Engineering, Northeastern University. The copy read was supplied by Mr. Baker and carries an IEEE PDF eXpress certification of 23 June 2010 and a digital signature of 12 July 2010.

Why this document is in the comment, and why in this subsection. Because it is the account its authors give of the technical basis of an instrument they wrote, which is the first ground on which this subsection admits a paper. The document states that it "summarizes a public report created by the IEEE Standards PAR1789 group" and that it "represents on-going work in IEEE PAR1789". PAR1789 is the project that produced IEEE Std 1789-2015, which this comment treats at Part V.D.3 and lists at Appendix D.2. This paper is therefore the working group's own statement, five years before the standard issued, of the health concerns the standard was written to address.

Who the working group was, which bears on the weight of the 2024 literature. The acknowledgment names the membership at the time of writing, including observers, and the Foundation records several names because they recur in this appendix. They include Sam Berman, whose 1991 electroretinogram study is cited in the paper's own table; Naomi Miller, the first author of the experiment at Appendix C.90 and of the letter at Appendix D.7; Howard Wolfman, a co-author of the review at Appendix C.91; Michael Poplawski of Pacific Northwest National Laboratory; Yoshi Ohno; David Sliney, whose work on optical radiation is relied on by the instrument at Appendix D.1; Ian Ashdown; Michael Shur; and the three authors. The Foundation asks the Department to notice the continuity: two of the people who set out these concerns in 2010 were still publishing on them in 2024, and what they published in 2024 is that no measurement method exists for one of the three artifacts and that safe levels cannot be set for sensitive people.

The distinction the document defines, and which the comment adopts. The nomenclature section defines its terms. "Visible Flicker: Flicker that is consciously

perceivable by a human viewer" and "Invisible or Imperceptible Flicker: Flicker that is not consciously perceivable by a human viewer". The structure of the health account follows from it: "The health effects of flicker can be divided into those that are the immediate result of a few seconds' exposure, such as epileptic seizures, and those that are the less obvious result of long-term exposure, such as malaise, headaches and impaired visual performance. The former are associated with visible flicker, typically within the range ~3-~70Hz, and the latter with invisible modulation of light at frequencies above those at which flicker is perceptible (invisible flicker). Human biological effects are a function of flicker frequency, modulation depth, brightness, lighting application, and several other factors". The second of the four contributions the paper lists for itself is "Human biological effects due to invisible flicker at frequencies below ~165Hz".

What the document states about invisible modulation, and the care with which it states it. This is the proposition the comment has wanted a source for, and the Foundation reproduces the sentence exactly because its verb matters. "Measurements of the electroretinogram have indicated that modulation of light in the frequency range 100-160Hz and even up to 200 Hz is resolved by the human retina although the flicker is too rapid to be seen", citing Burns and others 1992 and Berman and others 1991. The verb is resolved. The paper's own table records the same two sources against the effect "Human electroretinogram signals at light frequency" at frequencies "Up to 162Hz". The Foundation draws attention to this because the collation at Appendix C.94 reports the same two sources as establishing "unperceived neurological effects", which they do not. The retina resolving a modulation is a measurable electrophysiological fact and is not itself an injury, and the authors of the standard do not claim otherwise.

What the document reports beyond the retina. Three further findings, each attributed. In the cat, modulation at 100 and 120 hertz from fluorescent lamps was shown "to cause the phase-locked firing of cells in the lateral geniculate nucleus of the thalamus, part of the brain with short neural chains to the superior colliculus, a body that controls eye movements", citing Eysel and Burandt 1984. In humans, several studies show that "the characteristics of human eye movements across text are affected by modulation from fluorescent lamps and cathode ray tube displays", and two show "impairment of visual performance in tasks involving visual search as a result of flicker from fluorescent lamps". And in healthy observers, a decrement in sensitivity to visible flicker at 30 hertz follows "a prior exposure of only 2 minutes duration with flicker frequencies about 20% above the observers critical fusion frequency", citing Shady and others 2004.

The headache finding, which is the strongest item in the document. "Under double-masked conditions the 100Hz modulation of light from fluorescent lamps has been shown to double the average incidence of headaches in office workers, although this effect is attributable to a minority that is particularly affected", citing Wilkins and others 1989. The paper also gives the dose: "The peak-trough modulation depth known to induce headaches from fluorescent lighting at 100Hz is about 35%". The Foundation records both halves of the first sentence. A doubling of headache incidence under masked conditions is a strong result; that it is carried by a particularly affected minority is the same observation the author at Appendix D.7 makes about population averages fourteen years later.

The comparison between this technology and the one it replaced. Stated by the authors as the first of their general implications for practice. "Normally functioning fluorescent lighting controlled by magnetic ballasts has been associated with headaches due to the flicker produced. LEDs driven so that they flicker at a frequency twice that of the AC supply may have a depth of modulation greater than that from most fluorescent lamps. The effects of the flicker are therefore likely to be more pronounced in these cases". This is the document the Foundation relies on at Part V.B.9, where the comment declines to argue that this technology is the first artificial source to depart from natural conditions and argues instead about degree. Here the degree is stated by the authors of the standard.

The parameters of photosensitive seizure risk, which the comment needs at Part V.E.1. Prevalence: "About one in 4000 individuals is recognized as having photosensitive epilepsy", with seizures inducible in such individuals "and in perhaps as many again who have not been diagnosed and may be unaware that they are at risk". Onset is typically around puberty, the condition is five times as common in the 7 to 20 age group as in the general population, and "Three quarters of patients remain photosensitive for life". Frequency: "Any repetitive change in a visual stimulus within the frequency range 3 Hz to 70 Hz, is potentially a risk and the greatest likelihood of seizures is for frequencies in the range 15 Hz to 20 Hz", and "The flashes do not have to be rhythmic". Luminance: "Stimulation in the scotopic or low mesopic range (below about 1 cd/m2) has a low risk and the risk increases monotonically with log luminance in the high mesopic and photopic range". Contrast: "Contrasts above 10% are potentially a risk". Field position: "Stimuli presented in central vision pose more of a risk than those that are viewed in the periphery, even though flicker in the periphery may be more noticeable". Wavelength: "Deep red flicker and alternating red and blue flashes may be particularly hazardous". And eyes: bright flicker "can be more hazardous when the eyes are closed", while covering one eye with the palm reduces the effect "very greatly" in most patients.

The pattern hazard, which does not require flicker at all. The fourth general implication concerns spatial arrays rather than temporal modulation. "Spatial arrays of continuously illuminated point sources of light have the potential to induce seizures in patients with photosensitive epilepsy when the field of view is large and when the arrays provide a spatial frequency close to 3 cycles/degree (e.g. large LED public display boards viewed from close proximity)". The document elsewhere records that about one third of photosensitive patients are sensitive to spatial patterns even without flicker, and that "The worst patterns are those of stripes in which one cycle of the pattern (one pair of stripes) subtends at the eye an angle of about 15 minutes of arc".

The failure modes, and the one product measurement in the document. The paper analyzes how a lamp that modulates invisibly can come to modulate in the seizure range. Of the two common drive topologies it describes, both of which modulate at twice line frequency when working, it states that "there is risk of failure that can cause LED current modulation at AC line frequency, thereby entering the range of frequencies that may induce photosensitive epilepsy": a single open-circuit failure in one leg of the rectifier bridge, or an open circuit in one of two anti-parallel strings, halves the modulation frequency to 50 or 60 hertz. Uneven aging produces the same thing partially: in the authors' worked example a 50 percent increase in one string's resistance gives a 60 hertz Fourier component amounting to "over 33% of the DC component". And the measured case: a commercially available lamp of 64 red, green and blue emitters with a full bridge rectifier and capacitor filter in its Edison socket, connected to an ordinary residential phase-cut dimmer, was recorded by photosensor to flicker between about 3.0 and 3.3 hertz with an average of 3.153 hertz, which the authors note "is in the range that has been shown to be a risk for causing photosensitive epileptic seizures".

The remedies the authors identify as available. Two, and both are stated as easy. On dimming: there are "alternative approaches to dimming, such as amplitude dimming, in which the current through the LED is continuous and not pulsing", and "This approach does not use flicker to adjust brightness and therefore, should not induce flicker related health risks". On failure: "it is not difficult to create shut-down or other safety prevention circuits that prevent flickering in the 3Hz-70Hz range when the lamp is in failure mode".

What the authors expressly decline to do, which the comment must state wherever it relies on them. Three disclaimers, quoted in full. "This report does not attempt to make recommendations on safe flicker frequencies or modulation depths for LED lighting. Its purpose is to describe possible health implications of flicker". "This report endorses no technology for driving LED lamps". And in the conclusions: "This paper assigns no health

risk to the biological effects of flicker in the various LED lamps. The hope is that by discussing the issue of flicker within the power electronic community, it will be possible to decide as a community whether or not standards or recommended practices are necessary. We do not attempt to do so here". The authors of what became IEEE Std 1789-2015 were, in 2010, expressly not recommending that anything be required of anyone.

Two statements that run against this comment, recorded because the document makes them. The first concerns source geometry and is in tension with the emphasis at Part V.B.8 on small, bright emitters. "Point sources of light are less likely to induce seizures and headaches than a diffuse source of light that covers most of a person's field of vision. Flicker from LEDs used for general lighting is therefore more likely to be a health hazard than that from LEDs used in instrument panels". The Foundation does not treat this as a contradiction, because the mechanism here is the cortical representation of the stimulated retinal area and the mechanism at Part V.B.8 is retinal irradiance, but the comment must not conflate them and must not argue that a small source is worse for every purpose. The second concerns natural light. The first row of the paper's table attributes seizures, on clinical histories, to "Sunlight through roadside trees or reflected from waves". Flicker capable of provoking a seizure is not peculiar to artificial sources, and Part V.B.9 should cite this row.

The evidence column, which the Foundation regards as the document's most useful feature. The appendix table grades its own entries. Against the headache and eye strain effect of 100 hertz fluorescent lighting it records two rows, one supported by "Many anecdotes" and one by a "Double-masked study". Reduced speed of visual search at 32 percent modulation is supported by "Two masked studies". Epileptiform electroencephalographic responses are supported by "Many clinical EEG studies". Seizures in children with no previous diagnosis from a flashing televised cartoon at about 10 hertz are supported by a "Major incident". Prolonged photophobia from display rasters near 70 hertz is supported by "Many anecdotal reports". Increased heart rate in agoraphobic individuals at 100 hertz is attributed to Hazell and Wilkins 1990. Changes in plasma corticosterone in captive starlings are described as "Inconsistent". A comment relying on this table can therefore state for each proposition what kind of evidence supports it, and the Foundation does so.

What it establishes. That the authors of IEEE Std 1789-2015, writing in 2010, distinguished visible from invisible flicker and attributed effects to both; that they placed seizure risk at 3 to 70 hertz with a peak at 15 to 20 and biological effects of invisible modulation below about 165 hertz; that they reported the retina to resolve modulation to 160 and even 200 hertz unseen, thalamic phase-locking in the cat at 100 and 120 hertz, and a doubling of headache incidence in office workers under masked conditions at 100 hertz and about 35 percent modulation, carried by a particularly affected minority; that they considered modulation depth from light-emitting diodes at twice supply frequency likely to exceed that of fluorescent lamps and effects therefore likely to be more pronounced; that single-component failures and ordinary uneven aging can move a lamp from an invisible frequency into the seizure range, and that a commercial lamp on an ordinary dimmer was measured at 3.15 hertz; that protective circuits and amplitude dimming are available and not difficult; and that the working group expressly declined to say whether any standard or recommended practice was necessary.

What it does not establish. It is a conference paper and a tutorial summary of a working group report, not research, and almost every substantive proposition in it is attributed to a source the Foundation should obtain rather than cite at second hand. It reports one original measurement, of one lamp on one dimmer. Its health account is of fluorescent lighting and displays, because that is where the literature was in 2010; the only light-emitting diode measurement concerns a failure mode. It assigns no health risk, says so

twice, and recommends nothing. And its frequency figures carry the authors' own tildes: about 3 to about 70 hertz, below about 165 hertz.

Where it bears. Part V.D.3, which is written on it, as the draftsmen's account of the instrument. Part V.D.1, for the drive topologies and the failure modes. Part V.D.2, for the saccadic mechanism and the naming of vehicle rear lamps. Part V.E.1, for every parameter of seizure risk. Part V.B.9, for natural flicker and for the depth comparison with fluorescent lighting. Part VI, for the spatial-array pattern hazard and large display boards. Part VII, for the particularly affected minority. Part IX, for the availability of amplitude dimming and protective circuits.

D.6.7 Bullough J., Skinner N. and Rea M., Impacts of Flashing Emergency Lights and Vehicle-Mounted Illumination on Driver Visibility and Glare (2019). SAE Technical Paper 2019-01-0847, presented at the WCX SAE World Congress Experience, Detroit, Michigan, 9 April 2019. doi:10.4271/2019-01-0847. Five pages. All three authors of Rensselaer Polytechnic Institute. Published by SAE International; ISSN 0148-7191, e-ISSN 2688-3627.

What the Foundation has read, stated first. The abstract and the bibliographic record only. The paper is sold by the publisher and the Foundation has not obtained it. Every statement attributed to it in this comment is from the published abstract. This is a limitation on its use and is recorded at Part VI.C.1 as well as here.

Design, so far as the abstract states it. Participants viewed red and blue flashing lights on a scale model police vehicle, the lights conforming to then-current recommended practices for emergency lighting and varying in intensity and in optical power, defined as intensity multiplied by duration. The task was to identify as quickly as possible whether a police officer figure stood beside the vehicle and where. On some trials no figure was present. On some trials white light-emitting diode sources provided low-level illumination at both sides of the vehicle. No sample size, statistical result or numerical value appears in the abstract.

Findings as the abstract reports them. That the blue flashing lights were always perceived as brighter and as more glaring than the red flashing lights at the same intensity. That the probability of correctly detecting the officer figure was affected by the intensity of the flashing lights, the abstract not stating in which direction. That the color of the flashing lights did not affect detection. And that low-level white illumination at the side of the vehicle significantly improved detection accuracy.

The two statements the comment relies on. That public safety agencies are said to select emergency lighting on apparent brightness, with brighter judged better, which the authors describe as anecdotal. And that light-emitting diode emergency lights are brighter and more saturated and thereby cause greater discomfort and disability glare, with the consequence that responders are at higher risk because approaching drivers cannot see them.

A caution on how it sits beside Appendix D.4. The two documents report the same result on blue against red, and the lead author is common to both. They are consistent work by one group across two designs rather than independent replication by separate laboratories, and Part VI.C.1 says so. The Foundation has found no study of this question by any other group.

What it does not establish. Anything about health, and nothing about full-scale conditions. The experiment used a scale model in a laboratory. The disability glare statement in the abstract is an assertion in a framing passage rather than a reported measurement, so far as the Foundation can tell without the paper.

D.6.8 Fédération Internationale de l'Automobile, Glare on Road Traffic: European consumer study 2024 (2024). Informal document GRE-90-20, Revision 1, dated 26 April 2024, submitted by the expert from FIA to the ninetieth session of the Working Party on Lighting and Light-Signalling of the Economic Commission for Europe, Geneva, 29 April to 3 May 2024, agenda item 12. Sixty-eight pages, comprising a report at pages 3 to 10 and five attachments. Presented to the same session on 2 May 2024 in informal document GRE-90-40.

Why it is in this subsection, and what kind of document it is. Because it is a submission by a participant to the body in which the international vehicle lighting regulations are developed, which is the description this subsection exists to cover. It is not a technical paper and the Foundation does not present it as one. It is a consumer survey with recommendations attached, prepared by ten national motoring clubs and placed before a regulator. Mr. Baker should consider whether it would sit better at Appendix D.1, among expert assessments and policy opinions, where the joint statement of the emergency medical services organizations sits; that document is structurally similar, being a position adopted by multiple organizations with an evidence summary attached. The present placement rests on the forum rather than on the form.

What was done. Two arms using one six-page questionnaire, fieldwork to the end of 2023. A representative arm, commissioned by ADAC with ÖAMTC, TCS, TCB and ACL from a market research company, surveying a structured, supervised and demographically balanced sample of about one thousand drivers per country: 4,312 interviews in Germany, Austria, Switzerland and Belgium and 447 in Luxembourg. A self-selected arm, in which ANWB, IAM RoadSmart, BIHAMK, AMZS and NAF invited members to respond through club media, drawing about twenty-two thousand responses, of which the Netherlands component of 13,640 as at 13 November 2023 is reported in full at Attachment C.

What it reports. On the representative arm: 71 percent find glare intolerable or annoying, 32 percent almost always or regularly feel dazzled, 51 percent pinch their eyes shut or close them briefly, 58 percent have problems perceiving objects near the dazzling source, and 30 percent report an afterimage or pain. The report marks the last two as indications of physiological rather than psychological glare. Seventy-five percent considered a review of the regulations necessary. The self-selected arm returned 80, 50, 52, 64 and 25 percent on the same items and 81 percent on the regulatory question.

The three statements for which the comment principally cites it. First, that approval requirements are set in illuminance while the eye responds to luminance and contrast, with a supporting diagram sourced to Seibersdorf Laboratories on the angular extent of the source at the retina. Second, the recommendation that the luminance of light sources must be limited at a distance and at close range in order to exclude the risk of injury to the eye. Third, the paragraph stating that there are indications that high-luminance sources with a high proportion of blue light can cause damage to the eye at close range, that there are still few studies because present luminance levels are recent, and that the risk of injury must be safely excluded.

The measurement it supplies. A photograph of the emitting surface of a modern LED low beam against a five-millimeter grid, captioned as showing a perceived emission area of around five square centimeters in total, sourced to ADAC e.V.

What it does not establish, stated at length because the comment relies on it. It is not peer reviewed and its authors state in terms that it is not a scientific study of the effects of glare. It reports no photometric or radiometric measurement of any lamp apart from the single captioned photograph, no biological endpoint, no clinical examination and no exposure assessment. Its respondent-level data and its questionnaire are not published with it. Its finding that age is not a factor is a finding about reported frequency of being dazzled and not about susceptibility, and the report's own reference list attributes to the Royal Society for the Prevention of Accidents a nine-fold increase in glare recovery time between ages 15 and 65 which the body text uses without the age qualifier. It asserts a link between glare and accidents

on the authority of unnamed United States research followed by an argument from plausibility. Its reference list attributes to a secondary source a claim that glare from oncoming high beams accounts for twelve to fifteen percent of all United States traffic accidents, which the Foundation has not verified and does not use. The submitting organization represents motorists and has an interest in the outcome.

Where it bears. Part VI.B.1, which is largely written on it. Part V.B.8 and Part V.C.2, for the statement that an illuminance-based standard does not constrain source luminance and for the angular-extent relation. Part V.B.2 and Part V.B.3, for the close-range photochemical injury question. Part II.G, for the authors' statement that research on the subject is scarce and dated. Part II.H.5, as a second regulator describing the same gap that the National Highway Traffic Safety Administration described in its letter of 13 February 2024. Part V.C.5, against which its age finding must be read.

D.6.9 Longcore (2020) — a test of candidate spectral descriptors against wildlife response, taken for one measured correlation, for a mechanism by which a standard could be evaded, and for two concessions

Citation. Longcore T. "On the Use of Summary Metrics of Light Spectral Characteristics to Assess Effects of Artificial Light at Night on Wildlife." FIRES, Illuminating Engineering Society, New York. Posted 13 May 2020. Available at ies.org under the fires path, on-the-use-of-summary-metrics-of-light-spectral-characteristics-to-assess-effects-of-artificial-light-at-night-on-wildlife. Read in full from a printed capture of that page dated 14 May 2020.

What this document is, stated first because it governs its weight. A short signed note, about twelve hundred words with two figures, posted on the online forum of a standards body. The page carries an editorial disclaimer that the views expressed do not necessarily reflect those of the Society or represent its endorsement. It is not peer reviewed. It reports an analysis the author performed and presents the results in two figures; the text states one coefficient and describes the rest. It acknowledges constructive comments from two named persons and collaboration with two others.

Why it is in this subsection. Because it is a technical note by a participant in the discourse of a standards body, published by that body on its own forum and disclaimed by it, which is the category this subsection exists for. It is not an article in a peer-reviewed journal and so is outside Appendix C; it is not the opinion of a constituted body, the disclaimer saying so expressly, and so is not D.1; it is not a standard and so is not D.2.

Method. The author took the lamp spectrum database built for his 2018 paper, twenty-five light sources, added further sources and two further descriptors, and regressed four candidate summary descriptors against a composite wildlife index and its four components. The descriptors: correlated color temperature; the melanopic response of the source expressed as a percentage of the sensitivity to an equal illuminance of a standard daylight illuminant; the ratio of melanopic to photopic light; and the percentage of visible light below 530 nanometers. The components: insects, juvenile salmon, a seabird, and an average of sea turtle responses. The ultraviolet range was considered only to 350 nanometers.

Results, with the text and the figures distinguished. Stated in the text: that the correlation between correlated color temperature and the composite index is 0.62, described by the author as adequate but not outstanding; that the melanopic response and the melanopic to photopic ratio perform best in predicting the composite; that correlated color temperature was better for insects and the melanopic to photopic ratio better for the seabird; and that if the database contained sources with violet or near-ultraviolet emission the two best-performing descriptors would fail to identify their effects on insects. Presented only in a figure, and therefore not reported by this comment: every coefficient other than the 0.62.

