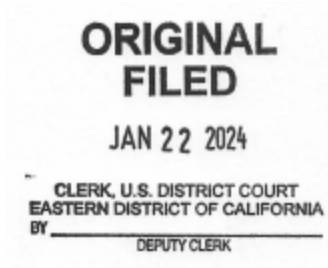


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Pro Se



BEFORE THE UNITED STATES DISTRICT COURT
EASTERN DISTRICT OF CALIFORNIA

COMPLAINT AND REQUEST FOR COERCIVE RELIEF
FDA REGULATION OF LIGHT EMITTING DIODE
PRODUCTS

MARK BAKER,
Plaintiff,

vs.

UNITED STATES FOOD AND DRUG
ADMINISTRATION; JEFFREY SHUREN, in
his official capacity as Director of the FDA
Center for Devices and Radiological Health,
ROBERT M. CALIFF, in his official capacity
as Commissioner of Food and Drugs; UNITED
STATES HEALTH AND HUMAN
SERVICES; and XAVIER BECERRA, in his
official capacity as Secretary of the Department
of Health and Human Services,

Defendants.

2:24 - CV 0278 - KJM DB PS
Case No.: _____

I. COMPLAINT

1. Plaintiff, Mark Baker, alleges that the United States Food and Drug Administration (FDA) has failed to comply with the Federal Food, Drug, and Cosmetic Act (FFDCA) and subsequent Radiation Control for Health and Safety Act, codified as 21 U.S.C. 360hh – 360ss, which mandates that the FDA minimize the emissions of and the exposure of people to, unnecessary electronic product radiation, publish performance standards for electromagnetic radiation from electronic products, and provide reports to Congress. Specifically, this complaint alleges that the FDA has failed to protect public health and safety from the harms of visible radiation from products using Light Emitting Diodes (LED) and that the failure of the FDA to publish performance standards for LED products has caused Plaintiff irreparable harm. Plaintiff requests that the Court order coercive relief.

II. PARTIES

2. Plaintiff is Mark Baker, a citizen of the United States of America.

3. Defendant FDA is an agency of the federal government within the United States Department of Health and Human Services (HHS). The Secretary of HHS has delegated to the FDA the authority to administer the provisions of the Radiation Control for Health and Safety Act for the regulation of electronic products that emit electromagnetic radiation. FDA's headquarters is located at 10903 New Hampshire Avenue, Silver Spring, Maryland 20993.

4. Defendant Jeffrey Shuren, named in this lawsuit in his official capacity, is the Director of the Center for Devices and Radiological Health at the FDA. Dr. Shuren is responsible for supervising all the activities of the FDA CDRH. Dr. Shuren's official address is 10903 New Hampshire Avenue, Silver Spring, Maryland 20993.

5. Defendant Robert Califf, named in this lawsuit in his official capacity, is the Commissioner of Food and Drugs at the FDA. Dr. Califf is responsible for supervising all the activities of the FDA. Dr. Califf's official address is 10903 New Hampshire Avenue, Silver Spring, Maryland 20993.

6. Defendant HHS is a federal agency underneath the executive branch of the U.S. government, including under 5 U.S.C. § 551 and 701(b)(1). Defendant's address is 200 Independence Avenue SW, Washington, D.C. 20201.

7. Defendant Xavier Becerra is the Secretary of HHS and is named in this lawsuit in his official capacity. Defendant Becerra is responsible for the overall operations of HHS, including the operations of the FDA. His official address is 200 Independence Avenue SW, Washington, D.C. 20201.

III. JURISDICTION AND VENUE

8. This Court has subject-matter jurisdiction under 28 U.S.C. § 1331 because this action raises federal questions under the Administrative Procedure Act (APA), 5 U.S.C. §§ 553, 701-06, and the FFDCA, 21 U.S.C. § 301 et seq.

9. This Court has jurisdiction under 28 U.S.C. § 1346(a) because this is a civil action against the United States.

10. This Court has jurisdiction under 28 U.S.C. § 1361 because this lawsuit is an action to compel an officer of the United States or any federal agency to perform his or her duty.

11. 31. This Court has jurisdiction to review Defendants' unlawful actions and enter appropriate relief under the APA, 5 U.S.C. §§ 553, 701-06.

12. This lawsuit seeks declaratory, injunctive, and other appropriate relief under the Declaratory Judgment Act, 28 U.S.C. §§ 2201-02, 5 U.S.C. §§ 705-06, Federal Rule of Civil Procedure 57, and this Court's inherent equitable powers.

13. Venue is proper in this district pursuant to 28 U.S.C. § 1391 because a substantial part of the facts, events or omissions giving rise to the claims occurred in this district, and a substantial part of property that is the subject of this action is situated in this district.

IV. FACTS

A. Statutory Background

14. The first half of the 20th century saw the invention of numerous products that emit electromagnetic radiation, including televisions, radios, and x-ray machines. The first laser was invented in 1960. The first Light Emitting Diode was invented in 1961. The first red LED was invented in 1962.

15. As these devices that emit electromagnetic radiation proliferated, Congress received numerous reports of harm and illness caused by this radiation.

16. By the 1960s, Congress recognized the hazards of radiation exposure from all segments of the electromagnetic spectrum and passed the Radiation Control for Health and Safety Act in 1968 to protect public health and safety.

17. The Radiation Control for Health and Safety Act is codified as 21 U.S.C. 360hh – 360ss and directs and mandates the Food and Drug Administration to minimize the emissions of, and the exposure of people to, unnecessary electronic product radiation, publish performance standards to protect public health and safety, and provide reports to Congress.

18. As of this writing, the FDA has published performance standards to ensure protection of the public in section 21 of the Code of Federal Regulations for the following products:

1020.10 - Television Receivers

1020.20 - Cold-Cathode Gas Discharge Tubes

1020.30 - Diagnostic x-ray systems and their major components

1020.31 - Radiologic equipment

1020.32 - Fluoroscopic equipment

1020.33 - Computed tomography (CT) equipment

1020.34 - Cabinet x-ray systems

1030.10 - Microwave ovens

1040.10 - Laser products

1040.11 - Specific laser products

1040.20 - Sunlamp products and ultraviolet lamps intended for use in sunlamp products

1040.30 - High-intensity mercury vapor discharge lamps

19. The FDA has failed to publish performance standards for any product that uses a Light Emitting Diode, including LED vehicle lights, LED streetlights, LED General Service Lamps, flashing LED lights such as on emergency vehicles, LED flashlights, LED bicycle headlights, LED appliance indicator lights, LED flashing lights on radio towers, LED lights on airplanes, LED strip lights, LED electronic displays, LED lights on children's shoes, and a myriad of other LED products.

20. Each LED product has its own characteristics and applications, and thus each should have its own performance standards. LED products are not inherently safe and have not been proven to be safe, and, in fact, LED products have been shown to be hazardous to human and environmental health.

B. FDA Position on Regulation of LED Products

21. The FDA published 21 C.F.R. 1040.10 – Laser Products, item (a), which reads *“Applicability. The provisions of this section and § 1040.11, as amended, are applicable as specified to all laser products manufactured or assembled after August 1, 1976...”*. Thus, at least as far back as 1976, the FDA recognized that visible light is part of the electromagnetic spectrum and must be regulated, just as radio waves, microwaves and x-rays are regulated.