THE SENTENCE THE COMMENT RELIES ON MOST, AND IT IS A WARNING. "Neither the M/P value nor the melanopic response can be used to evaluate effects on insects,

however, because any light source that avoids the peak of the melanopic response by using shorter wavelengths (e.g., a violet LED pump) will be extremely attractive to insects." Part I.G sets out what follows for the drafting of a performance standard, which is that a limit expressed in a single biologically weighted scalar may be satisfied by a change to the product that moves the emission into a band the scalar does not weight. The Foundation treats this as the most useful thing in the document precisely because it runs against the quantity the comment would otherwise have reached for.

Two concessions the Foundation adopts. "Adjusting spectrum is not a panacea," with the author naming timing, intensity, direction and switching as the other tools. And the opening sentence, that from the position of wildlife the best artificial light at night is no artificial light at night, immediately qualified by the author's recognition that this is not feasible while maintaining safety and achieving other goals. Both are recorded at Part I.G.

What it establishes. Subject to everything above: that the candidate summary descriptors for lamp spectra have been tested against wildlife response data by the person who assembled that data; that correlated color temperature correlated with a composite index at 0.62 across twenty-five sources; that no descriptor was best for every component; and that the two best-performing descriptors have a stated failure mode. It also establishes, by the author's own account of publishing the code, that the computation is available to a designer with a browser.

What it does not establish. Anything about human health. Every response curve in the index is an animal's, and the melanopic function it uses as a descriptor is a human quantity employed as a proxy for non-human effect, which is the reverse of the inference this comment usually examines. It establishes no effect of any lamp on anything: the wildlife responses are taken from the author's earlier work and are not re-measured here. And it is not evidence of the view of the Illuminating Engineering Society, which the page disclaims.

Considerations bearing on confidence. Against: not peer reviewed; twenty-five sources, increased by an unstated number; coefficients other than one are in a figure only; the insect component rests on attraction modeling, and the moth experiment at Appendix C.128 states that attractiveness is not a good proxy for other effects; the author is evaluating descriptors against a database he built, using an index he devised, which is not independent assessment; and the analysis is of 2020. In favor: the author states the limitations himself in two places; the underlying method and code are public; and the single most important statement in the note runs against the author's own preferred descriptors and against this comment's convenience, which is the kind of statement a document is most reliable for.

Authorship, and recurrence. Travis Longcore. He is a co-author of Appendix C.131, whose authorship field records him as the author of three further papers already recorded in this comment as acquisitions, one of which this note now supplies the full citation for. The note acknowledges comments from Ian Ashdown, who is credited with two figures in the Australian guidelines at Appendix D.1, and from Naomi Miller, a co-author of one of the works the note cites; and collaboration with Michael and Lorna Herf, who are co-authors of the 2018 paper and maintainers of the public repository the note names. The Foundation records the overlap and makes no suggestion of interest; it notes only that the spectral-descriptor literature this comment relies on is the work of a small number of connected people, which is the fact the consolidated statement of recurring investigators is to carry.

Where it bears. Part I.G, subsection h, which is written on it. Part IX.H and Part IX.J, for the choice of quantity in which a spectral limit is written and for the evasion mechanism. Part V.F, because the quantity the warning concerns is the quantity apt to the circadian question. Part V.I, for the concession that spectral adjustment is not a panacea, which is the position that subsection has settled on independently.

D.7 Reviews, signed commentary and correspondence in peer-reviewed journals

This category is created for the same reason and by the same reasoning as D.5 and D.6, and the Foundation states the elimination rather than leaving it to be inferred. A signed letter or commentary published in the correspondence pages of a peer-reviewed journal is not an article in that journal and has not been through its review of research, so it is outside Appendix C, whose criterion is publication as peer-reviewed research. It is the view of a named individual and not of a constituted body, so it is not an assessment under D.1, every entry in which is an opinion adopted by a committee. It is not a standard or an account of one, so it is not D.2. It is not a publication of a manufacturer or testing laboratory about its own products, so it is not D.3. It reports no commissioned research, so it is not D.4. It is not a chapter of an edited reference work, so it is not D.5. And it is neither a conference proceedings paper nor a draftsman's account of an instrument, so it is not D.6.

The Foundation cites a document of this kind for one purpose only: the view of a specialist about the state of a field, expressed in their own voice and published under their own name in a journal of that field. Authority of that kind is not the authority of research and the Foundation does not treat it as such. Where such a document reports observations, the observations are identified as the author's report and not as measurement, and the comment states that identification wherever it relies on them. Where an entry here bears on a question also addressed by research in Appendix C, the research governs.

D.7.1 Miller N. J., Correspondence: Flicker: The sneaky perception that ranges from invisible to debilitating (2024). Lighting Research and Technology 2024;56:666 to 668. doi:10.1177/14771535241290851. Published by SAGE for the Chartered Institution of Building Services Engineers. Sole author, Pacific Northwest National Laboratory, Portland, Oregon. The author is the first author of the experiment described at Appendix C.90, and this letter appeared in the same journal and the same year.

What the document is, stated before anything is taken from it. A letter to the editor. Its substance is a series of reports made to the author by members of the public, and the author identifies it as such, introducing the reports with the words "Here are a few of dozens of credible reports" and describing the letter itself as being about anecdotes. It contains no experiment, no protocol, no control condition and no statistical result. The Foundation relies on it for three things only: what a scientist at a national laboratory says is arriving in her correspondence, one measurement she reports having made herself, and the questions she says the field must answer. It is not cited, anywhere in this comment, as evidence that modulation causes any symptom.

Why the Foundation cites it at all. Because of who is saying it and what she says she used to think. The letter opens by naming the response it is written against: the author writes that she is responding to "manufacturers and retailers, automotive companies and property owners/managers whose automatic response is, 'that's just anecdotal." She states why such reports remain in that category: "reports of headaches, seizures, nausea, disorientation, etc. are still considered anecdotal because the neurological evidence is slow to arrive." And of the reports reaching her: "when consistent complaints flow into my in-box, unsolicited, with individuals begging for help to fix the flicker in their homes/cars/workplaces and their kids' schools, it is hard to discount them as fanciful or the product of hypochondriacs."

The measurement the author reports making herself, which is the only measurement in the document. Of a correspondent who reported seizures from lighting, the author records the products named as bus taillights, aircraft cabin lighting, and dashboard and instrument lighting inside a car, and then: "Having measured them, I know the frequency can range from 120 Hz up to over 840 Hz, and they use pulse-width modulation (PWM) to control LED output. Seizures are not supposed to happen from

those high frequencies. I used to discount these incidents. I do not anymore, although I still think they are rare." The Foundation draws attention to the structure of that passage and not merely to its content. A specialist measured the products, found frequencies at which the reported effect is not expected, and changed her position while keeping her estimate of frequency low.

The reports, summarized by the application they concern. The Foundation summarizes rather than reproduces, because the reports are third-party accounts and the comment does not adopt them. They concern LED holiday string lights; automotive tail lights, daytime running lights and marker lights, which one correspondent describes as modulating fully on and off two hundred times a second and producing "a repeating retinal pattern that produces a deceptive impression of where the vehicle is and what direction it is moving"; retail, postal and school interiors; subway tube replacements and platform display screens; aircraft cabin, dashboard and instrument lighting; retail LED lamps, of which one correspondent and her engineer husband compiled a list of lower-modulation products and published it for other families at her school; cellular telephone and computer display screens, with organic light-emitting diode screens identified as particularly troublesome and pixel pulse-width modulation and temporal color dithering offered as explanations; and color-changing products, where preliminary observation points to "sequential color changes (e.g. red followed sequentially by green to produce a perception of yellow) as a possible trigger." The author also records that reports are accumulating from people who sustained a head injury or concussion and afterward experienced symptoms from modulation they had not previously noticed, and that some correspondents have bought modulation meters or used slow-motion video to document the source.

The question the author puts about whose response a limit should be built on. This is the passage the comment relies on most. Reporting the finding of the experiment at Appendix C.90, the author writes: "The significance of this is perhaps average response of a population is an inadequate target for establishing a flicker metric. Perhaps we should address the 15% of the population that gets migraines instead. Or, should we focus on the very sensitive few that are almost completely debilitated by this issue?"

What the author says should happen, including the part that runs against this comment. The Foundation quotes the closing passage whole, because its first half is a reason for caution about regulation and the comment is worth less if the Department has to discover that for itself. "We need to know what populations experience these discomforting or disabling responses, how many people this represents, what characteristics of the TLM waveform are responsible for the problematic symptoms, and the mechanism by which the eye/brain system is affected. We need it soon if we are to avoid imposing limits on the manufacturing of products which are cost-effective, efficient, useful, fun and even inspiring. In the meantime, the responsible action is to reduce TLM in electric light sources to ensure fewer people are affected by them." The stated purpose of the research is in part to make limits on manufacturing unnecessary. The stated interim duty is nevertheless to reduce modulation now.

The causal question, which the author leaves open. The author sets out three candidate causes and does not choose between them: glare from luminaire optics, the spectral power distribution of a blue-pumped device with its local blue peak, or the modulation itself "because regular, high-modulation oscillation in luminance rarely occurs in the natural world in which humans evolved"; and if the modulation, then whether the stroboscopic effect, the phantom array effect "or something else altogether" is responsible. She states that "All of these possibilities are testable, given careful experimental studies with neurology collaboration and reliable, sensitive subjects willing to help solve the problem." The Foundation records this because it is the clearest statement available that the question

is open and answerable, and because the comment should not attribute to modulation what this author declines to attribute.

What it establishes. That reports of this kind are made, unsolicited, to a researcher at a national laboratory; that they concern the applications named above; that a specialist who measured some of the implicated products found pulse-width modulation between 120 and over 840 hertz; that she revised her own view of such reports; that she considers the population average a possibly inadequate basis for a modulation limit and names two alternative targets; and that she regards reduction of modulation as the responsible action pending the research.

What it does not establish. Anything about causation, prevalence, dose or mechanism, and the author asserts none of these. The reports are not cases in any clinical sense: there is no diagnosis, no exposure measurement for any individual, no control and no follow-up. Self-selected correspondence to a known researcher is the least representative sample available, a point the Foundation states because it is true and not because it has been put to it. The figure of 15 percent for migraine prevalence is given in passing without a citation. The description of tail lights modulating two hundred times a second is a correspondent's account and not a measurement. Nothing in this document is relied on in this comment for a proposition about health.

Where it bears. Part V.D.2, for the question of whose response a limit should be built on and for the interim duty. Part V.D.4, for the report concerning vehicle lamps and for the measured frequencies. Appendix A, for what the Foundation understands the status of an incident report to be. Part VII, for the population question. Part VIII.D, for the proposition that absence of a reporting mechanism is why such accounts reach a laboratory in-box instead of an agency.

D.7.2 Marchant P. and Norman P., In the best light? Road safety and public spending (2023). Signed feature in the magazine of the Royal Statistical Society, catalogued because Part V.M relies on it for the road collision results and for three quotations.

Citation. Marchant P. and Norman P. "In the best light? Road safety and public spending." Significance, volume 20, issue 3 (June 2023), pages 30–31. doi:10.1093/jrssig/qmad046. Published 5 June 2023.

What this document is, stated first because it governs its weight. A short feature article in a professional magazine, written by the authors of the research it describes. It is signed commentary, not the research. The two underlying papers have not been read by the Foundation.M requires them to be obtained.

Declared interests. The same declaration as at Appendix C.118: the first author has concerns about light pollution affecting astronomical observations and biodiversity and was motivated by them to examine claims of benefit for increased public lighting; the second has concerns that public money may be wasted on schemes with no proof of achieving their purpose.

What the comment takes from it. The road traffic collision results for the relighting of Leeds, being a confidence interval of about a 20 percent reduction to a 10 percent increase, and for Leeds combined with Birmingham, being a 16 percent reduction to a 12 percent increase, described by the authors as moving in the direction of harm. The collision result of the multi-authority study, being a 7 percent reduction to a 9 percent increase, across 15,833 kilometers of road in 62 local authorities. The authors' statement comparing the scrutiny given to lighting research with that given in health care. And their statement that white light contains all wavelengths, that organisms respond differently to different wavelengths, that the blue component is thought particularly damaging because it signals daytime, and that increasing brightness means more light scattered from surfaces into the environment notwithstanding better optical control.

What it does not establish. Anything of its own; it reports research published elsewhere. No health or biological endpoint is measured in the work it describes; the outcomes are recorded collisions and recorded crime. The statements about wavelength and biodiversity are the authors' summary of a field and carry no citation in the feature.

Where it bears. Part V.M, which is where it is used. Part VI.D, for roadway lighting. Part V.I, to which its closing passage on spectrum and biodiversity hands over.

D.7.3 Durmus, Jägerbrand and Tengelin (2024) — a research note asking whether red light can balance lighting function against ecological impact, and answering that it is uncertain

Citation. Durmus D., Jägerbrand A.K., Tengelin M.N. "Research note: Red light to mitigate light pollution: Is it possible to balance functionality and ecological impact?" Lighting Research and Technology. 2024;56(3). doi:10.1177/14771535231225362. Page range to be supplied. The authors declare no conflicts of interest and state that they received no financial support for the work.

What this document is. A research note and mini review. The authors state that they employed a qualitative approach, synthesizing pertinent literature to provide a concise overview for professionals. There is no original measurement, no original experiment, no stated search strategy and no inclusion criteria. It is placed in this subsection, among signed commentary in peer-reviewed journals, because that is what it is. Every empirical proposition in it is second-hand.I lists the four underlying sources that must be obtained before any of them is relied on as fact. The first author is a co-author of a study appraised in Appendix C, so the comment is not treating an unfamiliar source.

Why it is cited. Because it answers a question the Foundation's own settled position on spectral mitigation invites and cannot answer from the studies in Appendix C: if a longer wavelength is better, why not require red? The document is the only source the Foundation has found that collects the reasons against, and three of them do not appear anywhere else in this literature.

The case for red, as the authors state it. Long-wavelength light scatters less in the atmosphere, so it should produce less skyglow. It suppresses melatonin minimally, melanopsin being most sensitive near 479 nanometers. It preserves human dark adaptation. And nocturnal moths are said not to be spectrally sensitive at long wavelengths, so red light should attract fewer insects and therefore fewer of the bats that feed on them. The authors define red for their purposes as approximately 625 to 780 nanometers, noting that humans can detect radiation to about 1,100 nanometers.

The case against, which is the reason for the entry. Four strands. First, the bat evidence that motivates the requirement is divergent: two pipistrelle species show increased activity under red during migration, while light-averse Rhinolophus, Myotis and Plecotus species may avoid it, and in the single controlled experiment cited, activity fell under all colors and least under red; the authors characterize the responses as species-specific. Second, the ecological trap: a spectrum chosen because a species cannot detect it may leave that species unable to take evasive action, raising predation and so mortality in the population the measure was meant to protect. Third, other taxa detect red even though their peak sensitivity lies elsewhere: red light is reported to disrupt the magnetic orientation of migratory birds, with circling and collision risk, and in one experiment red and white advanced the onset of blue tit activity more than green did. Fourth, the human costs: narrowband red renders color poorly and is said to hinder identification of objects including faces, to compromise acuity and color discrimination, to reduce local contrast, to break down chromatic adaptation under extremely chromatic sources, and to lower subjective visual comfort; and because red lies far down the photopic and scotopic sensitivity functions it needs more radiant power for the same visual effect, the authors citing a commercial luminaire marketed for light pollution mitigation that delivers about 50 percent less luminous flux than a white one at comparable power.

The authors' conclusion. That advocating red light is well-intentioned but that caution is required, that red can be detected by a broad range of species and may have unforeseen consequences, that its effectiveness in mitigating ecological impacts remains uncertain, and that it should not be treated as a universal solution for insects and bats. They add that it is also possible that very little or no light is more beneficial outdoors than red light, and call for further research and monitoring before widespread adoption.

What the Foundation takes and does not take. It takes the reasons, as reasons, and the closing proposition, which is the position this comment argues from the statute: that the characteristics to regulate are the quantity, the direction and the duration of an emission rather than its color. It does not take any of the empirical claims as established, because this is a review. It does not treat the document as evidence about bats, which are otherwise absent from this comment. And it draws the consequence the authors do not: that a spectral prescription constrains nothing about where a luminaire sends its light, which Appendix C.136 shows to be the characteristic that governed.

Where it bears. Part V.I, where it is used, immediately after the settled position on spectral mitigation. Part V.B.3, for the limits of a single-number spectral descriptor, and for the acquisition of the first author's paper on that subject. Part V.M, for the finding that the public preference is for warm color temperature with good color rendering, which red does not provide. Part IV.G, for the collision between a spectral or geometric requirement and the federal lamp efficiency framework. Part II.H and Part IX.E, for the liaison duty under which that collision should be raised with the Department of Energy. Part IX.F, for the request that spectral content be measured and disclosed rather than prescribed.

D.7.4 Fobert, Miller, Swearer and Mayer-Pinto (2023) — a review of artificial light at night on temperate and tropical reefs, taken for three figures and an admission about measurement

Citation. Fobert E.K., Miller C.R., Swearer S.E., Mayer-Pinto M. "The impacts of artificial light at night on the ecology of temperate and tropical reefs." Philosophical Transactions of the Royal Society B. 2023;378(1892):20220362. doi:10.1098/rstb.2022.0362. Published 30 October 2023. Open access. Part of the theme issue Light pollution in complex ecological systems. One author supported by Australian Research Council grant DE220100308. No competing interests. The authors declare that no artificial-intelligence technologies were used.

What this document is. A review article. The journal classifies it as such, it reports no original measurement or experiment, and its data accessibility statement records that the article has no additional data. Its structure is a framework rather than a result: four mechanisms by which artificial light could alter reef systems, and three scenarios in which the authors suggest novel ecosystems could arise. The authors are candid that the underlying research is minimal and almost entirely at the level of the individual organism. The comment therefore places it here rather than in Appendix C, does not treat it as evidence, and declines the framework. The heading of this subsection has been widened to cover reviews, since a review article is not commentary and the comment now holds two.

Why it is cited. For three figures the comment had no source for, for one physical mechanism it did not have, and for an admission about measurement that is the most severe of its kind in this comment. Part V.I sets all of these out and they are not repeated here at length.

The extent of the exposure in water, at second hand. That about 22 percent of the world's coastal regions experience some degree of light pollution; that biologically important artificial light reaches more than 75 percent of the seafloor near coastal developments; that approximately 1.6 million square kilometers of coastal sea are exposed at a depth of ten meters; and that biologically important levels are estimated to reach 70 meters from skyglow and 100 meters from waterside street lighting. The last is a statement about a product class. All four are taken from four primary papers that have not been obtained.

The spectral mechanism. That short wavelengths penetrate deeper through the water column and that many marine organisms are sensitive to them because of the environment in which they evolved, with the consequence that the transition to light-emitting diodes increases the volume of water exposed rather than only the spectral content of the exposure. The comment identifies this at Part V.I as a different argument from the ones it makes elsewhere about spectrum, and as one that does not disturb the settled position on spectral mitigation.

The thresholds. Clownfish embryos failing to hatch at approximately 15 lux; Pacific oyster daily rhythms disrupted at as low as 0.1 lux; and sergeant major hatching inhibited at as low as 0.03 lux. The last is the lowest effect threshold anywhere in this comment and is about twice the median natural night sky brightness measured at Appendix C.128. Its source is a 1993 paper predating light-emitting diodes and must be read before the figure is relied on.

The admission about measurement. That any nocturnal sampling method introducing artificial light into the sampling environment will alter the outcome, and that light from a large vessel or even from a headlamp on a small open boat induces an avoidance response in the pelagic community below eighty meters. This is the ninth attestation collected at Part V.J.4 and the only one in which the act of measuring introduces the exposure, so that no improvement in instruments would cure it.

What the comment declines. The system-level framework and the novel-ecosystem scenarios, which are a research agenda. The diversity-collapse example, because the study behind it attributed spawning desynchronization to temperature and this review offers light only as something that could interfere comparably. And the route from reef decline to human beings through fisheries, declined on the construction of paragraph 360ii(a)(2) adopted at Part II.D.4.

One sentence adopted without alteration. That light pollution is largely an unregulated environmental stressor globally.

Where it bears. Part V.I, in the closing note on scope. Part V.J.4, for the ninth attestation and for the threshold comparison. Part V.B.3 and the settled spectral position at Part V.I, for the penetration mechanism. Part VI.D, for waterside street lighting as a product class delivering a biologically significant emission to one hundred meters of depth.

D.7.5 Hirt, Evans, Miller and Ryser (2023) — the guest editors' introduction to the Royal Society theme issue, taken for one assessment of the field and used otherwise as a map

Citation. Hirt M.R., Evans D.M., Miller C.R., Ryser R. "Light pollution in complex ecological systems." Philosophical Transactions of the Royal Society B. 2023;378(1892):20220351. doi:10.1098/rstb.2022.0351. Published 30 October 2023. Open access. The introduction to the theme issue of the same name. Two authors acknowledge support from the German Centre for Integrative Biodiversity Research, German Research Foundation grant FZT 118, 202548816. The conflict-of-interest declaration records that the issue was assembled by the guest editor team under the journal's supervision, that guest editors were excluded from assessing papers where they had a conflict, that independent reviewers assessed all papers and that invitation did not guarantee inclusion. The authors declare that no artificial-intelligence technologies were used. The acknowledgements thank Kevin Gaston and Andreas Jechow, both of whom appear elsewhere in this comment.

What this document is, stated before anything is taken from it. An editorial introduction written by the guest editors of a theme issue. Its data accessibility statement records that it has no additional data. It reports no measurement and no experiment, and its substantive content is a framing of the field together with a summary of the fifteen or so papers the editors solicited. It is the least evidentiary document cited anywhere in this comment and the Foundation uses it for two things only: one assessment of the state of the field, which is worth more from the editors than from anyone else, and a map of the collection.

The assessment taken, which is the reason for the entry. That light intensity is among the most important and most widely studied properties of artificial light at night; that the majority of studies of it nonetheless rest on binary comparisons of presence against absence, or include only a limited number of intensity levels, with only two exceptions named; that this is attributable to the practical difficulty of running experiments at many levels, particularly at the community level; that such studies risk misinterpreting the true impact of light and limit the ability to predict; and that fully quantitative or dose-response relationships are what theory and prediction require. Part V.A.2 sets out why the Foundation regards this as the central evidentiary obstacle between the published literature and a performance standard under section 360kk, and does not repeat the reasoning here. The two exceptions the editors name are recorded as acquisitions below.

A CAUTION THE FOUNDATION RECORDS AGAINST ITS OWN DIRECTION. One paper in the issue cuts against a mitigation this comment has been moving toward, and the Foundation records it prominently rather than leaving it to be discovered. Heinen and others, Part-night exposure to artificial light at night has more detrimental effects on aphid colonies than fully lit nights, Philosophical Transactions of the Royal Society B 2023;378:20220357. The editors summarize it as showing an increased negative effect on aphid population growth when lights are temporarily switched off during the night compared with night-long illumination, and draw the general conclusion that artificial light can have both positive and negative effects at the population level. Part-night switching is the mitigation the Andalusian instrument at Appendix D.2 codifies in its night period, which the standing question at Part V.I about the necessity of a streetlight at three in the morning assumes, and which the Foundation has been inclined to favor. The paper must be obtained and read before the comment advances part-night switching anywhere. The Foundation notes two things that limit the damage without disposing of it: the subject is an aphid colony and the mechanism is presumably specific to it, and the request this comment actually makes at Part IX is that a luminaire be capable of dimming and scheduling and that the exposure information be published, which is a request about capability and disclosure rather than a recommendation of any particular schedule. That distinction should be preserved deliberately and not by accident.

The map, and the acquisition priorities taken from it. The issue is the densest single collection of community-level work on this exposure and the Foundation has read none of it beyond the review at this subsection. All items are in volume 378, issue 1892. Highest priority, because each bears on an argument this comment already makes. Evans D.M., Mitigating the impacts of street lighting on biodiversity and ecosystem functioning, article 20220355, which the editors summarize as holding that although mitigation options are numerous, few have been rigorously tested; that is the proposition Part II.G makes about paragraph 360ii(a)(5) and the Foundation should cite someone else making it. Bará S. and Falchi F., Artificial light at night: a global disruptor of the night-time environment, article 20220352, which the editors summarize as holding that only a tiny fraction of reflected light is used for human vision while the rest pollutes the environment; that is a statement about waste and bears directly on the word unnecessary in paragraph 360ii(a)(2). Heinen R. and others, article 20220357, for the reason given above. Hölker F., Jechow A., Schroer S., Tockner K. and Gessner M.O., Light pollution of freshwater ecosystems: principles, ecological impacts and remedies, article 20220360, for its remedies and for a call to environmentally friendly lighting near sensitive waters. High priority. Dyer A. and others, article 20220359, for the saturating dose-response in which more than half the change occurred below full moonlight. Tidau S., Brough F.T., Gimenez L., Jenkins S.R. and Davies T.W., article 20220363, for nonlinear irradiance and barnacle survival. Barrientos R. and others, article 20220370, for the finding that nearby lighting rather than skyglow predicts habitat selection by a top predator, which should be read beside the skyglow null at Appendix C.135. Grenis K. and others, article 20220365, for contrasting moth community effects between skyglow and point sources. Spoelstra K. and others, article 20220364, for a long-term effect on invertebrate community composition independent of light spectra, which bears on the settled spectral position at Part V.I. Coetzee B.W.T., Burke A.M., Koekemoer L.L., Robertson M.P. and

Smit I.P.J., article 20220371, on light and disease vector interactions including malaria, which bears on the mosquito study at Appendix C.125 and on the only route in this subsection that reaches a human disease. Also in the issue and lower priority: Bucher and others on grassland plant diversity, article 20220358; Cesarz and others on soil communities, article 20220366, already recorded as an acquisition elsewhere; Parkinson and Tiegs on diode spectra and cross-ecosystem subsidies, article 20220361; Sanders and others on network rewiring, article 20220368; and Seymoure and others on a framework for species interactions, article 20220356.

Three further acquisitions this document identifies. The two dose-response exceptions the editors name: Sanders D., Kehoe R., Cruse D., van Veen F.J.F. and Gaston K.J., Low levels of artificial light at night strengthen top-down control in insect food web, Current Biology 2018;28:2474 to 2478; and de Jong M., Jeninga L., Ouyang J.Q., van Oers K., Spoelstra K. and Visser M.E., Dose-dependent responses of avian daily rhythms to artificial light at night, Physiology and Behavior 2016;155:172 to 179. The second is the only dose-response study in a vertebrate the Foundation has so far identified anywhere. And Abelson E., Seymoure B., Jechow A., Perkin E., Moon H., Hölker F., White J. and Longcore T., Ecological aspects and measurement of anthropogenic light at night, which the editors cite as in press at SSRN with identifier 10.2139/ssrn.4353905; a paper on the measurement of this exposure carrying that authorship bears on Part V.J and its present publication status must be established.

Two matters of corroboration. The editors summarize the mechanism of insect light entrapment in the terms the comment adopts at Appendix C.137, writing that recent work attributes the phenomenon to the insects' behavior of angling their back toward the brightest visual hemisphere, which results in continuous steering around artificial light sources. They cite it as a preprint, that work having been published in Nature Communications in January 2024. That is the third independent second-hand citation of it in this comment and is some evidence that the account is accepted in the field rather than contested. Separately, the editors give the annual rate of increase in light pollution as an estimated 9.6 percent, citing the citizen-science study of star visibility already recorded as an acquisition.

Where it bears. Part V.A.2, where the assessment is used and where the consequence for section 360kk is drawn. Part IX.C, for which it is the evidentiary basis of the request that research characterize the relationship between emission and effect across a range of levels. Part II.G, pending acquisition of the Evans paper. Part V.I, for the part-night caution and for the spectral point in the Spoelstra paper. Part V.J, pending acquisition of the Abelson measurement paper.

D.7.6 Marangoni, Davies, Smyth, Rodríguez, Hamann, Duarte, Pendoley, Berge, Maggi and Levy (2022) — a review of artificial light in marine ecosystems, taken principally for the field's own statement that it has no agreed unit of measurement

Citation. Marangoni L.F.B., Davies T., Smyth T., Rodríguez A., Hamann M., Duarte C., Pendoley K., Berge J., Maggi E., Levy O. "Impacts of artificial light at night in marine ecosystems—A review." Global Change Biology. 2022;28(18):5346–5367. doi:10.1111/gcb.16264. PMID 35583661. PMCID PMC9540822. Published 14 June 2022. Open access. The article records that Marangoni and Davies contributed equally.

What this document is. A review article. It reports no original measurement or experiment, and its data availability statement records that no new data were created or analyzed. The authors describe it as bringing together recognized experts across marine habitats and taxonomic groups to provide a gateway to the field. It is organized by habitat — sandy beaches including sea turtles, rocky intertidal shores, shallow water coral reefs, pelagic environments — with a separate section for seabirds, followed by a section on conservation guidelines and a list of research questions. The authors declare no competing interests.

Why it is cited, stated first because it is not the obvious reason. For its Box 1, which is the field's own statement that there is no globally recognized standard method and no agreed unit of measurement for monitoring biologically active light, that commercial lux meters

exclude the wavelengths falling outside the photopic curve and are insensitive below 450 nanometers, that they were designed for measuring light in buildings and cannot detect skyglow or dim light in the field, and that they supply no spectral information. Part V.J.4 quotes the box and is written on it. Everything else in this entry is secondary to that.

The second reason, which is the same box turned around. Because the review then reports the exposure of essentially every study it collects in the unit its own box says cannot measure the quantity. The Foundation counts two radiometric or quantum exposures in the whole document, both in the pelagic sections, against upwards of eighteen distinct values in lux. It reports this as a characteristic of the field and not as a fault of the authors, for the reason Part V.J.4 gives: a field cannot report in a unit that does not exist.

The research questions taken. Two of the eleven the review lists. That the field needs best practice techniques to monitor and measure "biologically meaningful (i.e., radiometric as opposed to photometric)" light, underwater and on land, at fine and broad scales. And that it needs the thresholds of intensity, wavelength and exposure time that elicit biological responses. The parenthesis in the first is the authors'. Three of the four emission characteristics Part IX asks to have characterized appear in the second.

The exposure-extent figures, at second hand. That at least 22 percent of coastal regions are exposed; that 1.9 million square kilometers of the world's coastal seas are exposed at one meter depth, 1.6 million at ten meters and 840,000 at twenty meters; and that 20 percent of the world's contiguous Marine Protected Areas are exposed across 100 percent of their range. The most exposed regions are the Mediterranean, the Red Sea and Persian Gulf, and the seas of southeast Asia. The first and third of these and two of the depth figures overlap with the figures taken from the review at this subsection immediately above, and the overlap is not independent: Davies is an author of the primary papers and of both reviews. Part V.I states that before using them.

What "biologically important" means, which closes an interpretive gap. In the depth figures used here and in the review above, biologically important artificial light is defined as the minimum irradiance of white light that elicits diel vertical migration in female Calanus copepods, measured experimentally and then applied as the criterion for the global maps. The maps are built on the relationship between a published atlas of night sky brightness and sea surface irradiances, coupled with monthly climatologies of inherent optical water properties and validated against measurements from the Persian Gulf.

Box 2, and the measurement that sharpens the ninth attestation. The review records that the optical instruments used to count plankton and fish at depth all require an external light source and names five of them; that red light has been recommended for such surveys on the assumption that most species react to it less; that two studies supported the assumption; and that Geoffroy and others in 2021 contradicted it, finding that pelagic organisms in Arctic and temperate regions strongly avoid artificial light including visible red at 575 to 700 nanometers, with density falling by as much as 99 percent and avoidance distances of 23 to 94 meters from the source at light levels of 11 to 18 microwatts per square centimeter. Part V.I sets out the three consequences. The attestation count at Part V.J.4 is unchanged; this quantifies the ninth.

Sea turtles, summarized here rather than in the body. That artificial light at night, even at low levels, is a threat influencing all seven species of marine turtle, principally as hatchlings or nesting adult females. That it affects the on-beach orientation and nest site selection of adult females, the on-beach orientation and sea-finding of hatchlings, and the at-sea dispersal of hatchlings during the swim frenzy of roughly 24 to 48 hours after emergence. That hatchling sea-finding is influenced by both the wavelength and the intensity of the light and is significantly compromised by shorter wavelengths even at lower intensity. That the thresholds of concern for wavelength and intensity are likely to vary within and among species, which Part V.I records as a caution against this comment's own direction. And that two studies of nest site selection both concluded that turtles use darker beaches and select darker sections of beaches.

Seabirds, summarized here for the same reason. That light pollution causes mortality of fledglings involving more than 70 species, some severely threatened, in all the oceans and seas, a phenomenon the field calls fallout; that about 90 percent of birds admitted to rescue programs survive, while studies indicate around 40 percent of grounded birds are never rescued; that tracking shows most Cory's shearwater fledglings are grounded within sixteen kilometers of their nests; that adult Manx shearwaters flying over a colony were deterred by blue and green light in comparison to red, and that the number flying over decreased with the duration and intensity of the treatment; and that around 31 percent of all seabird species are globally threatened and 47 percent have declining population trends. Rodríguez is a co-author of this review and of the study at Appendix C.133, and a 2020 paper of his on whether light-induced seabird mortality is explained by visual system development is cited in it; the authorship overlap is recorded here rather than left to be found.

The regulatory statement. That a few countries — Spain in Catalonia, Chile, France, and Italy in Piedmont — are trying to establish laws regulating light pollution; that most applicable documents are guidelines, codes or standards from regulators, advisory committees, non-governmental organizations or professional bodies "with no legal basis for enforcement of recommendations"; that many professional guidance documents are addressed to lighting engineers, give little detail on management for sensitive receptors, and "must be purchased at a substantial cost"; and that guidance for the marine environment does not exist in the English-language literature. Part V.I draws the consequence for section 360kk.

The ranked design recommendation. Six best-practice rules, reproduced at Part V.I, of which the authors state that the most important is avoiding short-wavelength blue light, for two reasons: its visibility across a wide range of taxa, and its greater capacity to penetrate the water column. The second reason does not transfer to land and the comment does not transfer it. The review also records that the guidelines it endorses recommend a case-by-case approach to assessment and mitigation, which is the opposite of a numerical performance standard; Part V.I states the distinction rather than arguing the point.

What the review concedes about its own evidence base. Two things, both in the authors' own words. That many of the short-term experiments it collects used "high ALAN levels (not considered environmental realistic)" and are offered as a step toward understanding mechanism. And that the intensities used in some sandy-beach studies were measured under the light source in the promenade area and "could be higher than those occurring in the intertidal area," a concern the authors rebut with unpublished data of one of their own number. The abstract also records that while strategies for mitigation were easily identified, barriers to their implementation are poorly understood.

The findings that run the other way, recorded because the review records them. An amphipod whose locomotor activity did not differ between a lit and an unlit beach. An isopod whose growth rate was unaffected and whose absorption efficiency increased. A coral microbial community that remained stable. A juvenile bonefish study and a seagrass fish assemblage with almost no effect. The Atlantic dog whelk, which forages more under artificial light rather than less, the opposite of the Chilean abalone. Intertidal microphytobenthos whose biomass and photosynthetic efficiency increased. And little penguins that preferred lit paths to dark ones in reaching their nests. The review also polices its own citations, describing one beach comparison as correlational and to be treated with caution and one absorption-efficiency result as restricted by the need to keep the animals without sand. Part V.I sets out what the Foundation makes of the heterogeneity.

What the comment declines. The habitat-by-habitat biological findings, which are collected at second hand from primary studies the Foundation has not read and which are reported in a unit the review itself says cannot measure the quantity. The comment takes no effect estimate from this document. It also declines the ten golden rules figure, which it has not seen, and does not attribute ten rules to the review.

Where it bears. Part V.J.4, which is written on Box 1 and on the two research questions, and which is the principal use. Part V.I, in the closing note on scope, for the depth figures, the Marine Protected Area figure, the definition of biologically important light, the Geoffroy avoidance measurement, the regulatory statement and the two cautions. Part V.J.5, for the radiometric-against-photometric distinction in the authors' own parenthesis. Part IX.G.1 and IX.J, for the ranked priority on short-wavelength content. Appendix C.133, for the seabird authorship overlap.

D.7.7 Green, Luginbuhl, Wainscoat and Duriscoe (2022) — the observatory site-protection review, taken for the quantification of direct uplight and for what regulators have actually prescribed

Citation. Green R.F., Luginbuhl C.B., Wainscoat R.J., Duriscoe D. "The growing threat of light pollution to ground-based observatories." The Astronomy and Astrophysics Review. 2022;30:1. doi:10.1007/s00159-021-00138-3. Published 27 January 2022. Open access.

What this document is. A review article in a review journal. It reports no original experiment. Its content is a synthesis of the physical modeling of skyglow, of field measurement practice, of the regulatory instruments in force around major observatories, and of the emerging problem of satellite constellations. The subject is the protection of astronomical observation and not human health, and the Foundation takes nothing from it about health.

Why it is cited. For two things. The quantification of direct upward emission against reflected ground light, which Part II.D.4 had asserted; and the worked example of Flagstaff, in which a numerical sky brightness target was set, converted into a prescribable limit, imposed, and then measured and found to have been achieved. Both are set out at Part II.D.4 and are not repeated here.

The uplight figures, at second hand. A representative reflectivity of 15 percent for illuminated surfaces, used in this modeling literature since 1986. A direct upward emission fraction averaging about 10 percent across an installed stock. The consequent split of upward-propagating flux into roughly equal direct and reflected parts. A factor of about 6.7 for direct over reflected neglecting angle, rising to a predicted 40 to more than 150 times at distance with little blocking, against a measured range of about 1.5 to 16 times. And the figure the comment relies on most: a fixture with one percent direct upward emission increases artificial sky brightness by 30 percent at fifty kilometers and 100 percent at two hundred kilometers against the same fixture fully shielded.

Distance scaling. Skyglow impact scales approximately as the inverse 2.5 power of distance. The authors give the consequence arithmetically: a source at 30 kilometers has 15 times the impact at 10 kilometers, 135 times at 3 kilometers and over 650 times at 1 kilometer. The comment does not presently use this and it bears on any argument about proximity of a source to a receptor.

The correction the Foundation adopts against its own interest. That the common explanation for the skyglow consequences of white light-emitting diodes is wrong. Scattering of short wavelengths is approximately balanced by the extinction that accompanies it within about ten kilometers, and beyond that extinction dominates, so a white source of given luminous output has less impact on integrated radiant skyglow at distance than a yellow one. The increased visual impact, which is two to three times that of high-pressure sodium at equal lumens, arises from the greater sensitivity of the dark-adapted eye to blue and green. Within the 350 to 500 nanometer band, which is the band this comment is about, white diodes were found to increase radiance by a factor of about two or more against high-pressure sodium. Part II.D.4 keeps the three statements apart.

What this review says about correlated color temperature, which corroborates Part I.G. That correlated color temperature "is properly applied only to light spectra that approximate the spectrum produced by a blackbody" and that it "does not accurately correlate

with either the ‘percent blue’ impact or visual sky glow impacts.” That is the proposition Part I.G takes from the 2018 spectral-index paper, reached independently by four astronomers in a different journal four years later. The Foundation has not added it to the body because the existing treatment is already sourced and verified; it is recorded here as corroboration available if that passage is ever challenged.

The metrics this review names, one of which the comment does not have. Four. The percent blue, being the ratio of radiant flux shortward of 500 nanometers to radiant flux over all wavelengths, which is the linear form of the logarithmic index Part I.G already uses. The Sloan g-prime passband as an alternative definition of the same thing. The scotopic to photopic ratio, which the authors say is “an approximate surrogate for many biological or ecological impacts” because short-wavelength sensitivity is a common attribute of biological systems, and which Appendix C.57 already supplies as a numerical criterion. And total spectral emission bandwidth, which the comment does not presently have as a named metric and which the authors describe as spectrally neutral because it treats all wavelength regions equally. Bandwidth is the quantity that distinguishes a warm broad-spectrum lamp from a narrow-band amber one, which is the distinction Part V.I draws and Part I.G records from the Andalusian instrument as a 25 nanometer limit.

What regulators have prescribed, and the contrast the Foundation should draw. The review reports that the Chilean national code limits luminous intensity in three stated wavelength intervals, each as a fraction of the intensity between 380 and 780 nanometers: below 0.15 for 300 to 379 nanometers, below 0.15 for 380 to 499 nanometers, and below 0.5 for 780 to 1,000 nanometers, with a tighter revision proposed in 2021. It reports that the code protecting Calar Alto allows zero percent of energy below 440 nanometers and requires a monochromatic or narrow-band source where color rendition is not critical. And it reports that United States codes have instead started limiting correlated color temperature: San Diego County below 2,500 kelvin near the observatory, southern Arizona codes below 3,500 kelvin, the City of Phoenix purchasing roadway lighting at 2,700 kelvin, and a Hawaii state law requiring all state lighting to be fully shielded and at or below 4,000 kelvin. The contrast is the point and Part IX.J should have it: where other jurisdictions prescribe radiant power in a stated wavelength interval, American jurisdictions prescribe the one descriptor the published characterization reports to be a poor predictor of blue content over exactly the range in which they are using it.

The structural statement about American regulation. That “the general approach in the United States is to make these regulations part of the local Zoning Code, which regulates the usage of property,” while most other codes are established to protect a specific site or form part of environmental or sustainability regulation. The review adds that almost all such regulations are prospective only, applying to new development or major redevelopment, the exception being the Andalusian requirement that fixtures with more than 25 percent uplight be removed within three years. The Foundation has not yet used this and it bears directly on the federalism passage at Part II.D.4: a zoning code governs where a lamp may be installed and prospectively; a performance standard under section 360kk governs what a product may emit when it is introduced into commerce. They are different instruments reaching different things, and the second is not available to a municipality.