22. On June 6, 2017, the FDA confirmed that they have the authority and imperative to regulate LED visible radiation by issuing CSMS# 17-000330 – LIGHT-EMITTING DIODE (LED) REPORTING TO FDA which states, *“FDA has regulatory authority over radiation-emitting electronic products, which are defined in 21 CFR 1000.3 as any electrically-powered product that can emit any form of radiation on the electromagnetic spectrum. As such, reporting to FDA upon importation of radiation-emitting electronic products is required. LED products emit visible*

optical radiation, which qualifies them to be radiation-emitting electronic products and gives FDA regulatory authority.”¹

23. In 2018, the FDA posted the statement on the FDA’s website, *“LEDs (Light Emitting Diodes) are different from laser diodes and are not subject to the Federal laser product performance standard.”²*

24. The FDA presentation [How to Get Your Electronic Product on the U.S. Market](#) details the authority of the FDA to regulate the radiation from electronic products and the requirements of manufacturers to receive FDA approval for their electronic products that emit radiation.³ On slide 3 of the presentation, the FDA states, *“FDA’s mission: Protect the public from hazardous or unnecessary exposure to radiation from electronic products.”* Slide 7 states, *“Any electrically-powered product that emits radiation.”* Slide 8 states, *“Ionizing or non - ionizing electromagnetic or particulate radiation.”* Slide 9 lists several non-medical products, including microwave ovens, laser pointers, police speed radars, and airport security scanners. Slide 13 states, *“Radiation Safety Performance Standards - Mandatory for many radiation - emitting electronic products/devices.”*

25. The Technical Electronic Product Radiation Safety Standards Committee (TEPRSSC) consists of 15 members. As of this writing, there are 11 vacancies.⁴ The last time that the TEPRSSC met was in 2016.⁵ Thus, the FDA is not receiving any advisory committee technical advice on the issue of regulating LED products.

26. Despite the FDA acknowledging that they have regulatory authority for LED products, the FDA has failed to publish the required performance standards for LED products.

27. The FDA appears to have developed the false belief that performance standards should only be published after numerous studies have been published that show significant

¹ <https://content.govdelivery.com/accounts/USDHSCBP/bulletins/1a00f8a>

² <https://www.fda.gov/radiation-emitting-products/home-business-and-entertainment-products/laser-products-and-instruments>

³ <https://www.fda.gov/media/88417/download>

⁴ <https://www.fda.gov/advisory-committees/advisory-committee-vacancies-qualifications-and-experience/medical-devices-and-radiation-emitting-products-committee-vacancies>

⁵ <https://www.fda.gov/advisory-committees/technical-electronic-product-radiation-safety-standards-committee/past-meeting-materials-technical-electronic-product-radiation-safety-standards-committee>

harm from LED products. This false belief is not supported by the statutes. Congress was already well aware of the known harms and potential harms from exposure to electromagnetic radiation in 1968. That is why Congress explicitly directs the FDA in 21 U.S.C. 360ii to “*protect the public health and safety from electronic product radiation*” and “*minimize the emissions of and the exposure of people to, unnecessary electronic product radiation.*” It is an abject failure of the FDA to have failed to minimize emissions of, and exposure to, LED product radiation during the past 66 years.

C. Statutes for Regulating Electromagnetic Radiation from Electronic Products

28. 21 U.S.C. 360ii(a) states, “*The Secretary shall establish and carry out an electronic product radiation control program designed to protect the public health and safety from electronic product radiation. As a part of such program, he shall –*”. The FDA has failed to apply this statute to LED products.

29. 21 U.S.C. 360ii(a)(1) “*pursuant to section 360kk of this title, develop and administer performance standards for electronic products;*” - The FDA has failed to develop and administer performance standards for LED products.

30. 21 U.S.C. 360ii(a)(2) “*plan, conduct, coordinate, and support research, development, training, and operational activities to minimize the emissions of and the exposure of people to, unnecessary electronic product radiation;*” – The FDA has failed to plan, conduct, coordinate, or support research, development, training, or operational activities to minimize the emissions of and the exposure of people to, unnecessary LED radiation.

31. 21 U.S.C. 360ii(a)(3) “*maintain liaison with and receive information from other Federal and State departments and agencies with related interests, professional organizations, industry, industry and labor associations, and other organizations on present and future potential electronic product radiation;*” – The FDA has failed to maintain a liaison with other Federal and State departments and agencies on issues concerning LED radiation.

32. 21 U.S.C. 360ii(a)(4) *“study and evaluate emissions of, and conditions of exposure to, electronic product radiation and intense magnetic fields;”* – The FDA has failed to adequately study and evaluate emissions, and conditions of exposure to LED radiation.

33. 21 U.S.C. 360ii(a)(5) *“develop, test, and evaluate the effectiveness of procedures and techniques for minimizing exposure to electronic product radiation;”* – The FDA has failed to develop, test, and evaluate the effectiveness of procedures and techniques for minimizing exposure to LED radiation.

34. 21 U.S.C. 360ii(a)(6) *“consult and maintain liaison with the Secretary of Commerce, the Secretary of Defense, the Secretary of Labor, the Atomic Energy Commission, and other appropriate Federal departments and agencies on (A) techniques, equipment, and programs for testing and evaluating electronic product radiation, and (B) the development of performance standards pursuant to section 360kk of this title to control such radiation emissions.”* - The FDA has failed to consult or liaise with any other federal agency to develop the required performance standards for LED products, including performance standards for LED vehicle headlights, LED streetlights, LED General Service Lamps, LED flashing/strobing lights, LED indicator lights in appliances, or any other LED product.

35. 21 U.S.C. 360jj(a)(2) *“The Secretary shall conduct the following studies, and shall make a report or reports of the results of such studies to the Congress on or before January 1, 1970, and from time to time thereafter as he may find necessary, together with such recommendations for legislation as he may deem appropriate: A study to determine the necessity for the development of standards for the use of nonmedical electronic products for commercial and industrial purposes;”* The FDA has not submitted any studies to Congress on the development of standards for LED products and has proposed no legislation for Congress related to LED products.

D. Deferral by Other Federal Agencies to the FDA

36. No federal agency other than the Food and Drug Administration has claimed that they have Congressional authority to regulate LED products. All responses sent to the Soft Lights

Foundation from federal agencies have indicated the same position, which is that the only federal agency with Congressional authority to regulate LED products is the FDA.

37. **FHWA** - In a letter to the Soft Lights Foundation on October 19, 2022, the Federal Highway Administration Office of Civil Rights stated, *“The allegations you have raised about the health impacts of RRFBs raise complex issues related to the regulation of all Light Emitting Diode (LED) lights, not just those used in RRFBs, that extend beyond FHWA’s authority.”*⁶

38. **EPA** – In a letter dated October 7, 2022, the Environmental Protection Agency stated, *“Congress has not granted the EPA any statutory authority to regulate visible light or non-ionizing radiation that is emitted from electrical devices, including LEDs.”*⁷

39. **NHTSA** - The National Highway Traffic Safety Administration wrote to the Soft Lights Foundation on December 2, 2022, stating, *“NHTSA, as an agency focused on automotive safety, also recognizes the expertise of its sister agencies that are health-focused, such as the FDA.”*⁸

40. **Access Board** - The Access Board sent a letter to the Soft Lights Foundation on August 21, 2023, stating *“The Access Board must deny this petition as the Board has no authority under 21 U.S.C. §360ii either to initiate rulemaking or to require the FDA, were they to do so, to coordinate with the Access Board.”*⁹

41. **CPSC** – The letter from the Consumer Product Safety Commission to the Soft Lights Foundation on November 7, 2022, states, *“The Commission shall have no authority under this chapter to regulate any risk of injury associated with electronic product radiation emitted from an electronic product.”*¹⁰

42. **OSHA** – The Occupational Safety and Health Administration wrote, *“DSG staff will also continue to stay apprised of this topic and any new scientific developments on hazards posed by*

⁶ <https://www.softlights.org/wp-content/uploads/2022/10/Baker-CL-2022-0375.pdf>

⁷ <https://www.softlights.org/wp-content/uploads/2022/10/CMS-AX-22-000-1287-Response.pdf>

⁸ https://www.softlights.org/wp-content/uploads/2022/12/NHTSA-220815-006_ND.pdf

⁹ https://www.softlights.org/wp-content/uploads/2023/08/Response-to-Petition-for-Rulemaking_8-21-23.pdf

¹⁰ <https://www.softlights.org/wp-content/uploads/2022/11/CPSC-Jurisdiction-Response.pdf>

*LED devices in the workplace.”*¹¹ This letter indicates that OSHA is waiting for the FDA to notify OSHA of the hazards posed by LED devices.