That thresholds have not been set, which is Part II.G’s proposition. The authors state that acceptable or target threshold values “have rarely been established for any of these metrics,” that mitigation has accordingly focused on minimizing impacts “with little or no discussion of what an acceptable impact might be, and thus no way to determine whether light pollution exceeds thresholds or has been successfully mitigated,” and that approaches have concentrated on individual fixtures or parcels “rather than the summed regional impact.” The last clause is also the multi-emitter point at Part V.J.3, made from the other side.

One numerical threshold that does exist. The Site Protection Commission of the International Astronomical Union adopted one in 1979: a contribution of 10 percent of the

natural level as the maximum tolerable limit, specified at 45 degrees elevation above the horizon and for wavelengths throughout the optical spectrum from 300 to 1,000 nanometers. The Foundation records it as a demonstration that a limit of this kind is writable and has been written, radiometrically and over a stated wavelength range, by an international body, forty-seven years ago, for a protected interest other than health.

A measured effect on human visual function. Using all-sky imagery with the modeled natural background subtracted, the National Park Service night sky team measured at a site in Death Valley National Park, more than 100 kilometers from the center of Las Vegas, an artificial brightest square degree of 17.6 magnitudes per square arcsecond, which the authors state is bright enough to inhibit dark adaptation of the human eye; the boundary between scotopic and mesopic vision is given as 17.0. At sites at the margin of and within Las Vegas and Washington, D.C., artificial skyglow is thousands of percent above natural on every indicator and dark adaptation is impossible. The Foundation has not used this and notes what it is and is not: dark adaptation is a physiological state of the human visual system, and its impairment at that distance is a measured consequence of emission from products. It is not a disease outcome and the comment should not present it as one.

Two further matters recorded for other Parts. That since 2006 the mission of the United States National Park Service has included preservation of the natural photic environment, and that the natural reference condition for skyglow illuminance is given as 0.8 millilux horizontal and 0.4 millilux vertical. That is a second federal body with a stated interest in this emission and bears on Part II.H. And that in the United States county and state lighting laws do not bind federal installations, the review noting that an Army training area 10 kilometers from the Maunakea observatories is exempt from the county ordinance and complies voluntarily. That bears on any argument about what local regulation can and cannot reach.

What the comment declines. Everything about satellite constellations in low-Earth orbit, which occupies a section of the review and concerns reflected sunlight rather than emission from a product on the ground. It is outside this comment and outside the subchapter. The Foundation also takes no astronomical impact finding as such: the protected interest in this review is the ability to observe, and this comment is about an emission and the people exposed to it.

Where it bears. Part II.D.4, which is written on the uplight quantification, the Flagstaff example and the Purkinje correction, and which is the principal use. Part I.G and Part IX.J, for the corroboration on correlated color temperature and for the contrast between what American and foreign jurisdictions prescribe. Part II.G and Part IX.C, for the absence of thresholds and for the one that exists. Part V.J.3, for the summed-regional-impact point. Part II.H, for the National Park Service mission and the exemption of federal installations from local lighting law.

D.7.8 Gaston, Bennie, Davies and Hopkins (2013) — the mechanistic review, taken for two reference tables and for a footnote that states both of this comment's measurement propositions in 2013

Citation. Gaston K.J., Bennie J., Davies T.W., Hopkins J. "The ecological impacts of nighttime light pollution: a mechanistic appraisal." Biological Reviews. 2013;88(4):912–927. doi:10.1111/brv.12036. Authors at the Environment and Sustainability Institute, University of Exeter, Penryn, Cornwall, and at Natural England, Peterborough. Funded by the European Research Council under the Seventh Framework Programme, grant agreement 268504 to the first author. Read from a file hosted on the Foundation's own server; the issue number is inferred and must be verified.

AUTHORSHIP, STATED BEFORE ANYTHING ELSE. Kevin Gaston and Jonathan Bennie are authors of Appendix C.94 and Appendix C.128 and co-authors of the satellite instrument paper relied on at Part V.J.4. Thomas Davies is a co-author of the marine review in this subsection and of Appendix C.141. John Hopkins was at Natural England, a non-departmental public body of the United Kingdom government, which is recorded because the comment elsewhere tracks government participation in this literature. The University of Exeter

group now appears in this comment five times and nothing here is offered as independent corroboration of anything else by the same authors.

What the document is. A synthetic review proposing a framework that cross-factors the three ways artificial light alters natural light regimes — spatially, temporally and spectrally — against two ways light acts on biological systems, as a resource and as a source of information. It reports no original measurement and no original data. It is thirteen years old, predating the general transition to light-emitting diode street lighting in the United States that Part IV.G describes, and the Foundation uses it for two tables and a footnote rather than for its survey of the literature.

Table 1, the reference illuminances. Set out at Part V.A.2. Full sunlight 103,000 lux; partly sunny 50,000; cloudy day 1,000 to 10,000; operating table 18,000; bright office 400 to 600; most homes 100 to 300; main road street lighting at average street level 15; lighted parking lot 10; residential side street 5; full moon under clear conditions 0.1 to 0.3; quarter moon 0.01 to 0.03; clear starry night 0.001; overcast night sky 0.00003 to 0.0001; urban skyglow 0.15. Attributed collectively to the British Standards Institute 2003, Rich and Longcore 2006b, and Dick 2011, without row-by-row sourcing. The caption carries its own caution, that although widely used, lux measurement places emphasis on brightness as perceived by human vision.

Table 3, the effect levels. Headed, in the authors' words, examples of the levels at which nighttime lighting has been observed to have biological effects, with species, setting, effect, illuminance and source, ordered by increasing intensity. Four owl rows at a millionth to a ten-thousandth of a lux for prey location, from a 1945 study and converted from footcandles, which are visual detection figures rather than effects of artificial light and are not used. Then: common toad, prey detection, 0.00028 lux; Syrian hamster, altered circadian rhythm, 0.01; salmon, prey detection, 0.01 to 5; fruit fly, increased activity and shifted peaks, 0.03; brown rat, increased rates of tumor growth and metabolism, 0.2; brown rat, increased rate of tumor growth, 0.21; five wader species, higher prey intake in a field experiment, 0.74; deer mouse, reduced nocturnal activity, 0.93; prairie rattlesnake, reduced activity, 1; American robin, earlier singing, mean 1.26 in field observations with a range of 0.05 to 3.06; leaf-eared mouse, reduced nocturnal activity, 1.5, and predator avoidance with reduced food consumption, below 2.0; Siberian hamster, suppressed immune response, 5; algae, mosses and ferns, minimum light for continued photosynthetic growth in caves, 10 to 50, 50 to 180 and 250; Atlantic salmon, altered timing of nocturnal migration, 14 measured at the stream surface; pond bats, reduced feeding and disturbed flight, below 30; lesser horseshoe bats, reduced activity and delayed commuting, 51.67 average; social vole, disrupted seasonal thermoregulation, 450 as a fifteen-minute pulse; field mouse, disrupted circadian rhythm, 1,000 as a fifteen-minute pulse. Except where noted the exposures are described as constant.

THE FOOTNOTE, WHICH IS WHY THIS ENTRY MATTERS MOST. In full: "Note that: (i) in many cases these represent levels of experimental treatments, and precisely where thresholds might lie remains unknown; and (ii) although widely used, lux measurement places emphasis on brightness at wavelengths perceived by human vision." Both of this comment's measurement propositions, stated by the field about itself in 2013, in the caption of the table that would otherwise be read as a list of thresholds. Part V.A.2 sets out what follows.

The conclusions the Foundation records. That artificial light increasingly encroaches on dark refuges in space, in time and across wavelengths. That effects have been documented across a wide range of species and processes, but that effects at population and ecosystem level are poorly known. And, from the abstract, that major research gaps exist, particularly in the impacts of light at population and ecosystem levels, in "identification of intensity thresholds" and in the spatial extent of impacts near artificial lights. The abstract also states that even low levels of nighttime light pollution can have significant impact.

What it establishes. Nothing of its own, being a review. It establishes what expert opinion was in 2013 and it supplies two tabulations whose rows are individually sourced or collectively attributed, which the comment uses for scale and for direction to primary studies.

What it does not establish. Any human effect. Any threshold, the authors saying expressly that where thresholds lie remains unknown. Anything about light-emitting diode products, the review predating their general deployment in the United States. And nothing at all that the comment should state without reading the primary study behind the row.

Where it bears. Part V.A.2, which is written on both tables and on the footnote, and which is the principal use. Part V.I, where the natural-darkness correction is made and now confirmed. Part V.J.4, for the 2013 date of the footnote's second limb. Part V.F, for the two rodent tumor rows, which are flagged and not used. Part IX.C, for the research gap the abstract names.

D.7.9 Swaddle, Francis, Barber and eleven others (2015) — the evolutionary framework review, catalogued for one human-exposure figure, for the theory behind two readings the comment has already adopted, and to record that the comment makes no use of its light-and-sound framing

Citation. Swaddle J.P., Francis C.D., Barber J.R., Cooper C.B., Kyba C.C.M., Dominoni D.M., Shannon G., Aschehoug E., Goodwin S.E., Kawahara A.Y., Luther D., Spoelstra K., Voss M. and Longcore T. "A framework to assess evolutionary responses to anthropogenic light and sound." Trends in Ecology and Evolution. 2015. doi:10.1016/j.tree.2015.06.009. Swaddle and Francis are stated to be joint first authors and Longcore is the corresponding author. Fourteen authors at thirteen institutions in the United States, Germany, the United Kingdom and the Netherlands.

THE COPY READ IS NOT THE VERSION OF RECORD. The file read is an author-deposited accepted manuscript bearing the publisher's in-press markers, including a running head giving the volume and issue as unassigned and a typesetting reference, and a notice that the content was uploaded to a research-networking site by one of the co-authors in November 2017. It therefore has no page numbers and the volume and issue are unknown. The citation above is incomplete for that reason and must be completed from the journal before any use.

What the document is. A review proposing a framework for investigating anthropogenic light and noise as agents of natural selection and as drivers of other evolutionary processes. It reports no original research and no measurement. Its subject is what would have to be established to show evolutionary change, and what is known is characterized by the authors as largely understudied.

The one figure the comment may want, and it concerns people. That in 2001 approximately 40 percent of the world population lived in areas that never experienced sub-moonlight illuminance. That is at second hand from the authors' reference 4 and the data are now a quarter of a century old. The Foundation records it because it is a statement about human exposure in a literature that is mostly about animals, and because it is the second independent route to the proposition at Part V.A.2, taken there from the reference table at Appendix D.7, that in a lit place the diffuse background is of the same order as moonlight. Neither source has been traced to a primary measurement and the body states the proposition only as an order of magnitude.

The theory behind two readings the comment has already adopted, including the part that cuts the other way. This review is the framework for the distinction the comment has twice had to draw between an effect and an injury. At Appendix C.138 and again at Appendix C.144 the Foundation adopted the authors' own suggestion that a difference observed under artificial light might be adaptive plasticity rather than harm. This review sets out the machinery of that argument, distinguishing behavioral flexibility, developmental plasticity and heritable genetic change, and it states a consequence the Foundation had not seen made explicit: that behavioral flexibility can weaken selection, because if most genotypes adjust in an adaptive

direction the strength of selection generally falls. That cuts against a comment arguing from evolutionary consequences, and the Foundation records it for that reason.

WHY THE COMMENT MAKES NO USE OF ITS CENTRAL FRAMING, WHICH IS A DECISION RATHER THAN AN OVERSIGHT. The review treats artificial light and anthropogenic noise together as sensory pollutants. The Foundation's own remit covers both, and subparagraph (B) of the statutory definition at section 360hh does reach sonic, infrasonic and ultrasonic waves emitted from an electronic product, as Part II sets out. The comment already uses that subparagraph, and uses it for the purpose it will bear: as the reason a definition reaching ionizing radiation at one end and infrasonic waves at the other does not stop at the edges of the visible band. That is an argument about the breadth of the definition. It is not an invitation to put sound before the Department in a comment responding to a request about electromagnetic fields, and this review supplies no reason to do so: its pairing of the two is ecological and evolutionary, not statutory. The Foundation therefore takes nothing from the pairing and records the decision here so that it is not revisited.

What it establishes. Nothing of its own. That a framework has been proposed, by fourteen investigators in a journal of the first rank, for asking whether these exposures act as agents of selection; and that as of 2015 the evolutionary implications were largely understudied.

What it does not establish. Any human health effect. Any effect of any kind, no original observation being reported. And no evolutionary change in any population, which is the point of the paper: it describes what would have to be measured.

Where it bears. Nowhere in the body at present. If the adaptive plasticity question at Appendices C.138 and C.144 is ever developed rather than simply conceded, this is the document that frames it.

D.8 Preprints and self-archived research reports

This category is created for the same reason and by the same reasoning as D.5, D.6 and D.7, and the Foundation again states the elimination rather than leaving it to be inferred. A preprint is original research by a named author, deposited in a public repository with a persistent identifier, which has not been through the peer review of any journal. It is therefore not an article within the meaning of Appendix C, which contains peer-reviewed articles and nothing else. It is not an expert assessment under D.1, not a standard under D.2, not a publication of a manufacturer or testing laboratory under D.3, not a commissioned report under D.4, not a reference work under D.5, not a conference paper under D.6, and not commentary in a journal under D.7. The Foundation places such documents here so that their status is visible on the face of the appendix, and cites them for what they measure rather than for conclusions drawn from the measurement.

D.8.1 Bará S., On the continued growth of light pollution from vehicle lights (2016-2025). Preprints da Corredoira 2025.3.v1, deposited at Zenodo, doi:10.5281/zenodo.15565958. Licensed CC BY-NC 4.0. Seventeen pages including supplementary data. The author is identified as a former profesor titular at the Universidade de Santiago de Compostela, now retired, with an ORCID identifier given. Not peer reviewed. Full text read. Treated at Part VI.B.1.

What it analyzes. The published photometric data of the Insurance Institute for Highway Safety headlight ratings for 287 car models from 27 manufacturers, most with several variants, over 2016 to 2025: 3,386 records and 13,544 individually measured lights, weighted by brand sales share for 2023. The underlying data are the Institute's and are public; the derivation of luminous intensity from them is the author's.

What it reports. Growth in the luminous intensity of the headlamps of the average car over the period of 18 percent for high beams combined, 35 percent for low beams combined and 22 percent for the mean of the two, corresponding to compound annual growth rates of 1.9, 3.4 and 2.2 percent a year. Combined with fleet growth, an estimated total emission

growth of 3.6 to 3.7 percent a year in the United States and European Union and 10.6 percent a year in China. That the rate was larger for low beams than for high beams, which the author takes to suggest faster growth of vehicle-induced emission in urban areas.

The author's own statement of its limits, reproduced because the comment relies on the figures. That the results were obtained "from a limited sample of cars and using very strong additional simplifications, so they should be taken with a grain of salt", and are offered "as a first approximation and as a stimulus for further research on this topic". His considered statement in the discussion is that the results are "strongly suggestive of a steady and non-negligible increase of the vehicle headlight emissions during the last ten years".

What it does not contain, stated because the subject invites the assumption that it does. Any spectral data. The paper reports luminous intensity and luminous flux. It says nothing about wavelength, correlated color temperature or short-wavelength content, and the single occurrence of the word blue in it refers to the color of symbols in a figure. No part of this comment cites it in relation to blue light. It also contains no health content of any kind and reports no exposure of any person.

The purpose for which the comment uses it, and the purpose for which it does not. For one fact: that the emission of vehicle headlamps increased measurably over the last decade, fastest in the low beam. The author's own subject is the contribution of vehicle lighting to skyglow and to the discrepancy between satellite and citizen-science measurements of sky brightness. The Foundation takes no position on that question and asks nothing of this Department in relation to it, consistently with Part II.H.3.

Where it bears. Part VI.B.1, which is written on it. Part II.H.5, for the liaison point about the Insurance Institute dataset. Part V.L, for the research gap.

D.8.2 Newman, Artificial Light at Night and the Predator-Prey Dynamics of Juvenile Atlantic Salmon in Freshwater (2015). Doctoral thesis, catalogued chiefly to record that two of its chapters were published as papers which the comment should cite instead.

Citation. Newman R.C. Artificial Light at Night and the Predator-Prey Dynamics of Juvenile Atlantic Salmon (Salmo salar L.) in Freshwater. Thesis submitted to Cardiff University for the degree of Doctor of Philosophy, Organisms and Environment, School of Biosciences, April 2015. Deposited in the university repository at orca.cardiff.ac.uk, eprint 79119. Approximately two hundred and twenty-four pages. Supervisors: Griffiths, Ormerod and Thomas, all of the Cardiff School of Biosciences.

What this document is, and the rule that governs it. A doctoral thesis, examined for a degree and deposited by its author in an institutional repository. It is original research by a named author with a persistent location and it has not been through the peer review of a journal, which places it in this subsection. But it differs from the preprint above in a way that governs every use of it: the thesis itself states that chapters of it were published as journal articles, so for those chapters a version of record exists and the comment must cite that version and not this one. The Foundation has read the thesis and has not read either paper.

THE PAPERS ARISING, AS THE THESIS LISTS THEM. Riley W.D., Davison P.I., Maxwell D.L., Newman R.C. and Ives M.J. (2015), A laboratory experiment to determine the dispersal response of Atlantic salmon (Salmo salar) fry to street light intensity, Freshwater Biology 60:1016 to 1028. That is the dispersal chapter and it is published. Newman R.C., Ellis T., Davison P.I., Ives M.J., Thomas R.J., Griffiths S.W. and Riley W.D., Toolbox: Light pollution and the cortisol stress response in dispersing Atlantic salmon (Salmo salar) fry, Conservation Physiology, recorded in the thesis as provisionally accepted in 2015 and therefore almost certainly published since. A third paper, on the effect of street lights on the signal crayfish, is listed as submitted to Oecologia and is said not to arise from this thesis.

What the thesis reports, stated as provisional in every particular. Four lines of work. On invertebrate drift in an experimentally lit stream, that light affected the drifting behavior of invertebrates from contrasting taxa with a divergent effect between taxa and between functional feeding groups, some increasing and others decreasing under part-lighting. On dispersing Atlantic salmon fry, that light disrupted the timing and periodicity of nocturnal dispersal behavior at all experimental light intensities, the range tested being 1 to 8 lux. On the physiology of the same animals, that the behavioral change was not the result of a cortisol stress response. And on Atlantic salmon parr, that fish housed under high-intensity light refuged 28 percent more than controls.

TWO OF THOSE FOUR RUN AGAINST THE DIRECTION A READER MIGHT EXPECT, AND THE FOUNDATION RECORDS THEM FIRST. The divergent invertebrate result is not a finding that light suppressed drift; some taxa increased and some decreased, and the thesis draws from that the conclusion that the influence of light is difficult to generalize between taxa and between life stages. And the cortisol result is a negative mechanistic finding reported by the author against the obvious interpretation of her own behavioral data: the fish changed their behavior and the stress hormone did not move. A comment that cited the behavioral disruption without the physiological null would be misrepresenting the work.

The one result that bears on Part V.A.2, and why it is not used there yet. That dispersal was disrupted at all tested intensities, the lowest being 1 lux. Within the range examined no threshold was found, which is the shape of result Part V.A.2 collects. The Foundation does not use it in the body because the figure comes from a thesis chapter whose published version has not been read, and because 1 lux is well above the natural nocturnal illuminances tabulated at Part V.A.2, so the absence of a threshold within 1 to 8 lux says nothing about what happens below it.

A defect in the document, recorded as the Foundation records such things elsewhere. The summary and the table of contents disagree about the chapter numbering. The summary attributes the invertebrate drift work to Chapter 2, dispersal to Chapter 3, cortisol to Chapter 4 and refuging to Chapter 5; the table of contents places the same four at Chapters 3, 4, 5 and 6, Chapter 2 being a quantitative review of the literature. Anyone citing a chapter of this thesis must say which numbering is being used.

What it establishes. For the comment, nothing yet. It establishes that the work exists, that two chapters of it are published, and what the author says she found. Every figure in it is provisional until the published papers are read.

What it does not establish. Anything about human health. Any effect at any spectral composition, the exposure being described only as broad spectrum. And nothing below 1 lux.

Where it bears. Nowhere in the body at present. If the published papers hold, the dispersal paper would bear on Part V.A.2 and the cortisol paper on Part V.F, and both would bear on Part V.I, where the Foundation has twice had to record that salmon are a subject of this literature without being able to cite a primary study.

D.9 Publications of advocacy and membership organizations

This category is created for the same reason and by the same reasoning as D.5, D.6, D.7 and D.8, and the Foundation again states the elimination rather than leaving it to be inferred. A briefing published by an organization that exists to advocate on the subject it is briefing about is not a peer-reviewed article, so Appendix C excludes it by that appendix's own stated criterion, which also excludes organizational publications by name. It is not an opinion adopted by a constituted body on a question referred to it, so it is not within D.1. It is not a standard, not a manufacturer's publication, not a commissioned report, not a reference work, not a technical paper of a standards-body participant, not a peer-reviewed review, and not a preprint of original research. It is therefore placed

here, in a category of its own, and the Foundation states plainly what weight a document of this kind can carry.

It can carry one thing. A statement in it that concedes a limitation adverse to the publisher's own position is worth attending to, because the incentive runs against making it. A statement in it that supports the publisher's position is worth no more than the primary source behind it, which should be obtained and cited instead. The single entry below is used on that basis and on no other, and the Foundation does not cite it for any fact.

D.9.1 International Dark-Sky Association, Artificial Light at Night: State of the Science 2022 — used for its concessions and for nothing else

Citation. International Dark-Sky Association. "Artificial Light at Night: State of the Science 2022." Published at darksky.org, June 2022; the final version is dated 27 May 2022. Eleven pages of text and approximately seven pages of references, three hundred and twenty-one references in all. No authors are named; the byline is the organization. The organization is a United States nonprofit corporation and has since been renamed DarkSky International.

What this document is, and what it is not. A briefing for a general readership, organized into six topics — the night sky, wildlife and ecology, human health, public safety, energy and climate, and light and social justice — with sections on satellite constellations and on research needs. It reports no measurement, no experiment and no original analysis. It is not peer reviewed in the sense a journal uses the term. The document states that it was externally reviewed by subject experts, who are thanked but not named, and describes itself as a living document to be updated.

Its stated method, which the Foundation records because it is unusually explicit. That the main source was a curated database of artificial-light-at-night research literature maintained by the same organization, supplemented by Google Scholar and PubMed. That database is ALAN_DB, described in the entry immediately below and relied on at Part V.A.1 for its existence and scale and for nothing else. That the compilers defined scientific literature as results subjected to at least single-blind external peer review in what they believed to be reputable outlets, considered both open-access and non-open-access papers, and used post-publication citation metrics where available. And that they generally did not consider technical reports, white papers, theses and other grey literature. The Foundation notes without comment that this document is itself of the kind its own method excludes.

What the comment takes. Six sentences, all quoted at Part V.A.3 and two of them taken up again at Part V.M. Three concede that the outdoor human health question is unresolved. Two concede that the satellite instrument cannot record the emission of white light-emitting diodes and that the health studies relying on it are accordingly less reliable. One concedes that claims about outdoor lighting and crime or traffic safety may be fundamentally wrong in either direction, and a seventh, recorded with it, that no known dose-response relationship exists from which an appropriate lighting level could be predicted.

What the comment declines, and why. Everything else. The document contains a large number of arresting figures — that skyglow affects more than 80 percent of all people and more than 99 percent of the populations of the United States and Europe; that white light-emitting diodes account for almost half of global lighting sales; that artificial light is likely responsible for the deaths of millions of birds and insects each year; that at least 160 species have been studied for effects of light exposure; that snow under cloud can raise night sky brightness by thousands of times against an overcast sky with no artificial light. Each is a summary of a cited source written for a general reader. Where this comment needs such a fact it takes it from the source, and several of those sources are already in Appendix C and Appendix D.

The relationship the Foundation discloses. Two of the five authors of the study at Appendix C.139 disclosed in that paper that they serve as uncompensated members of the board of directors of this organization. The disclosure is theirs. The Foundation repeats it so that the

two citations are not read as independent of each other, and records that it bears on neither the instrument specifications taken from that paper nor the concessions taken from this one.

Sources in it worth obtaining. Four. Nadybal, Collins and Grineski (2020), from which the document reproduces population-weighted average zenith night sky brightness by racial and ethnic group for the continental United States; that is a peer-reviewed primary study of disparate exposure in this country and it is not presently in this comment. The study the document cites for a ten-year rate of return on a United States solid-state lighting retrofit program of plus 118.2 percent on electricity savings alone, falling to minus 146.2 percent once health and carbon externalities are included, which bears directly on Part IV.G. The source for the statement that cloud and snow together can raise night sky brightness by thousands of times, which would extend the cloud-amplification material at Part II.D.4. And the source behind the statement that the lighting industry's own standards often do not establish benchmarks on the basis of scientific evidence.

Where it bears. Part V.A.3, which quotes the concessions and which is the principal use. Part V.J.4, where the instrument statement is recorded but is expressly not added to the count of attestations. Part V.M, for the two safety sentences. Part V.A.2, for the dose-response sentence.

D.9.2 DarkSky International and the Loss of the Night Network, ALAN_DB — a public index of the literature, cited for its existence and its scale and not for its contents

Citation. DarkSky International and the Loss of the Night Network. ALAN_DB. Zotero group library number 2913367, published at https://www.zotero.org/groups/2913367/alan_db and accessed October 16, 2026. Undated and continuously revised; no version, edition or persistent identifier is assigned. The maintaining organization was formerly the International Dark-Sky Association and is the publisher of the briefing document described immediately above.

What this is. A shared bibliographic library of research on artificial light at night, hosted on a reference-management service and open to the public. The maintaining organization states on its website that it maintains the database with its partners at the Loss of the Night Network, and that the library is free for public use with no login required.

Where to find it, and where the maintainer's figures are published. The library is at https://www.zotero.org/groups/2913367/alan_db. The statement that the maintaining organization keeps the database with the Loss of the Night Network, that it is free for public use and that no login is required, and the figure of nearly five thousand items, are at https://darksky.org/what-we-do/advancing-responsible-outdoor-lighting/research/. The figures of about four hundred and thirty additions a year, of roughly twenty-two percent annual growth and of four hundred and fifty-seven papers surveyed for 2022 are at https://darksky.org/news/artificial-light-at-night-state-of-the-science-2023-report/, an announcement published July 11, 2023 and updated July 18, 2023, bylined to John Barentine of Dark Sky Consulting LLC. All three were accessed October 16, 2026. The Foundation gives the addresses in the entry because the single proposition this entry supports is that the index is public and free to open, and an entry asserting that a resource is available cannot withhold where it is.

The figures, and which of them the Foundation vouches for. From the maintainer, and adopted by the comment only as the maintainer's statements: that the organization's state-of-the-science briefing drew on nearly five thousand pieces of scientific literature listed in the database; that an average of about four hundred and thirty publications have been added each year in recent years; that the contents have grown by roughly twenty-two percent a year on average; and that the 2023 edition of the briefing surveyed four hundred and fifty-seven papers published in 2022 alone, against three hundred and twenty-one references in the 2022 edition described above. From the Foundation, and vouched for: the library held 6,754 entries on October 16, 2026. Part V.A.1 reconciles the two and reports that the observed count is consistent

with the stated annual additions and not with the stated compound growth rate, which is why the comment does not rely on the latter.

What the comment uses it for, which is one proposition. That a free, public, continuously maintained index of this literature exists, and that the literature is therefore available to be evaluated by anyone who decides to evaluate it. Part V.A.1 draws that conclusion and no other, and in the same passage states that the one hundred and fifty-three articles in Appendix C are about one entry in forty-four of the library as the Foundation counted it on October 16, 2026.

What the comment does not use it for. Anything at all about the content, quality, direction or weight of the literature. A bibliography establishes that records exist. It establishes nothing about what is in them, and the Foundation advances no proposition of fact on the strength of this item. No entry in Appendix C was obtained from it.

Why it is in this subsection rather than another, and the problem with that. It is placed with the publications of advocacy and membership organizations because it is a product of one, and because the briefing immediately above identifies it as that briefing's main source, so the two belong together. But it is not a publication. It is a living web resource with no fixed contents. The Foundation records the awkwardness rather than disguising it.

Limitations, which are serious and are stated before the use. Five. It is mutable: a group library can be altered by anyone with permission to alter it, at any time, and what it contains on the day this comment is filed is not necessarily what it contained when the maintainer counted it or what it will contain when the Department reads this. It is unversioned: there is no snapshot, no archived release and no persistent identifier to cite. Its inclusion and exclusion criteria are not published as a standing editorial policy; the nearest thing is the method statement in the briefing described above, which concerns the briefing and not the library. Its counts are self-reported. And it is maintained by an advocacy organization and a research network rather than by a library, an agency or a journal.

How a federal record should handle a resource of this kind. The Foundation's position is that a live web page should not be relied on in a rulemaking record for any proposition of fact, and this comment relies on it for none. For the one proposition it does support, which is that the index exists and is public, the resource should be retrieved on a stated date, exported, and the dated export lodged with the comment or retained so that it can be produced.

Where it bears. Part V.A.1, in the passage on the asymmetry between what a small nonprofit corporation can do and what the Department can do, and in the Foundation's statement of the size of its own sample. Part IX.H.2, where the request that the Department publish its commissioned literature search is made more precise.

Appendix E — Chronology of Petitions, Litigation, and Congressional Action

This appendix is a dated record of the administrative and judicial filings on which Part IV is built, and of the agency responses to them. Part IV states what the record establishes. This appendix states what the record is, entry by entry, so that the Department can locate any item without relying on the narrative.

E.0 Scope, capacities, and the limits of this appendix

What is included. Petitions, requests, complaints and correspondence submitted by the Soft Lights Foundation to a federal agency, or by Mark Baker to a federal agency or court concerning visible light emitted by light-emitting diode products, together with the responses received. Filings before state bodies are described at Part IV.C.8 and are not repeated here.

Capacities, which this appendix keeps separate. Each entry states whether the document was submitted by the Foundation, by Mr. Baker in his individual capacity, or by both. The distinction matters and Part IV.A.2 explains why. The judicial actions were brought by Mr. Baker individually; the regulatory petitions were submitted by the Foundation, with one exception, noted at its entry, submitted jointly.

Locators. Every entry gives the original locator wherever one exists: a docket number, a case number, a Federal Register citation, or a control or tracking number assigned by the receiving agency. Where no public locator exists, which is the position for most incoming agency correspondence, the entry says so and the Foundation holds the document. This appendix does not cite the Foundation's own website as the authority for any document, consistently with the practice stated at Part IV.A.3.

What this appendix is not. It is not an exhibit list, which Part IV.A.3 commits the Foundation to produce separately and which will number the documents in the order the comment first cites them. It is not a complete account of the Foundation's advocacy, which extends to matters outside this subject. And it is not an argument. The entries record dates, parties, authorities invoked and relief sought. Where an entry bears on a proposition advanced elsewhere in this comment, it says where, and leaves the proposition there.

2021

E.1 December 7, 2021 — Letter to the Administrator of the Environmental Protection Agency

Capacity. The Foundation.

What is known. The document itself is not among those the Foundation has placed before this Department in this appendix. Its existence and date are established by the reply, at E.8, which identifies it as a letter of December 7, 2021 to Administrator Regan. The entry is included because the reply cannot be dated or understood without it.

2022

E.2 June 13, 2022 — Citizen petition to the Food and Drug Administration seeking a performance standard for light-emitting diode products

Capacity. The Foundation, signed by Mark Baker as President.

Authority invoked. 21 C.F.R. §§ 10.25 and 10.30. The petition also refers to the Radiation Control for Health and Safety Act of 1968 without a United States Code citation.

Relief sought. That the agency issue a new regulation at 21 C.F.R. part 1040.40 for light-emitting diode products, setting limits on spatial non-uniformity, on chip-level peak

luminance and peak radiance, on spectral power distribution, and on square wave flicker. The requested rule is the one Part IX.I discusses in its present form.

Locator. Docket No. FDA-2022-P-1151. The docket number field on the face of the petition is blank, the number having been assigned on receipt. Twenty-six pages.

Disposition. Interim response November 7, 2022, at E.11. Denied with three other petitions by the Final Response of May 24, 2024, at E.42.

E.3 August 5, 2022 — Petition to the National Highway Traffic Safety Administration for an order of non-compliance, model year 2021 Ford Bronco

Capacity. The Foundation. Addressed to Steven Cliff, Director.

Authority invoked. 49 C.F.R. part 552, subpart A. The petition also quotes section 103(a) of the Act.

Relief sought. That the agency issue Ford an order of non-compliance, and notify the public that light-emitting diode headlamps do not comply with federal safety regulations. Eleven pages.

Disposition. Denied with E.4 and E.7 at E.15.

E.4 August 11, 2022 — Petition to the National Highway Traffic Safety Administration for an order of non-compliance, model year 2021 Tesla Model 3

Capacity. The Foundation. Addressed to Steven Cliff, Director.

Particulars. Same authority and same relief as E.3, directed to Tesla. Eleven pages. Denied at E.15.

E.5 August 16, 2022 — First request to the Food and Drug Administration under the Freedom of Information Act

Capacity. Mark Baker individually.

Locator. Agency confirmation number FDA22085814. Freedom of Information Act Control No. 2022-6020, acknowledged August 17, 2022.

Where it bears. This is the first of the two requests at issue in the action at E.45. Part IV.D.3 describes the litigation.

E.6 September 7, 2022 — Response of the Occupational Safety and Health Administration

Document. Letter from Douglas L. Parker, Assistant Secretary for Occupational Safety and Health, United States Department of Labor, to Mark Baker as President of the Foundation.

What it says. That the agency does not plan to add the topic to its regulatory agenda at this time, and that its Directorate of Standards and Guidance will review the scientific literature and determine whether there are other appropriate approaches to address electromagnetic radiation from light-emitting diode devices in the workplace.

Locator. None assigned. The Foundation holds the letter.

Where it bears. Part II.H, on the liaison duty, and Part VIII. The Foundation records that the second sentence is a commitment to review rather than a denial of authority, which distinguishes this response from those at E.8 and E.12.

E.7 September 9, 2022 — Petition to the National Highway Traffic Safety Administration for an order of non-compliance, model year 2022 Rivian R1T

Capacity. The Foundation. Addressed to Steven Cliff, Director.

Particulars. Same relief as E.3 and E.4, directed to Rivian. This petition cites 49 C.F.R. § 571.108 expressly. Eleven pages. Denied at E.15.

E.8 October 7, 2022 — Response of the Environmental Protection Agency

Document. Letter from Lee Ann B. Veal, Director, Radiation Protection Division, Office of Radiation and Indoor Air, to Mark Baker as President of the Foundation, replying to the letter at E.1.

The operative sentence. That Congress has not granted the agency any statutory authority to regulate visible light or non-ionizing radiation.

Locator. None appears on the document.

Where it bears. Part II.H and Part IV.H.5. This is a federal agency disclaiming authority over the emission in terms, and the Foundation offers it for that and for nothing more. It does not establish that the agency is right about the limits of its own authority.

E.9 October 19, 2022 — Letter from the Federal Highway Administration

Document. Letter from Sharon J. Field, ADA Team Leader, Office of Civil Rights, Federal Highway Administration, 1200 New Jersey Avenue SE, Washington, D.C., digitally signed October 19, 2022. The letter bears two references of its own: In Reply Refer to HCR-40, and DOT number 2022-0375.

What it responds to. A complaint under the Americans with Disabilities Act and Section 504 of the Rehabilitation Act of 1973, submitted by Mr. Baker to the Department of Justice, which transferred it to the Department of Transportation. The complaint was against three cities, named in the letter as Ashland, Oregon, Little Canada, Minnesota, and Penn Yan, New York, and alleged that their installation and use of rectangular rapid flashing beacons discriminates against Mr. Baker and other individuals with disabilities by inducing, in the letter's words, disorientation, visual impairment, anxiety, fear, seizures, and other medical and health issues.

The disposition. Dismissal without further investigation. The letter states that there is no statutory requirement that every complaint under Title II receive a full investigation, citing the Department of Justice's 2010 final rule at 75 Fed. Reg. 56,163, 56,228 (Sept. 15, 2010), and sets out the factors an enforcement agency considers: whether a violation may have occurred, how limited resources are best spent, and whether the enforcement action fits the agency's overall policies. It notes the right to bring a private suit under section 203 of the Act at any time, per 28 C.F.R. § 35.172(d).

The sentence this comment relies on, quoted in full. "The allegations you have raised about the health impacts of RRFBs raise complex issues related to the regulation of all Light Emitting Diode (LED) lights, not just those used in RRFBs, that extend beyond FHWA's authority."

Where it bears. Part II.H, Part VIII.E.6 and Part IX.E. This is the clearest jurisdictional statement in this appendix, and it is clearer than the Foundation had previously recorded. The agency did not merely decline the complaint on resource grounds, although it did that too. It identified the subject of the complaint as the regulation of light-emitting diode lights generally, said so in terms by adding that the issues are not confined to the devices complained of, and placed that subject beyond its own authority. The agency whose Manual authorized the device, asked about the health effects of the light the device emits, named the subject of this comment and said it belongs somewhere else.

One connection the Foundation draws to the next entry but one. Little Canada, Minnesota is one of the three cities named in this complaint. Part VIII.E.6 sets out what happened when a state agency took up the same city and the same class of device.

What became of the three cities. Little Canada: a charge to the Minnesota Department of Human Rights produced a finding of probable cause on June 15, 2023, after which the State took no further step and no remedy followed. Ashland: Mr. Baker brought an action in state superior court in his individual capacity and dismissed it voluntarily on moving from Oregon to California, with no decision on the merits. Penn Yan: no further action occurred. Part VIII.E.6.

Capacity. The Foundation together with four named individuals, MarieAnn Cherry, Kristina Townsend, Heidi O'Leary and Kristin Campisi, described in the document collectively as Advocates.

What it is. A submission responding to the agency's request for comments on the petition at E.2, addressing neurological, psychological, circadian and ocular matters and reproducing case reports. Fifty-nine pages.

A characterization this comment should not carry forward. Part IV.C.1 describes this document as an update to the petition filed by the Foundation. On its face it is a comment on the docket, and it has five submitting parties rather than one. The discrepancy is not resolved here.

E.11 November 7, 2022 — Interim response of the Food and Drug Administration on Docket No. FDA-2022-P-1151

What it says. That the agency has been unable to reach a decision because the petition raises issues requiring further review, issued under 21 C.F.R. § 10.30(e)(2)(iv). The text is quoted at Part IV.F.5 as relayed through the inquiry at E.19.

E.12 November 9, 2022 — Response of the Federal Aviation Administration on jurisdiction

Document. Letter from Michael A. P. Meyers, P.E., Manager, Airport Engineering Division AAS-100, Office of Airport Safety and Standards.

What it says. That the agency provides standards and guidance for certain types of airport and obstruction lighting but is not a regulatory agency on light-emitting diode requirements, and that it defers to other agencies depending on the issue. It then states that it would defer to the Food and Drug Administration for comfort, health, and safety regulations, and to the Occupational Safety and Health Administration for specific topics such as cockpit lighting.

Locator. None appears on the document.

Where it bears. Part II.H, and Part IX.I. The Foundation draws attention to one word. A federal agency asked which body regulates this emission answered that it would defer to this Department for comfort as well as for health and safety. The Foundation does not suggest that a sister agency's letter enlarges the authority of § 360kk. It records that the agency which deferred understood the subject to include the quality this comment calls comfort, and did not treat it as outside the field.

E.13 November 23, 2022 — Petition to the Federal Highway Administration to repeal the Interim Approval for rectangular rapid flashing beacons

Capacity. The Foundation. No individual signatory is named on the document. Addressed to the Department of Transportation and the Federal Highway Administration.

Authority invoked. The Administrative Procedure Act, and the reservation in the Interim Approval itself that the agency may rescind it at any time. The petition also refers to the Radiation Control for Health and Safety Act, the Americans with Disabilities Act and the Rehabilitation Act.

Relief sought. That the agency repeal the Interim Approval for rectangular rapid flashing beacons. The petition addresses the 2009 edition of the Manual on Uniform Traffic Control

Devices, chapter 4L, and cites the Interim Approval by the agency's own web address, whose path component reads ia21. Twenty-two pages.

Locator. No docket number appears for this petition. The document cites the letter at E.9 and the petition at E.2.

Where it bears. Part IV.E.1 and Part VI.C. This petition and the request at E.46 are the Foundation's filings on these devices before this Department's sister agency, and neither is presently described in Part IV.

E.14 November 7, 2022 — Email from the Consumer Ombudsman of the Consumer Product Safety Commission on that agency's jurisdiction

Document. Electronic mail from Jonathan Midgett, Ph.D., Consumer Ombudsman, Office of the Executive Director, United States Consumer Product Safety Commission, sent November 7, 2022 at 7:15 a.m., to Mark Baker and to the agency's consumer address.

What it says. That the agency's staff evaluates products on an individual basis and that its jurisdiction over LED lights depends on the hazard; that the agency may have jurisdiction over LED lights for hazards such as electrocution and fire, but does not have jurisdiction over LED lights under the Consumer Product Safety Act if the risk is related to electronic product radiation that may be regulated by the Food and Drug Administration; and it then quotes 15 U.S.C. § 2080(a), with a bracketed note of the Commission's own recording that the referenced provisions of the Public Health Service Act were later transferred to 21 U.S.C. § 360hh.

Locator. None assigned. The Foundation holds the message.

Where it bears. Part II.H.9, which is written on it and which quotes it, and Part II.M. Part VI.M.3 and Part IX.E.4 proceed on the statutory bar rather than on this message, and the division of authority they describe is the division this message states.

A correction recorded here. An earlier state of this appendix marked this entry unread, because the copy of the message in the Foundation's files is an image scan without a text layer. That was wrong as to the comment: the message had already been read and was already quoted accurately at Part II.H.9. The error was in this appendix and not in the body.

E.15 December 8, 2022 — Denial of the three petitions for orders of non-compliance

Document. Soft Lights Foundation, Denial of Petition for Decision of Non-Compliance Order, 87 Fed. Reg. 75,327 (Dec. 8, 2022), Docket No. NHTSA-2022-0109, signed by the Associate Administrator for Enforcement.