43. **FAA** – On November 9, 2022, the Federal Aviation Administration wrote *“We would defer to the FDA for comfort, health, and safety regulations and to OSHA for specific topics like cockpit lighting, in regard to LED products.”*¹²

44. **DOE** – On March 21, 20223, the Department of Energy wrote in the federal register, *“DOE notes that the FDA has authority to regulate certain aspects of LED products as radiation-emitting devices and has issued performance standards for certain types of light-emitting products. Currently, there is no FDA performance standard for LED products in part 1040. DOE acknowledges that Soft Lights expresses in its petition health concerns that Soft Lights associates with LEDs. However, such concerns are not for the consideration of DOE. DOE is not currently aware, nor was it at the time the May 2022 Definition and Backstop Final Rules were issued, of any prohibition on the use of LED lighting that would have impacted its rulemaking.”*

45. Thus, there now exists the situation where billions of LED emitters have been released into the environment without any regulation whatsoever. The fact that all federal agencies defer to the FDA for regulations for all LED products means that the FDA is required to publish standards for LED vehicle headlights. It means that the FDA is required to publish performance standards for LED General Service Lamps. It means that the FDA is required to publish performance standards for LED streetlights. It means that the FDA is required to publish performance standards for occupational safety. It means that the FDA is required to publish performance standards to protect the environment. No federal agency other than the FDA has been given the Congressional authority to regulate LED products, and no other federal agency has asserted such authority. Despite the enormity of the task of regulating all LED products, the FDA has taken no action at all.

¹¹ <https://www.softlights.org/wp-content/uploads/2022/10/Letter-From-OSHA.pdf>

¹² <https://www.softlights.org/wp-content/uploads/2023/09/Jurisdiction-Letter-from-FAA.pdf>

E. Attempted Administrative Actions

46. Citizen petition FDA-2022-P-1151 was submitted on June 13, 2022, to compel the FDA to publish the required performance standards for LED products. The FDA published this petition on regulations.gov and is accepting public comment.¹³

47. On November 6, 2022, the FDA responded to citizen petition FDA-2022-P-1151 by stating, “FDA has been unable to reach a decision on your petition because it raises issues requiring further review and analysis by agency officials.”¹⁴ – The FDA has provided no further updates since that time.

48. Citizen petition FDA-2023-P-0233 was submitted on January 22, 2023, to compel the FDA to publish the required performance standards for LED flashing lights. The FDA has not acted on this petition.¹⁵

49. On March 21, 2023, Senator Maria Cantwell of Washington received a letter from the FDA stating that the FDA was unable to reach a decision on regulation of LED products.¹⁶

50. Citizen petition FDA-2023-P-3828 was submitted on September 7, 2023, to compel the FDA to publish the required performance standards for LED vehicle lights. The FDA has not acted on this petition.

51. Citizen petition FDA-2023-P-3879 was submitted on September 11, 2023, to compel the FDA to publish the required performance standards for LED streetlights. The FDA has not acted on this petition.¹⁷

52. On July 28, 2023, United States Representative Mike Thompson of California sent a letter to FDA Commissioner Robert Califf requesting that the FDA comply with 21 U.S.C. 360ii and publish performance standards for LED vehicle headlights.¹⁸ The FDA has not responded to Representative Thompson.

¹³ <https://www.regulations.gov/document/FDA-2022-P-1151-0001>

¹⁴ <https://www.softlights.org/wp-content/uploads/2022/11/FDA-2022-P-1151-Interim-Petition-Response.pdf>

¹⁵ <https://www.regulations.gov/document/FDA-2023-P-0233-0001>

¹⁶ <https://www.softlights.org/wp-content/uploads/2023/03/Maria-Cantwell-Letter.pdf>

¹⁷ <https://www.regulations.gov/document/FDA-2023-P-3879-0001>

¹⁸ <https://www.softlights.org/wp-content/uploads/2023/07/Thompson.pdf>

53. On October 3, 2023, United States Representative Mark Pocan of Wisconsin sent a letter to FDA Commissioner Robert Califf requesting that the FDA comply with 21 U.S.C. 360ii and publish performance standards for LED vehicle headlights.¹⁹ The FDA has not responded to Representative Pocan.

F. Adverse Health Impacts of LED Radiation

54. LED radiation is a significant human health hazard and has been documented to cause seizures, migraines, panic attacks, anxiety, nausea, fear, agitation, eye pain, and eye injury.²⁰

55. Light sources such as the sun, a candle, and an incandescent light bulb emit light that is substantially similar to what is known as black body radiation. The light emitted by an LED has drastically different spatial, spectral, and temporal characteristics as compared to a black body radiator. Many individuals have reported that they are unaffected by black body radiation but suffer serious and significant adverse health impacts from exposure to LED radiation.

56. Reports of radiation exposure from LED products have been reported to the FDA via Form FDA 3649.²¹ However, the FDA is not actively collecting epidemiological data regarding LED exposure incidents and is making little or no effort to understand the scope of the problem. Despite these reports of harm, the FDA has taken no action.

57. The TEPRSSC published a presentation on October 25, 2016 on non-coherent light sources, including LEDs.²² The presentation states that the last time the FDA updated performance standards for non-coherent light sources was in 1985. The report discusses the blue light hazard but made no mention of neurological or psychological hazards. Despite recognizing in this 2016 presentation that the FDA had not published any safety standards for LED products, the FDA has taken no action to publish performance standards.

¹⁹ <https://www.softlights.org/wp-content/uploads/2023/10/LED-headlights-letter-10-3-23.pdf>

²⁰ <https://www.softlights.org/stories/>

²¹ <https://www.softlights.org/wp-content/uploads/2022/10/COR22000194.pdf>

²² <https://www.fda.gov/media/101349/download>

58. The FDA has not published restrictions on luminance, spatial uniformity, dispersion characteristics, spectral power distribution, digital flicker, pulse width modulation, or flash characteristics for any LED product to protect public health and safety.

G. Discriminatory Barriers

59. LED products have been documented to cause numerous adverse neurological reactions, including seizures, migraines, and panic attacks.

60. LED products have been documented to cause eye pain and eye injury.

61. LED products have been documented to interfere with cognitive functioning and vision.

62. For individuals with disabilities, these adverse reactions when exposed to LED radiation may prevent the individual from full, safe, and equal access to services and programs. Thus, the use of LED products may violate the Americans with Disabilities Act, the Rehabilitation Act, and State civil and human rights laws.

63. As an example, in a case involving high-luminance LED flashing lights, the Minnesota Department of Human Rights issued a Finding of Probable Cause of Discrimination against a city for failing to provide accommodation for an individual diagnosed with epilepsy who suffered seizure-like symptoms when exposed to the LED flashing lights.²³

64. Plaintiff has been diagnosed with autism spectrum disorder, a qualified disability.

65. On April 3, 2019, after having been subjected to months of exposure to visible radiation from LED products such as LED headlights, LED floodlights, LED streetlights, and LED flashing lights, Plaintiff suffered a catastrophic mental breakdown and was held against his will for four days in a mental health hospital.