Why this entry matters more than the outcome. Because of what the published reasoning states. Part IV.C.3 sets it out at length, including the agency's statements that this Department has authority to regulate certain aspects of light-emitting diode products as radiation-emitting devices and that there is currently no performance standard for such products in part 1040.

E.16 December 10, 2022 — Petition to the National Highway Traffic Safety Administration to require lamps obeying the inverse square law

Capacity. The Foundation. Addressed to Ann Carlson, Director.

Authority invoked. 49 C.F.R. part 552, subpart A.

Relief sought. That 49 C.F.R. § 571.108 be amended to add a provision requiring that all lamp sources emit visible radiation that is spatially uniform and follows an inverse square law for dispersion. Part V.B.2 and Part VI.B address the physics; Part V.B.8 addresses the point-source question the agency answered at E.15.

Extent. One hundred and forty-six pages, of which the petition occupies the first fifteen and an appendix of public comments the remainder.

E.17 December 15, 2022 — Second request to the Food and Drug Administration under the Freedom of Information Act

Capacity. Mark Baker individually.

Locator. Freedom of Information Act Control No. 2022-8833. Tracking number 23-0024AA, assigned March 9, 2023, the agency having invoked unusual circumstances.

Where it bears. The second of the two requests at issue in the action at E.45.

2023

E.18 January 22, 2023 — Citizen petition to the Food and Drug Administration concerning light-emitting diode strobe and flashing lights

Capacity. The Foundation.

Locator. Docket No. FDA-2023-P-0233.

Disposition. Interim response June 30, 2023, at E.29. Denied by the Final Response of May 24, 2024, at E.42.

Status of this entry. The particulars are taken from Part IV.C.1 and from the Final Response. The docket itself has not been read. See item (4) of the note at E.0.

E.19 February 16, 2023 — Inquiry of Senator Maria Cantwell to the Food and Drug Administration

What it was. An inquiry on behalf of a constituent as to the status of citizen petition FDA-2022-P-1151. The agency's reply was relayed by the Senator's office on March 21, 2023, at E.22, and is quoted at Part IV.F.5.

E.20 February 26, 2023 — Letter to the Chair of the Equal Employment Opportunity Commission

Capacity. The Foundation. Addressed to Charlotte Burrows, Chair.

What it sought. The letter states no request for action. Its stated purpose is to alert the Commission to what it describes as fundamental safety and federal legal issues, and it contends that an employer is required by the Americans with Disabilities Act to remove the barriers to access created by the use of light-emitting diode products. Three pages.

Where it bears. Part VIII. The Foundation records that this document is correspondence rather than a petition or a charge, that no reference number was assigned, and that no response is recorded.

E.21 March 21, 2023 — Denial by the Department of Energy of the petition to repeal the 45 lumens-per-watt rule

Locator. Document ID EERE-2023-BT-PET-0003-0003.

Where it bears. Part IV.G, which sets out the lamp efficiency framework and this denial.

E.22 March 21, 2023 — Reply of the Food and Drug Administration relayed through the office of Senator Cantwell

What it says. That an interim response to citizen petition FDA-2022-P-1151 issued on November 7, 2022 under 21 C.F.R. § 10.30(e)(2)(iv), the agency having been unable to reach a decision because the petition raises issues requiring further review. Quoted at Part IV.F.5.

E.23 April 2, 2023 — Consumer report to the Federal Trade Commission

What it is, stated before anything else. Not a petition. It is a consumer report submitted through that agency's public fraud reporting portal, ReportFraud.ftc.gov, on a form headed Consumer Report To The FTC. It invokes no statutory or regulatory authority, seeks no rulemaking, and is not a filing in any docket. The Foundation states this at the head of the entry because the file name under which the document has been kept describes it as a submission, and because an appendix of petitions and litigation could otherwise be read as presenting it as one.

Capacity. Submitted in the name of Mark Baker, with the Foundation's electronic mail address, and signed in the body of the report as President of the Foundation.

Locator. Federal Trade Commission Report Number 158396451. The confirmation page was generated April 3, 2023.

What it asked. That the Commission direct lighting manufacturers to warn consumers that LED general service lamps have not been vetted or approved by the Food and Drug Administration, and that the Food and Drug Administration has not set restrictions on peak luminance, dispersion characteristics, spectral power distribution and square wave flicker. Those are the same four quantities the petition at E.2 asked this Department to limit, and Part I.G groups them as the spectral, spatial and temporal families.

What the agency's own confirmation says. That the Commission cannot resolve individual complaints and cannot resolve the individual report, that reports are shared with law enforcement partners and used to spot trends, and that it provides information about next steps. No substantive response is recorded.

A proposition in it that this comment does not adopt. The report states that LED visible radiation has been proven to be hazardous and that it is a health hazard. This comment makes no such claim. Part V.A states what the literature does and does not establish, and Part IX.C asks for the research that would be needed to support a finding of that kind. The entry records the document as written rather than softening it, and the Foundation does not ask the Department to read the assertion as its position in this proceeding.

Relationship to E.37. Distinct. The petition at E.37, of November 26, 2023, is a rulemaking request to the same Commission seeking the publication of luminance on product labeling. This is a consumer report on a complaint form seven months earlier. The question recorded in the earlier state of this entry, whether the two were the same document, is answered: they are not.

E.24 April 26, 2023 — Letter to the Assistant Attorney General for Civil Rights

Capacity. The Foundation. Addressed to Kristen Clarke, Assistant Attorney General for Civil Rights, United States Department of Justice.

What it sought. A federal civil rights investigation. Three pages.

What this comment does with it. Nothing, and the Foundation states that deliberately. The letter frames the matter as a violation of a civil right to visual freedom. That is not the frame of this comment, which proceeds on the statutory duties of 21 U.S.C. §§ 360ii and 360kk, and the entry is included for completeness of the record rather than for the proposition.

E.25 May 24, 2023 — Citizen petition to the Food and Drug Administration by Americans for Responsible Technology and others

Capacity. Not the Foundation. Neither the Foundation nor Mr. Baker is a signatory and neither name appears in the document.

What it is. A citizen petition titled Citizen Petition and Request for Legal Compliance: Legal Obligations of FDA Regarding Public Exposure to Non-Ionizing Radiation from Electronic Products, submitted to the Division of Dockets Management by Americans for Responsible

Technology as lead petitioner with Grassroots Environmental Education, Consumers for Safe Cell Phones, the California Brain Tumor Association, Manhattan Neighbors for Safer Telecommunications and five named individuals, certified by Douglas A. Wood as Founder and National Director.

Why it is recorded here. Because it is a petition to the same agency under the same subchapter in the same period, directed to the same statutory duties, by petitioners unconnected with the Foundation. That is a fact about the administrative record rather than about the Foundation, and Part II.E bears on it. Its subject is radiofrequency rather than visible light, and the Foundation does not adopt its contentions.

Status of this entry. The docket number has not been established and the page count is not determined. Item (5) of the note at E.0 records the question whether this entry belongs in this appendix at all.

E.26 May 29, 2023 — Petition to the National Highway Traffic Safety Administration to consult and maintain liaison with the Food and Drug Administration

Capacity. The Foundation. Addressed to Ann Carlson, Acting Director.

Authority invoked. 49 C.F.R. part 552, subpart A; 21 U.S.C. § 360ii(a)(3) and (a)(6), both quoted in the petition; and 49 C.F.R. § 1.94(b), cited in the document as section 194(b).

Relief sought. That the agency consult and liaise with the Food and Drug Administration and publish performance standards for all categories of light-emitting diodes used on vehicles. Seven pages.

Where it bears. Part II.H and Part IX.E. This is the first of four petitions, at E.26, E.27, E.28 and E.31, by which the Foundation asked four separate federal agencies to initiate the liaison that § 360ii(a)(3) and (a)(6) place on this Department. The Foundation records that it directed the request to the other agencies as well as to this one, and that the statutory duty it invoked is this Department's.

E.27 May 30, 2023 — Petition to the Department of Energy to consult and maintain liaison with the Food and Drug Administration

Capacity. The Foundation. Addressed to Jennifer Granholm, Secretary.

Authority invoked. 5 U.S.C. § 553(e); 21 U.S.C. § 360ii(a)(3) and (a)(6), quoted; 10 C.F.R. §§ 851.10 and 1041.130; and 5 U.S.C. §§ 551 to 559.

Relief sought. That the Department of Energy develop and publish performance standards for the visible radiation emitted by products using light-emitting diodes, and consult and liaise with the Food and Drug Administration. The petition cites that Department's rule dockets EERE-2021-BT-STD-0005 and EERE-2021-BT-STD-0012. Eight pages.

Where it bears. Part IV.G.6, on the liaison duty in the lamp efficiency context.

E.28 June 5, 2023 — Petition to the Architectural and Transportation Barriers Compliance Board to consult and maintain liaison with the Food and Drug Administration

Capacity. The Foundation. Addressed to Sachin Pavithran, Executive Director.

Authority invoked. 5 U.S.C. § 553(e); 21 U.S.C. § 360ii, including subsections (a)(3) and (a)(6), quoted; and the Americans with Disabilities Act. The Board's own authority under 29 U.S.C. § 792 is not cited.

Relief sought. That the Board coordinate with the Food and Drug Administration to develop and publish performance and accessibility requirements for visible radiation from light-emitting diode products. Twelve pages.

Three state and local matters cited in it. New York Public Service Commission Case No. 21-02623; Alaska State Commission for Human Rights No. J-22-097; and a Minnesota matter numbered Q-107420. Part IV.C.8 addresses state proceedings. None of the three is presently cited in this comment by number.

E.29 June 30, 2023 — Interim response of the Food and Drug Administration on Docket No. FDA-2023-P-0233

Particulars. Recorded at Part IV.C.1. The document has not been read for this appendix and its text is not characterized here.

E.30 July 28, 2023 — Letter from Representative Mike Thompson to the Commissioner of Food and Drugs

Author. Mike Thompson, Member of Congress, on the letterhead of the House of Representatives. One signatory.

Addressee. Robert M. Califf, Commissioner of Food and Drugs, United States Food and Drug Administration, Department of Health and Human Services, 10903 New Hampshire Avenue, Silver Spring, Maryland.

What it conveys. Concerns from constituents regarding excessively bright automotive headlights and the effect on the safety of other drivers, and the writer's own observation that certain vehicle lights are excessively bright and problematic to other drivers at night. It reports a National Highway Traffic Safety Administration finding that thirty percent of respondents said they had experienced disturbing nighttime headlight glare.

The statutes it puts to the Commissioner. 21 U.S.C. § 360ii(a), for the direction to establish an electronic product radiation control program by, among other things, promulgating performance standards for electronic products; and 21 U.S.C. § 360kk(a), quoted for the direction that the Secretary shall by regulation prescribe performance standards for electronic products to control the emission of electronic product radiation from such products if he determines that such standards are necessary for the protection of the public health and safety.

What it asks. That the Commissioner give full and fair consideration to prescribing performance standards for automotive light-emitting diode headlights that would address the health and safety issues related to excessively bright headlights.

What it also records. That the National Highway Traffic Safety Administration issued a rule on February 15, 2022 permitting automakers to install adaptive driving beam headlights on new vehicles, as required by the Bipartisan Infrastructure Law, and that the rule only permits such headlights and does not require them to be installed. Part VI.B and Part II.H.5 address that proceeding.

Where it bears. Part IV.F.5 and Part IX.I. This is the stronger of the two letters from Members of Congress to the officer holding the authority of § 360kk. It does not merely raise a concern. It quotes the standard-setting provision to the officer who holds it and asks him to consider exercising it, by name, for a named product class. It is dated ten months before the Final Response at E.42 found that no standard was necessary.

E.31 July 22, 2023 — Petition to the Occupational Safety and Health Administration to consult and maintain liaison with the Food and Drug Administration

Capacity. The Foundation. Addressed to Douglas Parker, Assistant Secretary of Labor.

Authority invoked. 5 U.S.C. § 553(e); 29 U.S.C. § 651, including subsection (b), quoted; and 21 U.S.C. § 360ii, the liaison provisions being quoted as numbered paragraphs rather than by subsection label.

Relief sought. That the agency consult and liaise with the Food and Drug Administration and publish performance standards for all categories of light-emitting diode products. Eight pages.

Relationship to E.6. This petition postdates that agency's letter of September 7, 2022 by about ten months. The letter had said the agency would review the scientific literature and determine whether other approaches were appropriate. No further response is recorded.

E.32 August 26, 2023 — Petition to the Architectural and Transportation Barriers Compliance Board to amend the public right-of-way accessibility guidelines

Capacity. The Foundation. Addressed to Sachin Pavithran, Executive Director.

Locator. The rule is identified on the face of the cover letter as Rule ATBCB 2011-0004. The body of the letter and the petition render the same number as ARBCB 2011-0004, which the Foundation records as a typographical error in its own document.

The rule concerned. Accessibility Guidelines for Pedestrian Facilities in the Public Right-of-Way, published August 8, 2023.

Relief sought. That the Board amend the final rule so that it does not promote, recommend, authorize or mention the use of rectangular rapid flashing beacons, and that any mention of flashing or strobing lights be qualified. Six pages.

Where it bears. Part IV.E.1 and Part VI.C. Like E.13, this filing is not presently described in Part IV.

E.33 September 7, 2023 — Citizen petition to the Food and Drug Administration concerning light-emitting diode vehicle lights, published on the docket

Locator. Docket No. FDA-2023-P-3828. Part IV.C.1 records this as the date of publication on the docket rather than of submission, and the distinction is the subject of item (2) of the note at E.0.

Disposition. Denied by the Final Response of May 24, 2024, at E.42.

E.34 September 11, 2023 — Citizen petition to the Food and Drug Administration concerning light-emitting diode street lights, published on the docket

Locator. Docket No. FDA-2023-P-3879.

Disposition. Denied by the Final Response of May 24, 2024, at E.42.

E.35 September 23, 2023 — Request to the Office of Defects Investigation of the National Highway Traffic Safety Administration

Capacity. The Foundation. Addressed to Cem Hatipoglu, Acting Director, Office of Defects Investigation.

What it sought. That the Office open an investigation into the automotive industry's change to light-emitting diode headlights and report to Congress, with an initial report by November 1, 2023 and further reports every three months. The document describes itself as a formal request rather than a petition, and was sent by electronic mail. Five pages.

Other matters it cites. Docket No. NHTSA-2022-0109, the denial at E.15; citizen petition FDA-2023-P-3828, at E.33; and a case of the Office of Inspector General of the Department of Transportation numbered EM230821-01. The last is not presently cited anywhere in this comment and should be established.

E.36 October 3, 2023 — Letter from Representative Mark Pocan to the Commissioner of Food and Drugs

Author. Mark Pocan, Member of Congress. One signatory.

Addressee. Robert Califf, M.D., Commissioner of Food and Drugs.

What it asks. That the Commissioner carefully consider the health and safety impacts of light-emitting diode headlights, and it encourages him to consider promulgating such a standard.

Where it bears. Part IV.F.5, which cites this letter. The Foundation records that this is a request that the Commissioner consider a standard, made by a Member of Congress to the officer holding the authority of § 360kk, about seven months before the Final Response at E.42 issued.

E.37 November 26, 2023 — Petition to the Federal Trade Commission to require publication of luminance

Capacity. The Foundation. No official is named.

Authority invoked. 21 U.S.C. §§ 360hh to 360ss; 21 U.S.C. § 360ii; and 21 C.F.R. § 1040.10, cited by analogy for the radiance restrictions applied to laser products.

Relief sought. That the Lighting Facts label be modified to include intensity in nits, and that all products using light-emitting diodes be required to show the luminance of the diodes on specification sheets, in user manuals, in marketing materials and on product websites. Thirteen pages.

Where it bears. Part IX.F, which asks this Department to require disclosure of emission characteristics. The Foundation records that it sought the same disclosure from another agency two and a half years earlier, and that the quantity it asked to have published is the quantity Part V.B.2 identifies as governing.

E.38 December 25, 2023 — Petition to the National Highway Traffic Safety Administration for an order of non-compliance, model year 2023 Jeep Grand Wagoneer

Capacity. The Foundation. Addressed to Ann Carlson, Acting Director.

Relief sought. That the agency issue Stellantis an order of non-compliance for the vehicle, and direct Stellantis to comply with 5 U.S.C. §§ 551 to 559 for light-emitting diode headlights. Fifteen pages, of which the petition occupies eight and an appendix the remainder.

Status. The disposition has not been established.C.3 records the decision still to be taken on whether the model-specific petitions after the first three are listed in the body at all.

2024

E.39 January 22, 2024 — Baker v. Food and Drug Administration, No. 2:24-cv-00278-DC-SCR (E.D. Cal.)

Capacity. Mark Baker individually, pro se. The Foundation is not a party.

Dates. The complaint is dated January 19, 2024 in the signature block. Part IV.D.1 gives January 22, 2024 as the date of filing. The copy read for this appendix bears no case number or filing stamp, the number having been assigned on filing.

Defendants. The Food and Drug Administration; Jeffrey Shuren, Director of the Center for Devices and Radiological Health; Robert M. Califf, Commissioner of Food and Drugs; the Department of Health and Human Services; and Xavier Becerra, Secretary, each official defendant in an official capacity.

Counts. Three. Agency action without observance of procedure required by law, and agency action contrary to constitutional right, both under the Administrative Procedure Act; and equal protection under the Fifth Amendment.

Relief sought. Orders compelling compliance with 21 U.S.C. § 360ii(a) and its subsections and with § 360jj, and orders requiring the agency to act on each of the four citizen petitions within stated periods. Thirty-six pages including appendices A through J.

A defect in the complaint, recorded as found. The prayer for relief identifies the vehicle lights petition as FDA-2023-P-2838. Paragraph 50 of the same complaint gives FDA-2023-P-3828, which is the correct number. The Foundation records the discrepancy in its own filing rather than leaving it to be discovered.

Disposition. Voluntarily dismissed. Part IV.D.1.

E.40 February 24, 2024 — Petition to the National Highway Traffic Safety Administration to limit headlamp intensity

Capacity. The Foundation. Addressed to Sophie Shulman, Acting Director.

Relief sought. That Table XIX-a of Federal Motor Vehicle Safety Standard No. 108 be updated to set an overall maximum intensity for any point in space at 100 feet from the source, the petition proposing 20,000 candelas or such other value as the agency determines appropriate. Six pages.

Note on the date. The document is dated February 24, 2024. Part IV.C.4 should be checked against that date.

E.41 May 15, 2024 — Petition to the National Highway Traffic Safety Administration to limit correlated color temperature

Capacity. The Foundation. Addressed to Sophie Shulman, Acting Director.

Authority invoked. 49 C.F.R. part 552, subpart A, and 21 U.S.C. § 360ii(a)(6), quoted.

Relief sought. That Federal Motor Vehicle Safety Standard No. 108 be amended to add a section S10.19 on spectral power distribution, setting the correlated color temperature of headlights and daytime running lights to a minimum of 2000 K and a maximum of 2900 K, or such other values as that agency and the Food and Drug Administration determine. Eighteen pages.

A limit the Foundation states itself. Part V.B.3 and Part V.I record that correlated color temperature does not describe the spectral content of a source and that reducing it addresses only one of three levers. This petition is recorded as part of the chronology, not as a position this comment adopts in that form.

E.42 May 24, 2024 — Final Response of the Food and Drug Administration denying four citizen petitions

Document. Signed by Ellen J. Flannery, J.D., Deputy Center Director for Policy and Director of the Office of Policy, Center for Devices and Radiological Health. It disposes together of Docket Nos. FDA-2022-P-1151, FDA-2023-P-0233, FDA-2023-P-3828 and FDA-2023-P-3879.

Locator. In the district court record at ECF No. 9-2 in No. 2:24-cv-02558-DC-SCR.

Where it bears. Part I.C, where it is examined, and throughout Part II, where its stated grounds are tested. It is the determination this comment principally addresses.

E.43 June 11, 2024 — Request by Representative Mike Thompson for a congressional hearing

Author. Mike Thompson, Member of Congress. One signatory.

Addressee. Cathy McMorris Rodgers, Chair, and Frank Pallone, Ranking Member, Committee on Energy and Commerce of the House of Representatives.

What it asks. A hearing with the full committee or the relevant subcommittee, requested as a means of creating a safer driving environment for all.

Where it bears. Part IV.F.5. The Foundation records that the request was made to the committee of jurisdiction over this Department, eighteen days after the Final Response at E.42, and that no hearing is recorded as having been held.

E.44 September 22, 2024 — Baker v. Food and Drug Administration and National Highway Traffic Safety Administration, No. 2:24-cv-02558-DC-SCR (E.D. Cal.)

Capacity. Mark Baker individually. No attorney appears in the signature block.

Defendants. The Food and Drug Administration; Michelle Tarver, Acting Director of the Center for Devices and Radiological Health; Robert Califf, Commissioner; the Department of Health and Human Services; Xavier Becerra, Secretary; the National Highway Traffic Safety Administration; Sophie Shulman, Deputy Administrator; the Department of Transportation; and Pete Buttigieg, Secretary.