66. As a result of the mental breakdown due to LED radiation exposure, Plaintiff could no longer maintain his job as a middle school math teacher and became unemployed.

²³ <https://www.softlights.org/wp-content/uploads/2023/06/74059-6-15-2023-ECP-Memorandum-.pdf>

67. Since 2019, Plaintiff has suffered numerous additional mental breakdowns caused by exposure to LED radiation, including LED vehicle headlights, LED streetlights, LED floodlights, and LED flashing lights on emergency vehicles.

68. Plaintiff has been forced out of hotels, grocery stores, and government buildings due to the feeling of suffocation caused by the overwhelming intensity of LED radiation being emitted.

69. In one incident, Plaintiff was the driver of a vehicle when Plaintiff encountered a California Department of Transportation vehicle with multiple rapidly flashing LED lights. Plaintiff suffered a severe decrease in vision and cognitive abilities, began screaming, and experienced strong suicidal ideations, tempered only by the presence of his partner in the passenger seat.

V. FIRST CAUSE OF ACTION

(Administrative Procedure Act – Agency Action Without Observance of Procedure Required by Law)

70. The Plaintiff realleges and incorporates by reference the allegations set forth in each of the preceding paragraphs of this Complaint.

71. The Food and Drug Administration has failed to protect the public from the harms of electromagnetic radiation emitted by Light Emitting Diode Products, in violation of 21 U.S.C. 360hh – 360ss.

72. The FDA has failed to comply with any of the requirements of 21 U.S.C. 360ii(a)(1), (2), (3), (4), (5), or (6) and publish performance standards for LED products.

73. The FDA has failed to comply with 21 U.S.C. 360jj and submit reports to Congress.

VI. SECOND CAUSE OF ACTION

(Administrative Procedure Act – Agency Action Contrary to Constitutional Right)

74. The Plaintiff realleges and incorporates by reference the allegations set forth in each of the preceding paragraphs of this Complaint.

75. The FDA's failure to publish performance standards for LED products is causing irreparable harm and thus violates Plaintiff's constitutional guarantee of equal protection in violation of 5 U.S.C. § 706(2)(B).

VII. THIRD CAUSE OF ACTION **(Equal Protection)**

76. The Plaintiff realleges and incorporates by reference the allegations set forth in each of the preceding paragraphs of this Complaint.

77. Through their actions described above, Defendants' violate the equal protection guarantee of the Due Process Clause of the Fifth Amendment to the United States Constitution.

78. LED radiation creates a discriminatory barrier for Plaintiff, denying Plaintiff full, safe, and equal access to public services and businesses in violation of the Fifth Amendment's equal protection clause.

VIII. RELIEF REQUESTED

79. Therefore, Plaintiff requests that the Court enter judgment:

80. A) Ordering the FDA to comply with 21 U.S.C 360ii(a) and act to protect the comfort, neurological health, psychological health, photobiological health, hormonal health, safety, and civil rights of the public from the harms of LED radiation.

81. B) Ordering the FDA to comply with 21 U.S.C. 360ii(a)(1), (2), (3), (4), (5), and (6), which includes publishing performance standards for LED products, liaising with other federal agencies on the development of these performance standards, and minimizing the emissions of, and the exposure of people to, unnecessary LED radiation.

82. C) Ordering the FDA to comply with 21 U.S.C. 360jj and submit regular, periodic reports to Congress on the harms of LED radiation and the regulatory actions being taken by the FDA.

83. D) Ordering the FDA to approve petition FDA-2023-P-0233 and publish performance standards for LED flashing lights no later than 12 months after this judgment.

84. E) Ordering the FDA to approve petition FDA-2023-P-2838 and publish performance standards for LED vehicle headlights no later than 12 months after this judgment.

85. F) Ordering the FDA to approve petition FDA-2023-P-3879 and publish performance standards for LED streetlights no later than 12 months after this judgment.

86. G) Ordering the FDA to approve petition FDA-2022-P-1151 and publish performance standards for all other LED products no later than 24 months after this judgment.

Dated: January 19, 2024

Respectfully submitted,

/s/ Mark Baker

9450 SW Gemini Drive PMB 44671

Beaverton, OR 97008

mbaker@softlights.org

APPENDIX A – HUMAN HEALTH

January 16, 2024 – [Nighttime Outdoor Artificial Light and Risk of Age-Related Macular Degeneration](#) – A study of 126,418 subjects found a correlation between Artificial Outdoor Light At Night and Exudative Age-related Macular Degeneration.

October 9, 2023 – [Day and night light exposure are associated with psychiatric disorders: an objective light study in >85,000 people](#) – Increased exposure to light at night increases a person's risk for psychiatric disorders such as anxiety, bipolar and PTSD severity as well as self-harm.

October 4, 2023 – [Lights should support circadian rhythms: evidence-based scientific consensus](#) – 2,697 peer-reviewed publications show the blue light is harmful.

June 23, 2023 – [Outdoor artificial light at night and risk of early-onset dementia: A case-control study in the Modena population, Northern Italy](#) – Study showing a connection between artificial light at night and dementia.

May, 2023 – [Understanding Light Pollution: Recent Advances on Its Health Threats and Regulations](#) – Discussion of health impacts of light pollution.

March 16, 2023 – [Light at night and cause-specific mortality risk in Mainland China: a nationwide observational study](#) – The first study showing a direct correlation between artificial light at night and death. – Cellular risks of blue light exposure.

March 13, 2023 – [The #1 EMF You've Forgotten About](#) – Detailed blog discussion of the impacts of blue wavelength light on human health.

January 4, 2023 – [Network-driven intracellular cAMP coordinates circadian rhythm in the suprachiasmatic nucleus](#) – Circadian rhythms are controlled by blue wavelength light.

December, 2022 – [Associations Between Indoor Light Pollution and Unhealthy Outcomes in 2,947 Adults: Cross-sectional Analysis in HEIJO-KYO Cohort](#) – LAN levels are significantly associated with parameters of obesity, dyslipidemia, systemic inflammation, sleep disturbances, and depressive symptoms.

October 24, 2022 – [Light Pollution Linked with Cognitive Decline](#) – Outdoor light pollution study.

September 28, 2022 – [Functional connectivity of brain networks with three monochromatic wavelengths: a pilot study using resting-state functional magnetic resonance imaging](#) – Each wavelength has different impacts on human brain activity.

August 10, 2022 – [Artificial light at night and risk of mental disorders: A systematic review](#) – “the epidemiological evidence produced so far seems to support an association between LAN and risk of depressive disorders.”

August 10, 2022 – [Disruption of the Circadian Clock Drives Apc Loss of Heterozygosity to Accelerate Colorectal Cancer](#) – Interruption of the circadian clock increases cancer risk.

July 15, 2022 – [Outdoor light at night, overweight and obesity in school-aged children and adolescents](#) – Outdoor light at night increases obesity in children.

June 22, 2022 – [Light at Night in Older Age Associated with Obesity, Diabetes, and Hypertension](#) – ALAN causes sickness.

June 14, 2022 – [Linking Individual Differences Between in Human Primary Visual to Contrast Sensitivity Around the Visual Field](#) – Research on how vision works.

June 6, 2022 – [Risk of COPD Exacerbation is Increased by Poor Sleep Quality and Modified by Social Adversity](#) – Poor sleep increases risk of lung disease.

March 14, 2022 – [Light Exposure During Sleep Impairs Cardiometabolic Function](#) – Blue light is bad. Any light is bad. Tiny amounts of light at night is bad.

March 10, 2022 – [Outdoor Light at Night and Autism Spectrum Disorder](#) – Artificial Light at Night significantly increases the risk of developing autism.

March 3, 2022 – [The Mind After Midnight: Nocturnal Wakefulness, Behavioral Dysregulation, and Psychopathology](#) – Maladaptive Behaviors After Midnight.