Counts. Two, both under the Administrative Procedure Act: agency action unlawfully withheld, and agency action not in accordance with law.

Statutes quoted in the complaint. 21 U.S.C. § 360ii(a)(6)(A); 21 U.S.C. § 360kk(f)(1)(A); 5 U.S.C. § 702; and 5 U.S.C. § 706(1).

Relief sought. An order directing the two agencies to establish and maintain a liaison on testing and evaluating visible light from light-emitting diode vehicle headlamps, and an order directing the Food and Drug Administration to reconstitute the Technical Electronic Product Radiation Safety Standards Committee with full membership and meetings at least quarterly. Twenty-four pages.

Where it bears. Part II.H and Part IX.H, which ask for the same two things of this Department directly. Part IV.D.2 describes the action.

2025

E.45 January 2025 — Baker v. Food and Drug Administration, action under the Freedom of Information Act on the 2022 requests

Capacity. Mark Baker. No attorney appears in the signature block.

Dates. The complaint is dated January 20, 2025 in the signature block. The copy read for this appendix bears no case number or filing stamp.

Requests at issue. The two requests at E.5 and E.17: that of August 16, 2022, agency confirmation FDA22085814, Control No. 2022-6020; and that of December 15, 2022, Control No. 2022-8833, tracking number 23-0024AA.

Count. One, for violation of the Freedom of Information Act, 5 U.S.C. § 552, by the withholding of non-exempt responsive records. Ten pages.

THIS ACTION IS NOT DESCRIBED IN PART IV. Part IV.D lists three actions, and the Freedom of Information Act action it describes at Part IV.D.3 is a different one: No. 2:26-cv-02776-DJC-CSK, brought on the 2025 request at E.48 and concerning Control No. 2025-3046. This earlier action, on the 2022 requests, is absent from the comment. Its case number and disposition have not been established and this appendix asserts neither.

E.46 January 25, 2025 — Request to the Federal Highway Administration under the Freedom of Information Act

Capacity. The Foundation, signed by Mark Baker as President. Addressed to the Office of Administration.

What it sought. Nine categories of record concerning rectangular rapid flashing beacons: the approval of the devices in the Manual on Uniform Traffic Control Devices; the rejection of a civil rights complaint of June 29, 2022; the decision not to act on the petition at E.13; records of that agency's dealings with the Food and Drug Administration concerning these devices, including any decision on liaison as to testing, evaluation and performance standards; records of its dealings with the Access Board; records on testing and evaluating the health and safety of the devices, including effects on individuals with light sensitivity; records of reported harm; records on limits for intensity and digital pulsing; and a Vaughn index for any withheld document. Two pages.

Locator. No tracking number is stated on the document.

Where it bears. Part II.H. The fourth category is a request, directed to the other agency, for the records of the liaison this comment says did not occur. Whether any record was produced has not been established.

E.47 January 25, 2025 — Request to the Department of Energy under the Freedom of Information Act

Capacity. The Foundation, signed by Mark Baker as President. Addressed to the FOIA Request Service Center.

What it sought. Records for 2005 to 2024 on the decisions to grant categorical exclusions under the National Environmental Policy Act for the 45 and 120 lumens-per-watt general service lamp rules; communications with the Food and Drug Administration on the human health impacts of visible light from electronic products; communications with the Environmental Protection Agency on light pollution; that Department's definitions of less environmental impact, cumulative impact to human health, cumulative impact to environment, and significant; and a Vaughn index. Three pages.

Documents it names. The categorical exclusion of April 4, 2022, document CX-026079; and the denial at E.21, EERE-2023-BT-PET-0003-0003.

Where it bears. Part IV.G.7, on the categorical exclusions, and Part IV.H, on the National Environmental Policy Act.

E.48 March 30, 2025 — Request to the Center for Devices and Radiological Health under the Freedom of Information Act

Capacity. Dual. Submitted by Mr. Baker individually and, in the accompanying cover letter, by him as President of the Foundation. Two signature blocks appear, which the agency admits. Part IV.D.3.

What it sought. Eighteen items. Records of the Radiation Control Program as applied to fourteen named product categories, of which two are regulated (microwave ovens under 21 C.F.R. § 1030.10, and light-emitting products under §§ 1040.10, 1040.11, 1040.20 and 1040.30) and twelve are not; records under 21 U.S.C. § 360ii(a)(6)(A) as to ten named federal agencies; all reports of adverse reactions involving radiofrequency exposure; all reports of adverse reactions involving visible light exposure; and a Vaughn index. Three pages.

Locator. Automated reference FDA25112488, assigned the same day. Freedom of Information Act Control No. 2025-3046, assigned on or about April 4, 2025.

Where it bears. Part IV.D.3, which describes the litigation that followed, and Part IV.I.6. The division of the fourteen categories into two regulated and twelve not is the division this comment draws throughout.

E.49 December 30, 2025 — Petition to the Food and Drug Administration to conduct the study and report to Congress required by 21 U.S.C. § 360jj(a)(2)

Capacity. Jointly. The petition carries two signature blocks: Mark Baker as an individual, and Mark Baker as President of the Foundation. It is the only petition in this appendix submitted in both capacities.

Authority invoked. 21 C.F.R. §§ 10.25 and 10.30, including § 10.30(e)(2), which the petition quotes for the requirement that the Commissioner furnish a response within 180 days; 21 U.S.C. § 360jj(a) and (a)(2); 21 U.S.C. § 360ii, described in the petition as a non-discretionary mandate; 21 U.S.C. § 360ii(a)(6)(A); and the Administrative Procedure Act.

Relief sought. That the agency conduct the study directed by § 360jj(a)(2) and submit a report to Congress no later than 365 days after the submission of the petition. One hundred and forty-nine pages.

Disposition. Acknowledged January 2, 2026. A tentative response issued in June 2026. Part II.I.5 describes the petition in full and Part IV.C.2 summarizes it.

2026

E.50 August 12, 2026 — Baker v. Food and Drug Administration, No. 2:26-cv-02776-DJC-CSK (E.D. Cal.)

Capacity. Mark Baker individually. The agency admits that the Foundation is not a party plaintiff and may not appear without counsel.

Subject. The request at E.48, Control No. 2025-3046, on which no determination had been made and no record produced.

Counts. Three, under 5 U.S.C. §§ 552(a)(6)(A), 552(a)(3) and 552(a)(6)(E).

The admission. The Answer of September 14, 2026 admits paragraph 32 of the complaint in full, that as of the filing of the complaint the agency had made no determination, produced no responsive record, and asserted no exemption. Part IV.D.3 sets this out and it is the only unqualified admission in the Answer.

Status. No record produced. No declaration describing any search has been filed. Part IV.D.4.

E.51 What the chronology shows, stated without argument

The Foundation confines itself to what can be counted from the entries above, and leaves the inferences to Part IV.I.

Five citizen petitions were submitted to this Department, at E.2, E.18, E.33, E.34 and E.49. Four were denied together by the single document at E.42. The fifth received a tentative response.

Four petitions were submitted to other federal agencies asking each to consult and maintain liaison with this Department under 21 U.S.C. § 360ii(a)(3) and (a)(6), at E.26, E.27, E.28 and E.31. No entry in this appendix records a liaison having been established in consequence.

Four federal agencies stated a position on their own authority over this emission, at E.6, E.8, E.12 and E.14, and all four have been read. One declined to add the subject to its regulatory agenda while undertaking to review the literature. One stated that Congress has granted it no authority over visible light. One stated that it is not a regulatory agency on the subject and would defer to this Department for comfort, health and safety. And one stated that it is barred by statute from reaching the risk at all where that risk may be subjected to regulation under the chapter this comment concerns.

Five requests for records were made under the Freedom of Information Act, at E.5, E.17, E.46, E.47 and E.48, to three different agencies. As to the one in litigation, the United States has admitted that no record has been produced.

Four items of congressional correspondence are recorded, at E.19, E.30, E.36 and E.43, from three Members of Congress. Two of the four were addressed to the officer holding the authority of 21 U.S.C. § 360kk, both of them before the Final Response at E.42, and one of those two quoted that provision to him and asked him to consider exercising it for a named product class. One was addressed to the committee of jurisdiction, and one was an inquiry to the agency on a constituent's behalf.

Appendix F — Radiation-Emitting Product Codes for Light-Emitting Diode Products: Those Assigned and Those Proposed

This appendix has two parts. F.1 records the product codes the Center for Devices and Radiological Health has already assigned to the products this comment is about. F.2 proposes thirteen it has not. The request founded on it is at Part IX.G.7.

Every entry in both parts names the products it captures. The Foundation adds those examples because the purpose of a classification is that a person holding a product can find where it belongs, and because the examples make visible both what the present classification reaches and what it does not.

The Foundation drafts the proposals in F.2 rather than describing them, because a request that an agency classify something is easy to defer and a request that it adopt a drafted entry is not. The Foundation does not ask that its drafting be adopted as written. The definitions are offered as a starting point and the assignment of codes is the Center's. Everything quoted in F.1 is quoted exactly as the Center publishes it, including two errors of transcription which are neither marked nor corrected.

F.1 The product codes the Center has already assigned

The Center maintains a classification of radiation-emitting electronic products in which each class carries a product code, a definition, a radiation type, the reports required of it and the performance standard applicable to it. It is published at https://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfPCD_RH/classification.cfm and was read on October 17, 2026.

Three hundred and ten product codes are classified with a radiation type of Optical. Of those, one hundred and forty-seven record that no performance standard applies; one hundred and forty-one are laser products subject to 21 C.F.R. § 1040.10, in seventy-six cases together with § 1040.11; four are sunlamp products subject to § 1040.20; four are high-intensity mercury vapor lamps subject to § 1040.30; and fourteen have the field blank. The arithmetic is the Foundation's.

The Foundation asks the Department to read that distribution once more. Of the one hundred and forty-nine optical product codes that carry a performance standard, one hundred and forty-one are lasers. The whole of the regulation of optical radiation by performance standard in this system, outside the laser, is four codes for sunlamps and four for mercury vapor lamps. Every other way of making visible light — the diode, the fluorescent tube, the tungsten halogen lamp, the sodium vapor lamp, the metal halide lamp, the liquid crystal display, the flat panel — is unstandardized.

The twenty-one codes below are the entire contents of the category the Center calls General Optical Products, Non-Medical, given in the order the database returns them. Twenty of the twenty-one record that no standard applies.

F.1.1 QQJ — applicator, negative pressure, external, ocular

Definition, as the Center gives it. "External ocular negative pressure system. An external ocular negative pressure system uses hardware and software to create negative pressure in front of the eye to temporarily lower intraocular pressure in glaucoma patients."

Applicable performance standard. (blank)

Bearing on this comment. Nothing. The entry carries a device regulation number at 21 C.F.R. § 886.5000 and is an ophthalmic medical device. It appears to be misfiled in a non-medical category and is reproduced only so that the census is complete.

F.1.2 RGW — uv/ir research

Definition, as the Center gives it. "A noncoherent ultraviolet or infrared light source used in research."

Applicable performance standard. No standard applicable. General Radiological Health requirements apply. [1000-1005]

F.1.3 RGX — fluorescent lamp

Definition, as the Center gives it. "A general purpose fluorescent lamp used for illumination."

Applicable performance standard. No standard applicable. General Radiological Health requirements apply. [1000-1005]

Examples within this class. Fluorescent tube lamps and compact fluorescent lamps.

Bearing on this comment. The technology the diode replaced indoors. Classified and unstandardized, as the diode is.

F.1.4 RGY — ir intrusion detector

Definition, as the Center gives it. "A noncoherent infrared light source used to detect motion to protect against intrusion."

Applicable performance standard. No standard applicable. General Radiological Health requirements apply. [1000-1005]

F.1.5 RGZ — ir security

Definition, as the Center gives it. "A noncoherent infrared light source used for security."

Applicable performance standard. No standard applicable. General Radiological Health requirements apply. [1000-1005]

F.1.6 RHA — ir data transmit/control

Definition, as the Center gives it. "A noncoherent infrared source used for data transmission or remote control of another product or machine."

Applicable performance standard. No standard applicable. General Radiological Health requirements apply. [1000-1005]

F.1.7 RHB — tungsten halogen lamp

Definition, as the Center gives it. "A tungsten halogen lamp."

Applicable performance standard. No standard applicable. General Radiological Health requirements apply. [1000-1005]

Examples within this class. Halogen capsules, reflector lamps and linear halogen lamps.

Bearing on this comment. As with the fluorescent lamp: classified, unstandardized.

F.1.8 RHD — ir remote controller

Definition, as the Center gives it. "A noncoherent infrared light source used to transmit signals and/or information in order to operate equipment or machinery remotely."

Applicable performance standard. No standard applicable. General Radiological Health requirements apply. [1000-1005]

F.1.9 RHF — digital display monitor

Definition, as the Center gives it. "A monitor or projector that uses a high intensity light source to illuminate pixels to produce images driven from a digital image source."

Applicable performance standard. No standard applicable. General Radiological Health requirements apply. [1000-1005]

Examples within this class. Projectors and digital signage monitors viewed indoors.

Bearing on this comment. One of three display codes. The definition turns on a high intensity light source and the term high is nowhere defined. Part VI.H.

F.1.10 RHG — light, spectrum, broad (non-medical)

Definition, as the Center gives it. "A broad spectrum output noncoherent light source intended for general purpose."

Applicable performance standard. No standard applicable. General Radiological Health requirements apply. [1000-1005]

F.1.11 RHH — led lamps emitting visible light intended to be used for illumination purposes

Definition, as the Center gives it. "LED lamps emitting predominantly visible and/or white light intended to be used for illumination purposes. These include illumination products, flashlights, finished bulbs or lamps."

Applicable performance standard. No standard applicable. General Radiological Health requirements apply. [1000-1005]

Examples within this class. LED general service lamps; LED tube lamps of the kind installed in offices, schools and grocery stores; LED reflector and decorative lamps; flashlights and portable work lights; and the replaceable lamp fitted inside a street luminaire.

Bearing on this comment. The first of five diode codes, and the one relied on at Part II.B and Part IX.A. It reaches the lamp. It does not reach the luminaire the lamp is fitted into, which is the subject of the proposals at F.2.5 and F.2.8. Parts VI.D, VI.E, VI.F and VI.G.

F.1.12 RHU — led for signaling/tracking/triggering

Definition, as the Center gives it. "Products that incorporate light emitting diodes (LEDs) to be used in relation to a computer or electronic tool, to signal/trigger a sensor, to track movement, or control the product."

Applicable performance standard. No standard applicable. General Radiological Health requirements apply. [1000-1005]

Examples within this class. Optical sensors, encoders, position and motion trackers, and emitters that signal to a machine.

Bearing on this comment. Signaling, but to a machine rather than to a person. Nothing in it reaches a vehicle signal lamp, a warning beacon or a traffic signal. Compare F.1.22 and F.1.23 and the proposals at F.2.2, F.2.3 and F.2.9.

F.1.13 RHX — sodium vapor lamp

Definition, as the Center gives it. "A sodium vapor lamp is a gas discharge lamp that uses sodium in an excited state to product light. There are two varieties of such lamps: Low pressure and high pressure. It is for general purpose illumination."

Applicable performance standard. No standard applicable. General Radiological Health requirements apply. [1000-1005]

Examples within this class. Low and high pressure sodium street and area lamps.

Bearing on this comment. The technology the diode replaced on the roadway. Classified, unstandardized. The quoted definition reads product light for produce light and is reproduced as found.

F.1.14 RID — liquid crystal display (lcd)

Definition, as the Center gives it. "A liquid crystal display (LCD) is a flat panel display that uses the light modulating properties of liquid crystal."

Applicable performance standard. No standard applicable. General Radiological Health requirements apply. [1000-1005]

Examples within this class. Liquid crystal panels, including those backlit by diodes.

Bearing on this comment. The second display code. Part VI.H.

F.1.15 RIH — metal halide lamp, other

Definition, as the Center gives it. "Any metal halide lamp, including sodium vapor, that does not incorporate a high-pressure arc discharge tube that has a fill consisting primarily of mercury and that is contained within an outer envelope."

Applicable performance standard. No standard applicable. General Radiological Health requirements apply. [1000-1005]

Examples within this class. Metal halide lamps used for area, sports field and high-bay lighting.

Bearing on this comment. Drawn so as to exclude what 21 C.F.R. § 1040.30 covers. The high-intensity mercury vapor lamp has a performance standard; the metal halide lamp that is not one does not. The boundary of the only non-laser lamp standard in the system is visible in that definition.

F.1.16 RII — scientific optical instrument, noncoherent

Definition, as the Center gives it. "Any scientific or research instrument that incorporates or uses any noncoherent light source."

Applicable performance standard. No standard applicable. General Radiological Health requirements apply. [1000-1005]

F.1.17 RIK — television or monitor, non-crt, non-medical

Definition, as the Center gives it. "An electronic product designed to receive and display television or video signals from broadcast, cable, video player or recorder, computer, or other source. This may be a receiver or monitor or similar. This does not use a cathode ray tube (CRT) to display the image. This would include LED, OLED, LCD, Plasma technology televisions/monitors."

Applicable performance standard. No standard applicable. General Radiological Health requirements apply. [1000-1005]

Examples within this class. LED television sets; organic diode television sets; computer monitors.

Bearing on this comment. The third display code, and the one that expressly names diode and organic diode panels. It is drawn for a receiver or monitor viewed by a person who chose to look. It does not reach an outdoor message sign, which is the subject of F.2.6, nor a display fitted in a vehicle, which is the subject of F.2.10. Parts VI.H and VI.J.

F.1.18 RIO — led toys and entertainment products

Definition, as the Center gives it. "Products that incorporate light emitting diodes (LEDs) to be used in toys or entertaiment products to control, illuminate, or interact with the user. These products include LED "lasertag" toys, and blacklights for home use."

Applicable performance standard. No standard applicable. General Radiological Health requirements apply. [1000-1005]

Examples within this class. Diodes in children's toys; light-up play equipment; home blacklights.

Bearing on this comment. The quoted definition reads entertaiment and is reproduced as found. Part VI.K, and Part V.K.5 for the toy standard.

F.1.19 RIP — led diodes sold as components to be installed

Definition, as the Center gives it. "LEDs sold as components to be installed in finished electronic products, such as bare LED diodes and LED diode arrays without control or power modules or standard lamp fitting included. Not including finished bulbs or lamps."

Applicable performance standard. No standard applicable. General Radiological Health requirements apply. [1000-1005]

Examples within this class. Bare diodes and diode arrays sold to manufacturers for installation.

Bearing on this comment. The component, before it is anything. Between this code and F.1.11 there is a gap into which strip and tape lighting falls, which is the subject of the proposal at F.2.7.

F.1.20 RIQ — low emission leds as indicators or decorations

Definition, as the Center gives it. "Finished LED products intended to act as an indicator or for decorative purposes, such as Christmas tree lights or display backlighting. LED product only intending to emit visible radiation at low intensities."

Applicable performance standard. No standard applicable. General Radiological Health requirements apply. [1000-1005]

Examples within this class. Indicator and status lamps on appliances, cordless tools, chargers, smoke alarms, routers and televisions; seasonal and decorative light strings; backlighting behind a display panel.

Bearing on this comment. The appliance indicator is classified, and the Foundation therefore proposes no new code for it. The defect here is not absence but definition: the class is confined to products only intending to emit visible radiation at low intensities, and the term low is nowhere defined. Part VI.G sets two indicator components of identical size beside each other and finds a difference of between about two hundred and twenty and four hundred and twenty times in luminous intensity, and both fall within this class as drawn. That is an argument for the performance standard sought at Part IX.I, not for a further product code.

F.1.21 SBS — laryngeal injection set with led light

Definition, as the Center gives it. None is published.

Applicable performance standard. No standard applicable. General Radiological Health requirements apply. [1000-1005]

Bearing on this comment. Nothing. A medical device, and the database publishes no definition for it. Reproduced so that the census is complete.

Two codes in other categories, set out here because the comparison is the argument of this appendix

F.1.22 REZ — laser traffic signal

Definition, as the Center gives it. "Product, laser, traffic signal/control"

Applicable performance standard. Laser products. [1040.10]

Annual reports required. Yes.

F.1.23 RFA — laser automotive lighting & signals

Definition, as the Center gives it. "Product, laser, automotive, lighting/signals"

Applicable performance standard. Laser products. [1040.10] Specific purpose laser products. [1040.11]

Annual reports required. Yes.

A traffic signal is classified, standardized and subject to annual reporting when its emitter is a laser. The same signal, at the same intersection, seen by the same driver, is unclassified, unstandardized and unreported when its emitter is a diode. The same is true of automotive lighting. The Foundation offers no theory of why the system developed that way. It observes that the difference cannot be a difference in exposure, because the exposure is optical radiation entering a human eye in both cases, and asks the Department to close it. The proposals at F.2.1, F.2.2 and F.2.9 are the diode counterparts of these two entries.