November, 2021 – [One Third of Us are At Risk](#) – Compiled links to medical research on the effects of LEDs.

June 6, 2021 – [Afraid of the dark: Light acutely suppresses activity in the human amygdala](#) – Fear of the dark is real.

May 13, 2021 – [Should We Re-think Regulations and Standards for Lighting at Workplaces? A Practice Review on Existing Lighting Recommendations](#) – Quote: the quality of light should not be reduced for lower energy consumption.

March, 2021 – [Do no harm: the beginning of the age of healthy hospital lighting](#) – Reduction of blue wavelength light improves sleep.

February 8, 2021 – [Associations between Artificial Light and Risk for Thyroid Cancer](#) – Artificial light increases thyroid cancer risk by 55%.

February, 2021 – [Insights into blue light accelerated tooth whitening](#) – At a radiance of 190 mW/cm², LEDs will bleach teeth.

January 27, 2021 – [Moonstruck sleep: Synchronization of human sleep with the moon cycle under field conditions](#) – Sleep timing is synchronized under the moon cycle. Artificial light disrupts this cycle.

January 7, 2021 – [Light Pollution, Sleep Deprivation, and Infant Health at Birth](#) – This study confirms that light pollution can lead to premature births.

November 5, 2020 – [Evening home lighting adversely impacts the circadian system and sleep](#) – This article makes the case that the economic benefits of energy efficient LED lighting are outweighed by the substantial disease burden they produce.

May 24, 2020 – [20% to 30% Have Heightened Sensitivity](#) – This article articulates how the 20% to 30% of the population who are sensitive receptors have been so far snubbed by the the psychology profession.

February 29, 2020 – [LED Street Lights – Major Health Concerns](#) This presentation by Dr. Wojcik summarizes the research about the dangers of blue wavelength light.

February 27, 2020 – [Blue Light Suppresses Melatonin in Dairy Calves](#) This study shows that melatonin is suppressed by blue wavelength light, thus affecting eating, drinking, etc.\

2020 – [Replace Toxic Fluorescent Light with Natural Light Now!](#) – A discussion of research studies showing the adverse health impacts of fluorescent and LED light on health and student learning.

December 13, 2019 – [Light-Emitting Diodes \(LEDS\): Implications for Safety](#) – Even though this is an article from ICNIRP, it contains a fundamentally false statement on efficiency and is missing discussion of non-uniform luminance.

October 17, 2019 – [Daily blue-light exposure shortens lifespan and causes brain neurodegeneration in Drosophila.](#) – LED blue wavelength light causes serious injury to flies.

April, 2019 – [Ocular hazards of curing light units used in dental practice – A systematic review](#) – The article states, “This review concludes that blue light poses maximum risk to cause retinal degeneration based on the evaluated studies.”

October 2, 2018 – [Melatonin: An Anti-Tumor Agent](#) This study shows that light at night increases risk of breast and prostate cancer.

July 2018 – [Light Pollution, Sleep Deprivation, and Infant Health at Birth](#) – Skyglow results in reduced birth weight and pre-term births.

June 25, 2018 – [Current Understanding of Photophobia, Visual Networks, and Headaches](#) – How light triggers pain.

June 5, 2018 – [SCHEER Final Opinion on Light Emitting Diodes](#) – An overly positive opinion of LEDs, choosing to ignore the downsides and missing studies.

February, 2018 – [Including an index measuring the weighted content of blue light in lamp labelling](#) – A proposal for G-Index in place of Correlated Color Temperature.

August 8, 2017 – [Harvard University – Outdoor Light at Night and Breast Cancer Incidence in the Nurses' Health Study II](#) This study shows the link between artificial light at night and breast cancer.

February, 2017 – [Blue Light Paradox](#) – Blue wavelength controls circadian rhythms, but also damages the eye.

January 31, 2017 – [National Institutes of Health – Timing of Light Exposure Affects Mood and Brain Circuits](#) – This scientific research article covers how circadian rhythms are being disrupted by artificial light at night.

January 2017 – [Photobiological Safety](#) – Discussion of the impacts of LED light on circadian rhythms and eye cells by Christophe Martinsons.

April, 2016 – [Exposure of Fluid Milk to LED Light](#) – LED light has a strong negative impact on the taste of milk.

January 24, 2016 – [NIH – Effects of Blue Light on the Circadian System and Eye Physiology](#) This scientific research paper concludes that blue light causes photoreceptor damage.

January 2013 – [Health Effects of Large LED Screens on Local Residents](#) – Luminance above 10,000 nits is dangerous and this article mentions the need to further study the impacts of LEDs on those with epilepsy.

November 8, 2012 – [Ensuring Safety in LED Lighting](#) – Significant coverage of the dangers of LED radiation. Blue light hazard, excessive luminance, macular degeneration, sleep disruption, and LEDs classified as lasers for use in toys.

June 3, 2011 – [Limiting the impact of light pollution on human health, environment, and stellar visibility.](#) – Impacts of light pollution.

December, 2010 – [Light Pollution: Light at Night and Breast Cancer Risk Worldwide](#) This study shows that cancer risk increased by as high as 50% for countries with high Artificial Light at Night.

August 20, 1999 – [Daylighting in Schools Study](#) – Students perform better under natural light.

November 22, 1996 – [Effect of bright light exposure on muscle sympathetic nerve activity in human](#) – 5000 lux light triggers nerve activity, even after the light is shut off.

APPENDIX B -EYE HAZARDS

December 17, 2023 – [Lighting for the Aging Eye](#) – Discussion of the impacts of light on an older person’s eyes.

May, 2023 – [Blueberry Stem Extract Suppresses Blue Light-Emitting Diode Light-Induced Endoplasmic Reticulum Stress on Retinal Photoreceptor Cells](#) – Blue light causes retinal photoreceptor damage via oxidative and endoplasmic reticulum (ER) stress.

April, 2023 – [Blue light exposure collapses the inner blood-retinal barrier by accelerating endothelial CLDN5 degradation through the disturbance of GNAZ and the activation of ADAM17](#) – Blue light causes cellular harm.

March, 2023 – [Blue Light—Ocular and Systemic Damaging Effects: A Narrative Review](#) – The harmful effects of blue wavelength light.

January 4, 2023 – [Network-driven intracellular cAMP coordinates circadian rhythm in the suprachiasmatic nucleus](#) – Circadian rhythms are controlled by blue wavelength light.

January, 2023 – [Blue light pollution causes retinal damage and degeneration by inducing ferroptosis](#) – Blue wavelength light causes cell death.

July 27, 2022 – [Age-dependent effects of blue light exposure on lifespan, neurodegeneration, and mitochondria physiology in *Drosophila melanogaster*](#) – Blue wavelength light is even more toxic as we age.

April, 2021 – [What is Photobiological Safety Standard?](#) – Discussion of IEC 62471 and concern about eye damage from LEDs and the classification groups Risk Group 0, 1, 2 and 3.

July 14, 2020 – [Comparison of ophthalmic toxicity of light-emitting diode and organic light-emitting diode light sources](#) – LEDs are toxic to the eye, OLEDs less so.

February, 2020 – [Light-induced Retinal Ganglion Cell Damage and the Relevant Mechanisms](#) – Retinal Ganglion Cells in the eye are damaged by excessive visible radiation.

August 21, 2019 – [Mitochondria as Potential Targets and Initiators of the Blue Light Hazard to the Retina](#) – Describes the structure of the eye at the cellular level and details the photobiological hazards and serious injury to the eye caused by blue wavelength light.

December 18, 2018 – [Research progress about the effect and prevention of blue light on eyes](#) – Quote: “High energy short wave blue light between 415 and 455 nm is the most harmful. Direct penetration of crystals into the retina causes irreversible photochemical retinal damage.”