F.2 The product codes the Foundation proposes

No product code in the classification reaches a light-emitting diode headlamp, a diode vehicle signal or marker lamp, a diode emergency or warning beacon, a diode traffic signal head, a pedestrian crossing beacon, a diode roadway luminaire, an outdoor message sign, a display or interior lamp fitted in a vehicle, a lamp on a bicycle or scooter, or a deterrent lighting system. The product classes described at Parts VI.B, VI.C, VI.D, VI.I and VI.J of this comment are, on the Foundation's search, absent from the classification entirely, while the laser versions of two of them are classified, standardized and reported.

Each proposal below follows the fields the Center's own entries use, with three added: the products the class captures, the reason the class needs a code of its own, and the Part of this comment that describes the exposure. The proposed codes continue the sequence in which the Center assigned the existing diode codes. RIQ is presently the last assigned code in that run and RIR through RJD appear unused. Assignment is the Center's and the particular letters are not the point of the request.

F.2.1 Proposed code RIR — led vehicle headlamps and forward lighting

Product. led vehicle headlamps and forward lighting

Definition. Light-emitting diode lamps, capsules and integrated headlamp assemblies installed on motor vehicles to illuminate the roadway forward of the vehicle, including low beam, high beam, daytime running lamps, fog and auxiliary forward lighting, whether supplied as original equipment or as replacement or aftermarket assemblies.

Examples within this class. Diode headlamps supplied as original equipment; aftermarket diode headlamp capsules and assemblies, including retrofit capsules fitted to housings designed for another source; daytime running lamps; fog and driving lamps; auxiliary forward-facing lamps fitted to light bars and bumpers.

Product Description. General Optical Products / Non-Medical.

Radiation Type. Optical.

Radiation Safety Report Type Required? Product report under 21 C.F.R. § 1002.10, which requires that the class be added to Table 1 to § 1002.1.

Annual Reports Required? Yes, under 21 C.F.R. § 1002.13, by parity with the laser classes at F.1.22 and F.1.23.

Applicable Performance Standard(s). None at present. The standard sought is described at Part IX.I. Until one is prescribed, the general radiological health requirements at parts 1000 to 1005 apply, as they do to every class in F.1 today.

Why the class needs a code of its own. The class is absent although the laser equivalent is classified at F.1.23 and carries a performance standard. The exposure is to an oncoming driver at close range and at night, and it is the exposure on which this comment has the largest body of first-hand report.

Where the exposure is described. Part VI.B, and Part IV.F for the congressional direction to examine low beam brightness.

F.2.2 Proposed code RIS — led vehicle signal, marker and identification lamps

Product. led vehicle signal, marker and identification lamps

Definition. Light-emitting diode lamps installed on motor vehicles to signal position, intention or presence rather than to illuminate the roadway, including stop lamps, turn signal lamps, hazard warning lamps, tail lamps, side marker lamps, clearance and identification lamps and reversing lamps.

Examples within this class. Turn signal lamps; stop lamps; tail lamps; hazard warning lamps; reversing and backup lamps; side marker, clearance and identification lamps.

Product Description. General Optical Products / Non-Medical.

Radiation Type. Optical.

Radiation Safety Report Type Required? Product report under 21 C.F.R. § 1002.10, which requires that the class be added to Table 1 to § 1002.1.

Annual Reports Required? Yes, under 21 C.F.R. § 1002.13, by parity with the laser classes at F.1.22 and F.1.23.

Applicable Performance Standard(s). None at present. The standard sought is described at Part IX.I. Until one is prescribed, the general radiological health requirements at parts 1000 to 1005 apply, as they do to every class in F.1 today.

Why the class needs a code of its own. The class is absent although the laser equivalent is classified at F.1.23. It is distinguished from the headlamp class because the emission is intermittent in normal use and because the governing characteristic is luminous intensity at small angular subtense rather than beam pattern.

Where the exposure is described. Part VI.B.

F.2.3 Proposed code RIT — led emergency and warning beacons and light bars

Product. led emergency and warning beacons and light bars

Definition. Light-emitting diode lamps and lamp assemblies operated in a flashing, strobing, oscillating, rotating or otherwise modulated mode to warn or direct, including beacons and light bars fitted to emergency, police, fire, ambulance, utility, construction, towing and service vehicles, and portable or stationary warning beacons.

Examples within this class. Auxiliary vehicle warning lamps; flashing lamps on police, fire, ambulance, utility, tow and construction vehicles; roof-mounted and grille-mounted light bars; portable warning beacons and arrow boards.

Product Description. General Optical Products / Non-Medical.

Radiation Type. Optical.

Radiation Safety Report Type Required? Product report under 21 C.F.R. § 1002.10, which requires that the class be added to Table 1 to § 1002.1.

Annual Reports Required? Yes, under 21 C.F.R. § 1002.13, by parity with the laser classes at F.1.22 and F.1.23.

Applicable Performance Standard(s). None at present. The standard sought is described at Part IX.I. Until one is prescribed, the general radiological health requirements at parts 1000 to 1005 apply, as they do to every class in F.1 today.

Why the class needs a code of its own. The class is absent although the laser traffic signal is classified at F.1.22. It is the class in which the temporal characteristics described at Part I.G govern, and the only class in this comment for which a consensus numerical criterion addressed to seizure already exists, at Appendix D.2.17.

Where the exposure is described. Part VI.C, and Part IX.I for the performance standard sought.

F.2.4 Proposed code RIU — led pedestrian and roadway warning beacons

Product. led pedestrian and roadway warning beacons

Definition. Light-emitting diode beacons installed at or adjacent to a roadway to warn approaching drivers of a crossing, hazard or condition, operated in a flashing or irregular-flash mode, including rectangular rapid-flashing beacons, overhead and in-roadway warning lights, school zone beacons and hazard identification beacons.

Examples within this class. Rectangular rapid-flashing beacons at pedestrian crossings; school zone beacons; in-roadway and overhead warning lights; hazard identification beacons.

Product Description. General Optical Products / Non-Medical.

Radiation Type. Optical.

Radiation Safety Report Type Required? Product report under 21 C.F.R. § 1002.10, which requires that the class be added to Table 1 to § 1002.1.

Annual Reports Required? Yes, under 21 C.F.R. § 1002.13, by parity with the laser classes at F.1.22 and F.1.23.

Applicable Performance Standard(s). None at present. The standard sought is described at Part IX.I. Until one is prescribed, the general radiological health requirements at parts 1000 to 1005 apply, as they do to every class in F.1 today.

Why the class needs a code of its own. The class is absent. It is distinguished from the vehicle beacon class because the installation is permanent public infrastructure specified by a public entity rather than equipment fitted to a vehicle, and because the flash pattern is prescribed by a different federal instrument.

Where the exposure is described. Part VI.C, and Part VIII for the accessibility consequence.

F.2.5 Proposed code RIV — led roadway, area and exterior luminaires

Product. led roadway, area and exterior luminaires

Definition. Complete light-emitting diode luminaires intended for permanent outdoor installation to illuminate roadways, sidewalks, pathways, parking areas, yards, grounds and building exteriors, comprising the emitting array together with its optical assembly, as distinct from a replaceable lamp classified at F.1.11.

Examples within this class. Street lights; parking area and yard luminaires; flood lights; wall packs and building exterior luminaires; security lighting installed to illuminate a surface; garden, landscape and pathway lights.

Product Description. General Optical Products / Non-Medical.

Radiation Type. Optical.

Radiation Safety Report Type Required? Product report under 21 C.F.R. § 1002.10, which requires that the class be added to Table 1 to § 1002.1.

Annual Reports Required? Yes, under 21 C.F.R. § 1002.13, by parity with the laser classes at F.1.22 and F.1.23.

Applicable Performance Standard(s). None at present. The standard sought is described at Part IX.I. Until one is prescribed, the general radiological health requirements at parts 1000 to 1005 apply, as they do to every class in F.1 today.

Why the class needs a code of its own. The lamp is classified at F.1.11; the luminaire is not. The luminaire is the product to which a person is exposed, and the optical assembly determines the luminance, the beam distribution and the angle at which the emitter is seen, none of which is a property of the lamp alone.

Where the exposure is described. Part VI.D.

F.2.6 Proposed code RIW — led display panels for outdoor and public viewing

Product. led display panels for outdoor and public viewing

Definition. Light-emitting diode display panels intended to be viewed outdoors or by the public at distance, including billboards, dynamic message signs, changeable message boards, scoreboards and architectural video walls, whose emission is directed toward a public way or toward occupied property.

Examples within this class. Outdoor advertising displays and billboards; dynamic message signs and changeable message boards on highways; illuminated traffic message signs; scoreboards; architectural video walls.

Product Description. General Optical Products / Non-Medical.

Radiation Type. Optical.

Radiation Safety Report Type Required? Product report under 21 C.F.R. § 1002.10, which requires that the class be added to Table 1 to § 1002.1.

Annual Reports Required? Yes, under 21 C.F.R. § 1002.13, by parity with the laser classes at F.1.22 and F.1.23.

Applicable Performance Standard(s). None at present. The standard sought is described at Part IX.I. Until one is prescribed, the general radiological health requirements at parts 1000 to 1005 apply, as they do to every class in F.1 today.

Why the class needs a code of its own. The display codes at F.1.9, F.1.14 and F.1.17 describe televisions, monitors and projectors, which are viewed indoors, at a chosen distance, by a person who chose to look. None of them reaches a panel of thousands of emitters directed at a roadway or a bedroom window, which is a different exposure in geometry, in luminance and in whether it can be avoided.

Where the exposure is described. Part VI.J.

F.2.7 Proposed code RIX — led strip, tape and linear accent lighting

Product. led strip, tape and linear accent lighting

Definition. Light-emitting diode lighting supplied in continuous flexible or rigid linear form for installation and cutting to length by the purchaser, including strip and tape lighting,

cove, channel, under-cabinet, shelf and accent lighting, whether or not supplied with a power supply, driver or controller.

Examples within this class. Strip lighting in refrigerated grocery cases and display coolers; strip lighting applied to window trim and shelving; cove, channel and under-cabinet lighting; colored decorative strips applied to vehicle charging stations, automated teller machines and kiosks.

Product Description. General Optical Products / Non-Medical.

Radiation Type. Optical.

Radiation Safety Report Type Required? Product report under 21 C.F.R. § 1002.10, which requires that the class be added to Table 1 to § 1002.1.

Annual Reports Required? Yes, under 21 C.F.R. § 1002.13, by parity with the laser classes at F.1.22 and F.1.23.

Applicable Performance Standard(s). None at present. The standard sought is described at Part IX.I. Until one is prescribed, the general radiological health requirements at parts 1000 to 1005 apply, as they do to every class in F.1 today.

Why the class needs a code of its own. The class falls between two existing codes and is caught by neither. It is not a finished bulb or lamp within F.1.11, and it is not a bare diode or array sold as a component within F.1.19, because it is sold finished to a consumer or installer. It is among the fastest-growing lighting formats and is commonly installed without a diffuser, so the emitters are seen directly.

Where the exposure is described. Part VI.G and Part VI.K.

F.2.8 Proposed code RIY — led linear and panel luminaires for interior general illumination

Product. led linear and panel luminaires for interior general illumination

Definition. Complete light-emitting diode luminaires intended for permanent interior installation to provide general illumination, including recessed troffers, linear suspended and surface-mounted luminaires, flat panel luminaires and high-bay luminaires, as distinct from a replaceable lamp classified at F.1.11.

Examples within this class. Recessed troffers and flat panel luminaires in offices, schools and grocery stores; linear suspended and surface-mounted luminaires; high-bay luminaires in warehouses and retail premises; the luminaire into which a diode tube lamp is fitted.

Product Description. General Optical Products / Non-Medical.

Radiation Type. Optical.

Radiation Safety Report Type Required? Product report under 21 C.F.R. § 1002.10, which requires that the class be added to Table 1 to § 1002.1.

Annual Reports Required? Yes, under 21 C.F.R. § 1002.13, by parity with the laser classes at F.1.22 and F.1.23.

Applicable Performance Standard(s). None at present. The standard sought is described at Part IX.I. Until one is prescribed, the general radiological health requirements at parts 1000 to 1005 apply, as they do to every class in F.1 today.

Why the class needs a code of its own. As with the exterior luminaire, the lamp is classified and the luminaire is not. This is the product class through which people are exposed for the longest durations, in schools, workplaces, healthcare settings and retail premises, and the one for which the duration of exposure is set by an institution rather than by the person exposed.

Where the exposure is described. Part VI.E and Part VI.F.

F.2.9 Proposed code RIZ — led traffic signal heads and roadway control signals

Product. led traffic signal heads and roadway control signals

Definition. Light-emitting diode signal heads and lamp assemblies installed at, over or beside a roadway to control or direct traffic, including vehicular signal heads, pedestrian signal heads and countdown displays, lane control signals, ramp metering signals, and railroad grade crossing signals, whether operated steady-burning or flashing.

Examples within this class. Red, amber and green vehicular signal heads; pedestrian walk and countdown signals; lane control and reversible lane signals; ramp meters; railroad grade crossing flashers and gate lamps.

Product Description. General Optical Products / Non-Medical.

Radiation Type. Optical.

Radiation Safety Report Type Required? Product report under 21 C.F.R. § 1002.10, which requires that the class be added to Table 1 to § 1002.1.

Annual Reports Required? Yes, under 21 C.F.R. § 1002.13, by parity with the laser classes at F.1.22 and F.1.23.

Applicable Performance Standard(s). None at present. The standard sought is described at Part IX.I. Until one is prescribed, the general radiological health requirements at parts 1000 to 1005 apply, as they do to every class in F.1 today.

Why the class needs a code of its own. This is the diode counterpart of the entry at F.1.22. A laser traffic signal is classified, carries a performance standard under 21 C.F.R. § 1040.10 and reports annually. The signal actually installed at American intersections is a diode array, and it has no code. The class is distinguished from the warning beacon at F.2.4 because a signal head conveys a regulatory instruction rather than a warning, and from the message panel at F.2.6 because it displays no text or image.

Where the exposure is described. Part VI.C and Part VI.J.

F.2.10 Proposed code RJA — led information displays within the motor vehicle occupant compartment

Product. led information displays within the motor vehicle occupant compartment

Definition. Light-emitting diode and organic light-emitting diode display panels installed within the occupant compartment of a motor vehicle to present information to the driver or passengers, including instrument clusters, center and console displays, head-up displays projected onto the windshield, rear-seat entertainment displays and camera monitor systems that replace or supplement a mirror.

Examples within this class. Digital instrument clusters; center console and infotainment displays; head-up displays; rear-seat entertainment screens; camera monitor systems and digital rear-view mirrors.

Product Description. General Optical Products / Non-Medical.

Radiation Type. Optical.

Radiation Safety Report Type Required? Product report under 21 C.F.R. § 1002.10, which requires that the class be added to Table 1 to § 1002.1.

Annual Reports Required? Yes, under 21 C.F.R. § 1002.13, by parity with the laser classes at F.1.22 and F.1.23.

Applicable Performance Standard(s). None at present. The standard sought is described at Part IX.I. Until one is prescribed, the general radiological health requirements at parts 1000 to 1005 apply, as they do to every class in F.1 today.

Why the class needs a code of its own. The display codes at F.1.9, F.1.14 and F.1.17 describe a receiver or monitor viewed by a person who chose to look at it. A display fitted in a vehicle is encountered by a driver who must look at the road, at night, with eyes adapted to darkness, and who cannot switch it off; and in the case of a camera monitor system the driver is required to look at it. The exposure differs from a television in adaptation state, in duration and in whether it is voluntary.

Where the exposure is described. Part VI.B and Part VI.H.

F.2.11 Proposed code RJB — led interior illumination lamps in motor vehicles

Product. led interior illumination lamps in motor vehicles

Definition. Light-emitting diode lamps installed within the occupant compartment, trunk or engine compartment of a motor vehicle to illuminate rather than to display, including dome, map, reading, courtesy, footwell, vanity, door and cargo lamps, and ambient or decorative interior lighting.

Examples within this class. Dome and map lamps; courtesy, door and footwell lamps; vanity and visor lamps; cargo and engine compartment lamps; ambient and color-changing interior accent lighting.

Product Description. General Optical Products / Non-Medical.

Radiation Type. Optical.

Radiation Safety Report Type Required? Product report under 21 C.F.R. § 1002.10, which requires that the class be added to Table 1 to § 1002.1.

Annual Reports Required? Yes, under 21 C.F.R. § 1002.13, by parity with the laser classes at F.1.22 and F.1.23.

Applicable Performance Standard(s). None at present. The standard sought is described at Part IX.I. Until one is prescribed, the general radiological health requirements at parts 1000 to 1005 apply, as they do to every class in F.1 today.

Why the class needs a code of its own. Neither the forward lighting class at F.2.1 nor the signal class at F.2.2 reaches a lamp that faces inward, and the interior luminaire class at F.2.8 is drawn for permanent installation in a building. The exposure is at very short range, in a dark-adapted eye, and frequently while the person is driving.

Where the exposure is described. Part VI.B and Part VI.G.

F.2.12 Proposed code RJC — led lamps on bicycles, scooters and personal mobility devices

Product. led lamps on bicycles, scooters and personal mobility devices

Definition. Light-emitting diode lamps fitted to or carried on bicycles, electric bicycles, scooters, hoverboards, skateboards, personal mobility devices and similar conveyances that are not motor vehicles, including forward lamps, rear lamps, side and wheel lighting and deck or frame illumination, whether operated steady-burning or flashing.

Examples within this class. Bicycle headlamps; bicycle tail lamps; scooter and electric bicycle lamps; hoverboard and skateboard deck lighting; wheel and spoke lighting; helmet-mounted lamps.

Product Description. General Optical Products / Non-Medical.

Radiation Type. Optical.

Radiation Safety Report Type Required? Product report under 21 C.F.R. § 1002.10, which requires that the class be added to Table 1 to § 1002.1.

Annual Reports Required? Yes, under 21 C.F.R. § 1002.13, by parity with the laser classes at F.1.22 and F.1.23.

Applicable Performance Standard(s). None at present. The standard sought is described at Part IX.I. Until one is prescribed, the general radiological health requirements at parts 1000 to 1005 apply, as they do to every class in F.1 today.

Why the class needs a code of its own. The vehicle classes at F.2.1 and F.2.2 reach motor vehicles. A bicycle or scooter lamp is not a motor vehicle lamp and no code reaches it, although it is commonly operated in a flash mode, is commonly of high luminous intensity in a small emitting area, and is aimed directly at oncoming drivers and pedestrians at close range.

Where the exposure is described. Part VI.B and Part VI.C.

F.2.13 Proposed code RJD — led deterrent, surveillance and security lighting systems

Product. led deterrent, surveillance and security lighting systems

Definition. Light-emitting diode lamps and lamp assemblies installed or deployed to deter, repel, warn off or draw attention to persons rather than to illuminate a surface for visual task performance, including mobile and trailer-mounted surveillance units, pulsing, strobing or color-changing deterrent lighting, anti-loitering lighting and lighting operated so as to make an area uncomfortable to occupy.

Examples within this class. Trailer-mounted and pole-mounted mobile surveillance units; pulsing blue or colored deterrent lamps on commercial premises; anti-loitering lighting; lighting operated in a strobing mode to discourage occupation of an area.

Product Description. General Optical Products / Non-Medical.

Radiation Type. Optical.

Radiation Safety Report Type Required? Product report under 21 C.F.R. § 1002.10, which requires that the class be added to Table 1 to § 1002.1.

Annual Reports Required? Yes, under 21 C.F.R. § 1002.13, by parity with the laser classes at F.1.22 and F.1.23.

Applicable Performance Standard(s). None at present. The standard sought is described at Part IX.I. Until one is prescribed, the general radiological health requirements at parts 1000 to 1005 apply, as they do to every class in F.1 today.

Why the class needs a code of its own. The exterior luminaire class at F.2.5 is drawn for luminaires installed to illuminate. A device whose purpose is deterrence by glare, color or modulation is not an illumination product, and the quantity that matters is luminance and temporal modulation rather than illuminance on a surface. The class is absent from the classification entirely.

Where the exposure is described. Part VI.I.

One product class for which the Foundation proposes no code

The indicator lamp on a household appliance or a cordless tool is already classified, at F.1.20. The Foundation therefore proposes no code for it, and records here why it is nonetheless treated at length at Part VI.G. The defect in that class is not that it is missing but that it is bounded by an undefined word. It reaches products only intending to emit visible radiation at low intensities, and nothing in the classification, in parts 1000 to 1005 or in any performance standard says what low means. Two indicator components of identical physical size, described at Part VI.G, differ by between about two hundred and twenty and four hundred and twenty times in luminous intensity, and both are within the class. A product code cannot cure that. Only a criterion can, which is what Part IX.I asks for.

What this appendix does not ask for

It does not ask the Department to find any of these products unsafe. A product code is a classification and asserts nothing about hazard; the Center has assigned codes to flashlights and to Christmas tree lights. It does not ask for a performance standard, which is asked for separately at Part IX.I and on a different footing. It does not ask the Department to displace the National Highway Traffic Safety Administration, the Federal Highway Administration or any other agency from its own field; a radiation-emitting product code and a motor vehicle safety standard address different questions and have coexisted for laser products since 21 C.F.R. § 1040.10 was prescribed. And it does not ask for anything requiring new statutory authority. Every step proposed here is available under regulations the Department wrote and administers today.

Respectfully submitted,

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