December, 2018 – [Exposure to excessive blue LED light damages retinal pigment epithelium and photoreceptors of pigmented mice.](#)

June 29, 2017 – [Effects of white light-emitting diode \(LED\) exposure on retinal pigment epithelium *in vivo*](#)

February 18, 2017 – [Light-emitting-diode induced retinal damage and its wavelength dependency *in vivo*](#)

October, 2016 – [Blue Light: What are the Risks to Our Eyes?](#) – International Review of Ophthalmic Optics – Quote: *We cannot seriously deny the potential ocular risks from overexposure to blue light. It is important not to forget that it is the cumulative effect over time that is dangerous and must be fought.*

April 8, 2015 – [Retinal damage induced by commercial light emitting diodes \(LEDs\).](#)

March, 2014 – [White light-emitting diodes \(LEDs\) at domestic lighting levels and retinal injury in a rat model.](#)

APPENDIX C – NEUROLOGY

February 21, 2023 – [Associations Between the Pupil Light Reflex and the Broader Autism Phenotype in Children and Adults](#) – An individual with autism has a slower pupil light reflex.

November 30, 2022 – [A Case Study on the Effect of Light and Colors in the Built Environment on Autistic Children’s Behavior](#) – Quote, “especially since bright lights and loud sounds can be bothersome sensory overloads to autistic children affecting their functioning and behavior.”

February 7, 2022 – [Visually sensitive seizures: An updated review by the Epilepsy Foundation](#) – The abstract states that visually-induced seizures remain significant public health hazards so they warrant ongoing scientific and regulatory efforts and public education and that images with flashes brighter than 20 candelas/m² at 3-60 (particularly 15-20) Hz occupying at least 10 to 25% of the visual field are a risk. This confirms that LED flashing lights will trigger epileptic seizures.

November 19, 2021 – [Sensory Friendly LED Lighting for Healthcare Environments](#) – An important acknowledgement that light affects people with autism and that hospital environments can harm people with autism. However, the report fails to acknowledge non-uniform luminance and generally promotes unsafe LED lighting.

June 8, 2021 – [Visual Sensory Experiences from the Viewpoint of Autistic Adults](#) – Quote: “a dislike for extreme or flashing lights”

January 2013 – [Health Effects of Large LED Screens on Local Residents](#) – Luminance above 10,000 nits is dangerous and this article mentions the need to further study the impacts of LEDs on those with epilepsy.

[Psychological factors in exceptional, extreme and torturous environments](#) – Includes discussion of strobe lights as torture.

[The Hidden Harm](#) – Includes discussion of using bright lights as a torture method.

[Photosensitivity and Seizures](#) – A short article about light causing seizures in those with epilepsy.

[Why Light Worsens Migraine Headaches](#) – Discussion of how light increases the pain of migraine headaches.

[Sensitivity Intolerance in Autism](#) – Discussion of how light impacts those with autism.

[Lighting Ergonomics, Light Flicker](#) – Discussion of sub-sensory flicker.

[Avoiding Flashing on Web Pages](#) – Discussion of avoiding flashing that may trigger seizures.

[Blue Light and Bipolar Disorder](#) – August 4, 2021

Appendix D – ECOLOGY

January 11, 2024 – [How Artificial Light Threatens Nature](#) – Video documentary that details how artificial light is devastating the ecosystem.

October 30, 2023 – [Light Pollution in Complex Ecological Systems](#) – Light pollution is increasing at 10% per year and adversely impacting entire ecosystems.

September 21, 2023 – [Phenotypic signatures of urbanization? Resident, but not migratory, songbird eye size varies with urban-associated light pollution levels](#) – The eye size of urban birds is shrinking.

September 14, 2022 – [Environmental risks from artificial nighttime lighting widespread and increasing across Europe](#) – LEDs have increased light pollution and have increased the emissions of toxic blue wavelength light.

September 9, 2022 – [The Dark Side of LEDs: Suppression of Melatonin by Blue Light](#) – An article about the studies of researcher

May 20, 2022 – [Light pollution can disorient monarch butterflies](#) – Even a single light can interfere with a butterfly’s navigation system.

March 29, 2022 – [Broad spectrum artificial light at night increases the conspicuousness of camouflaged prey](#) – LED light leads to predator advantage.

April 27, 2022 – [Oriented Migratory Flight at Night: Consequences of nighttime light pollution for monarch butterflies](#) – ALAN interferes with monarch butterfly migration.

2022 – [Artificial Light at Night: State of the Science 2022](#) – IDA report. Discusses how LED light is increasing light pollution. Falsely claims that LEDs are energy efficient.

August, 2021 – [Street lighting has detrimental impacts on local insect populations](#) – This study shows that LEDs are killing insects even faster than High Pressure Sodium.

August, 2021 – [First Estimation of Global Trends in Nocturnal Power Emissions Reveals Acceleration of Light Pollution](#) – Light pollution continues to grow and LED blue wavelength light is making it worse.

April, 2021 – [Narrow Spectrum Artificial Light Silences Fireflies](#) – Artificial light, especially bright amber, suppresses courtship. “we should focus on minimizing the time that lights are on and how bright they are.” – [News Story](#)

March, 2021 – [Light Pollution Drives Increased Risk of West Nile Virus](#) – Even low levels of artificial light at night increase the risk of transmission of the virus.

March, 2021 – [Superoxide is Promoted by Sucrose and Affects Amplitude of Circadian Rhythms in the Evening](#) – Both light and sugars affect the biological clock of plants. – [News Story](#)

March 10, 2020 – [Artificial Lighting Impacts to Salmon in WRIA 8 Briefing Memo](#) – Artificial light is impacting the survival of juvenile salmon.

January, 2020 – [Australian Light Pollution Guidelines for Wildlife](#) This detailed document describes best lighting practices.

2020 – [“use lamps with the lowest CCT, melanopic response, or M/P value possible to achieve the goals of the lighting project.”](#) – Illuminating Engineering Society – [On the Use of Summary Metrics of Light Spectral Characteristics to Assess Effects of Artificial Light at Night on Wildlife](#)

2020 – [“ALAN reduces habitat suitability”](#) – El Sevier – [Effects of artificial light at night on the foraging behavior of an endangered nocturnal mammal](#)

July 30, 2018 – [Waters under Artificial Lights: Does Light Pollution Matter for Aquatic Primary Producers?](#) – ALAN and LED light negatively impacts periphyton.

July 30, 2018 – [Waters under Artificial Lights: Does Light Pollution Matter for Aquatic Primary Producers?](#) – ALAN negatively impacts periphyton.

2018 – [“Anthropogenic lighting drastically alters nocturnal environments, threatening a wide range of species”](#) – Colorado State University – [Anthropogenic light disrupts natural light cycles in critical conservation areas](#)

2018 – [“we advocate warm color temperature white light as nighttime illumination”](#) – Health and Human Services USA – [Light at night disrupts nocturnal rest and elevates glucocorticoids at cool color temperatures](#)

2018 – [“bombarded with numerous novel stimuli in their environment that could lead to grave consequences.”](#) – Journal of Ecology – [Connecting spectral radiometry of anthropogenic light sources to the visual ecology of organisms](#)

2018 – [“if the tendency to light more when light is cheaper can be overcome”](#) – Luger Research – [Hazard or Hope? LEDs and Wildlife](#)

2017 – [“When the installation was illuminated, birds aggregated in high densities, decreased flight speeds, followed circular flight paths, and vocalized frequently”](#) – [Proceedings of the National Academy of Sciences](#) – [High-intensity urban light installation dramatically alters nocturnal bird migration](#)

2013 – [“alters detection of day and night” – Exeter University – Measuring biological light pollution and uncovering its ecological effects](#)

2013 – [“the significant impact that even low levels of nighttime light pollution can have” – Cambridge University – The ecological impacts of nighttime light pollution: a mechanistic appraisal](#)

November, 2017 – [Artificially lit surface of Earth at night increasing in radiance and extent](#) – This study uses satellite data to show that light pollution has increased due to the use of LED lights.

2017 – [“Managers should avoid lights that have ultraviolet or blue light \(shorter wavelengths\)” – National Park Service – Artificial Night Lighting and Protected Lands](#)

April, 2015 – [Artificial Light at Night and the Predator-Prey Dynamics of Juvenile Atlantic Salmon](#) – Even tiny amounts of artificial light affect salmon.

2015 – [“The most immediate threat from anthropogenic noise and light is the loss of species” – Trends in Ecology & Evolution – A framework to assess evolutionary responses to anthropogenic light and sound](#)

May 29, 2014 – [Potential Biological and Ecological Effects of Flickering Artificial Light](#) – Explains how the visual system of different creatures have a rate at which they capture images. Electric light interferes with this system, causing perceived flicker.

2014 – [“exacerbate existing domestic, e.g., midge swarms and industrial infestations of sanitary and phytosanitary pests” – Ecological Society of America – LED lighting increases the ecological impact of light pollution irrespective of color temperature](#)

2012 – [“Technological innovations and changes in lighting strategies should consider benefits for reductions in greenhouse gases and energy consumption in parallel with their potential ecological impacts” – Global Change Biology – Conserving energy at a cost to biodiversity? Impacts of LED lighting on bats](#)

2009 – [“Light pollution can have significant conservation consequences for a threatened bat species” – Current Biology – Street Lighting Disturbs Commuting Bats](#)

APPENDIX E – PHYSICS

July 3, 2023 – [LED Bulb Truth](#) – This video shows the physics characteristics of incandescent, CFL, and LED. The narrator mentions the directed energy beam of LED and shows the spectral power distribution and flicker characteristics of LED light.

May 4, 2023 – [Light field analysis for modeling and transmission characteristics of partially coherent light-emitting diodes](#) – A discussion of the Lambertian spatial distribution of LED light and its semi-coherent properties.

January 22, 2023 – [A Quest for New Metrics to Curb the Increase In Glare from LED Lighting](#) – Lead author Dr. Peter Veto details the primary problems with LED light sources: unregulated peak luminance and inappropriate measurement techniques.

November 14, 2022 – [Curved vs. Flat](#) – A comparison of curved vs. flat surface radiation emitters.

August, 2022 – [Radio Wave Packet](#) – What you need to know about wireless technology.

June 7, 2021 – [What is Peak Brightness](#) – Confirmation by a writer in the LED display industry that LED brightness is measured with luminance in nits, not luminous intensity in candela.

December, 2021 – [Is Street Lighting Damaging Our Health?](#) – The first documented admission by an LED lighting company, Cree Lighting, that the industry has been using the wrong metrics to measure LEDs. ([.pdf version](#))

October, 2019 – [Derivation and Experimental Verification of the Near-field 2D and 3D Optical Intensities From a Finite-size Light Emitting Diode \(LED\)](#) – Calculating peak intensities for the Lambertian shape generated by LEDs.

August, 2018 – [Determination of a laser eye dazzle safety framework](#) – Describes how a laser beam can cover part or all of an eye.

July 1, 2016 – [The Influence of LED Emission Characteristics on the Efficiency of Lighting Systems](#) – Describes the difference between volume and surface LED emitters and describes the spatial emissions as a Lambertian or near-Lambertian.

February 7, 2014 – [Can Light Bend Around Corners?](#) – Light interferes with itself, causing beam spread.

2013 – [Radiance of the sun, a 1 mW laser pointer and a phosphor emitter](#) – Discussion of homogenous and non-homogenous emitters and the importance of field of view. Includes discussion of safety limits.

2013 – [Angular Distribution of Average Luminous Intensity of Low-power LEDs](#) – LEDs emit non-uniform energy in a Lambertian shape, sometimes off-center.

2011 – [Measuring Luminance with a Digital Camera](#) – Explains how to use a digital camera to measure luminance from LED light sources.

January, 2009 – [Electromagnetic Radiation from Organic Light-emitting Diodes](#) – Shows a Light Intensity Diagram for an OLED with Lambertian shape.

2009 – [Light-Emitting Diode Technology for Solid State Lighting](#) – States that there are no known studies in the impacts of spikey spectral distribution on human perception and accurately predicts that LEDs will change the world.

2008 – [Digital Billboard Recommendations and Comparisons to Conventional Billboards](#) – Dr. Ian Lewin examines LED billboards. 300 nits is comfortable.

2008 – [Modeling the Radiation Pattern of LEDs](#) – LEDs emit non-uniform radiation.

2007 – [Spherical Wave Propagation](#) – Antennas emit radiation in a spherical wave that disperses following an inverse square law, so long as the antenna emits isotropic radiation. A flat surface antenna will instead emit a directed energy beam.

2007 – [Luminance and Light Intensity Conversion](#)

[Illuminance vs Luminance](#) – Luminance is the light that hits the eye. Luminance plus contrast is brightness. In the case of LEDs, the luminance is coming straight from the source without being reflected first.

[Yujileds](#) – Industry information about LEDs contains color many color temperature charts and other useful information.

[Light Emitting Diodes Chapter 16](#) – Differentiates between “point sources” and “surface sources” for brightness.

[Inverse Square Law, General](#) – Quote: “Any point source which spreads its influence equally in all directions without a limit to its range will obey the inverse square law.” – LEDs are Lambertian Sources, not Point Sources, and the influence is not spread equally in all directions. Thus, LED radiation does not obey an inverse square law.

APPENDIX F – FLICKER

August, 2023 – [Illuminating Engineering Society Newsletter](#) – IES states, “*Temporal light modulation (TLM, or flicker) is an increasing phenomenon in indoor, outdoor, and vehicular applications, due to the widespread adoption of LED sources. Most LED lighting systems don’t produce problematic TLM, but for those that do, there has been a delayed recognition that certain TLM waveform characteristics and viewing conditions can result in distraction and disorientation, cognitive effects, and **serious health consequences** in some populations.*”

July 27, 2017 – [The Scientific Reason You Don’t Like LED Bulbs](#) – Explains that LED bulb can flicker at 400 Hertz, but humans are negatively affected up to 3000 Hertz.

2011 – [Exploring Flicker in Solid State Lighting](#) – Pacific Northwest National Laboratory (Department of Energy). Includes statements that flicker can cause neurological problems.

2010 – [LED Lighting Flicker and Potential Health Concerns](#) – There are various reasons why LEDs can flicker and this flicker can cause seizures and other negative neurological responses.

APPENDIX G – FLASHING LIGHTS

October 26, 2022 – [Team-driven Improvement in the Use of Lights and Sirens](#) – Discussion of the dangers of using lights and sirens.

April 22, 2022 – [Can behavioral interventions be too salient? Evidence from traffic safety messages.](#) – Electronic signs are distracting and lead to more crashes.

March 29, 2022 – [Flashing Emergency Lights: Influence of Intensity, Flash Rate and Synchronization on Driver Visibility, Comfort and Confidence](#) – Flashing lights can be too bright and flash too quickly.

February 7, 2022 – [Visually sensitive seizures: An updated review by the Epilepsy Foundation](#) – The abstract states that visually-induced seizures remain significant public health hazards so they warrant ongoing scientific and regulatory efforts and public education and that images with flashes brighter than 20 candelas/m² at 3-60 (particularly 15-20) Hz occupying at least 10 to 25% of the visual field are a risk. This confirms that LED flashing lights will trigger epileptic seizures.

January 27, 2022 – [Video of Dodge Charger Driver Dead](#) – Police vehicles with high-intensity LED flashing lights.

December, 2021 – [Effects of Emergency Vehicle Lighting Characteristics on Driver Perception and Behavior](#) – This study concludes that high intensity flashing lights put lives at risk.

August, 2021 – [Risk of Fire Alarm Strobe Lights](#) – An article by a risk management expert on LED strobe lights used in buildings.

January 28, 2021 – [How Do Flashing Lights Trigger Epileptic Seizures?](#) – This overview article mentions that contrast is a trigger, as is flash rate.

January 9, 2021– [California Highway Patrol](#) – Video of CHP vehicle on roadway with high luminance LED strobe lights.

June 11, 2019 – [Stroboscopic light effects during electronic dance music festivals and photosensitive epilepsy: a cohort study and case report](#) The connection between strobe lights and seizures.

April 2, 2019 – [Impacts of Flashing Emergency Lights](#) This study concludes that strobing LED lights are dangerous.

February 9, 2019 – [Massachusetts State Police](#) – Compilation video showing high luminance strobe lights on MSP vehicles.

January 12, 2019 – [Is Use of Warning Lights and Sirens Associated With Increased Risk of Ambulance Crashes? A Contemporary Analysis Using National EMS Information System \(NEMSIS\) Data](#) – Ambulance use of lights and sirens is associated with increased risk of ambulance crashes.

January, 2018 – [Police Warning Signals](#) – This article in Police Chief Magazine discusses the dangers of overly intense strobing lights.

May 2, 2017 – [Flashing Lights Induce Prolonged Distortions in Visual Cortical Responses and Visual Perception](#) – A flashing light induces an anomalously delayed response in the primary visual cortex of mice, rats, and humans.

June 5, 2016 – [Why Running Lights and Sirens is Dangerous](#) – Flashing Lights and Sirens may save a few minutes, but does not change the outcome of the event. There is no value to using them, but there is harm.

June 1, 2016 – [National Institutes of Health – Psychological Factors in Exceptional, Extreme and Torturous Environments](#) This scientific research shows that strobing LED lights are instruments of torture.

April 18, 2014 – [Hazardous Effects of Light Stimulation in the Central Nervous System](#) – High-temporal-frequency visual stimuli can yield hazardous responses in the central nervous system.

October, 2010 – [Ambulance Lights](#) – Article on ambulance lights. “Fewer lights, flashing slower & less brightly are more effective.”

2005 – [Photic- and Pattern-induced Seizures: Expert Consensus of the Epilepsy Foundation of America Working Group](#) – A pre-LED study of how flashing lights cause seizures.

August 5, 2001 – [Rear Lighting Configurations for Winter Maintenance Vehicles](#) Strobing lights are less effective than static lights for safety.

March 22, 1971 – [Failure of Visual Estimation of Motion Under Strobe](#) – The author shows how difficult it is to catch a bean bag tossed under strobing lights.

December 27, 1955 – [Siren, Light Removal Makes Police Unhappy](#) – “Removal of the sirens and red lights has materially reduced accidents involving police cars rushing to other smashups or speeding to the scene of a crime.”

APPENDIX H – STREET LIGHTING

July, 2023 – [How a Simple Concept Enabled a \\$50 Billion LED Streetlight Scam that Changed our World](#) – This 19 minute video describes some of the false claims of LED street lighting.

May, 2023 – [The LED's Challenge to High Pressure Sodium \(Response / Debunking / Topic Expansion\)](#) – This hour-long video debunks many myths about blue rich LED streetlighting.

March, 2023 – [A Multi-Field Analysis of Street Lighting in Grand Rapids, Michigan](#) – A detailed analysis showing why LED streetlights with blue wavelength light are unsafe and why Low Pressure Sodium is most energy efficient and safest type of street lighting.

2019 – [EU Joint Research Center – Revision of the EU Green Public Procurement Criteria for Road Lighting and traffic signals](#) – This key document uses the concept of the spectral G-index to set a standard for both correlated color temperature and amount of blue wavelength.

January 9, 2018 – [Road Lighting Research for Drivers and Pedestrians](#) – Admitting that the standards do not match the empirical realities.

APPENIDX I – VEHICLE LIGHTS

March 22, 2023 – [Performance investigation of different headlights used in vehicles under foggy conditions](#) – LED headlights are worse for driver detection times in fog.

July 23, 2022 – [Why are LED Headlights so Glaring?](#) – In this two-part video, Dr. Peter Veto explains the technical details of why LED headlights are so dangerous. LEDs are a small source, thus emitting more glare and LED headlights emit more high-energy blue wavelength.

December 15, 2021 – [The Phantom Wiggle](#) – Dr. Peter Veto recently identified The Phantom Wiggle, which shows LED visible radiation appearing to move in space. This effect has not yet been studied, but the effect is related to the fact that LEDs have flicker and the brain is unable to properly locate the source in space. This effect may have serious consequences our ability to judge distance when a vehicle is using LED radiation devices.

June 23, 2021 – [Adaptive Driving Beam and Glare](#) – Dr. Peter Veto discusses the fallacy of ADB headlights.

March, 2021 – [Pedestrian Fatalities by State: Preliminary 2020 data](#) – – This report shows that pedestrian fatalities increased by 21% from 2019 to 2020.

January 28, 2018 – [Driving in the Dark: Designing Autonomous Vehicles for Reducing Light Pollution](#) – This engineering ethics article discusses how damaging light pollution is to our ecosystem and how we can design autonomous vehicles to have minimal external lights.

October, 2017 – [Development of a System to Study the Impact of Headlight Glare in a Driving Simulator](#) – This article discusses the design of a simulator to study LED headlight glare.

February, 2004 – [LightAware Report](#) – This report shows crash and fatality statistics showing a positive relationship between the introduction of LED headlights and vehicle crashes and pedestrian deaths.

2004 – [NHTSA ASTEX Case](#) – This report demonstrates that at one time, NHTSA actually did investigate and take action when headlights did not comply with FMVSS-108.

November, 1989 – [The Measurement of Dark Adaptation Level in the Presence of Glare](#) – Study on the impacts of light on rods and cones from headlights.

APPENDIX J – ELECTRONIC SIGNS

July 28, 2023 – [DIGITAL SIGNAGE | Consider digital billboards a contributing outdoor light source](#) – The author states that LED billboards have negative impacts on mental workload, ability to follow signs, eye movements, and fixations.

February 28, 2021– [The Development Of Brightness Evaluation Method For Digital Billboards](#) – This research article discusses the many dangers of LED billboards.

January 15, 2021 – [Influence of Coloured Light from LED Display Screens](#) – This research shows that LED billboards affect driver safety.

April 9, 2019 – [Billboard Study, City of New Orleans](#) –

February 2016 – [Collection of Digital Billboard Research Studies](#) – A professional review of studies prior to 2016

November, 2014 – [Nevada Department of Transportation Study of Electronic Billboards](#)

May 2013 – [Driver attention is Captured by Roadside Advertising Signs](#) – Danish Study concludes that even non-LED roadside signs cause dangerous distraction.

January 2013 – [Health Effects of Large LED Screens on Local Residents](#) – Luminance above 10,000 nits is dangerous.

July 8, 2012 – [Effects of Electronic Billboards on Driver Distraction](#) – Swedish Study.

November 9, 2010 – [Digital Billboard Luminance Recommendation](#) – Recommendation of 20 nit maximum due to transient eye adaptation.

March 1, 2010 – [Digital Billboards, Diversions Drivers Can't Escape](#) – New York Times.