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BY EMAIL

Jennifer Granholm, Secretary
Department of Energy
The.secretary@hq.doe.gov

Re: Petition to Publish Performance Standards for LED Lighting

Dear Secretary Granholm,

Pursuant to 5 USC 553(e) Rulemaking, the Soft Lights Foundation hereby submits this petition requesting that DOE coordinate with the Food and Drug Administration to develop and publish performance standards for the visible radiation emitted by products using Light Emitting Diodes. The petition is contained in the following pages.

Sincerely,

A handwritten signature in black ink that reads "Mark Baker". The signature is written in a cursive, slightly slanted style.

Mark Baker
President
Soft Lights Foundation
mbaker@softlights.org

Petition To Publish Performance Standards for the Visible Radiation Emitted by Products Using Light Emitting Diodes.

I. Introduction

In 1968, Congress passed the Radiation Control for Health and Safety Act. This law is codified in 21 USC Chapter 9, Subchapter V, Part C – Electronic Product Radiation Control. The law directs the Secretary of Health and Human Services to develop and publish performance standards for electronic products and to collaborate with other federal agencies in the development of these standards.¹

Health and Human Services, Food and Drug Administration, and the Department of Energy have not complied with this statute and have not coordinated to develop and publish performance standards for the visible radiation emitted by products using Light Emitting Diodes. There are no published performance standards for LED General Service Lamps, LED streetlights, and other types of LED lighting, other than requirements for luminous efficacy.

The performance standards that are needed for LED devices include restrictions for peak luminance, spatial uniformity, inverse square law dispersion, spectral power distribution, square wave flicker, pulse width modulation, and flash characteristics.

This petition requests that DOE consult and liaison with the FDA to develop techniques to evaluate the visible radiation emitted by LEDs and to publish performance standards to minimize exposure to LED visible radiation to ensure the comfort, health, and safety of the public as required by 21 USC Chapter 9, Subchapter V, Part C, Section 360ii – Program of Control.

II. 21 USC Section 360ii – Program of Control

21 USC Chapter 9, Subchapter V, Part C, Section 360ii – Program of Control, details the requirements for Health and Human Services to establish and carry out an electronic product radiation control program. HHS implements this section via the HHS Food and Drug Administration Center for Devices and Radiological Health.

In the following sections, we assess the requirements of Section 360ii.

(a) ESTABLISHMENT *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—*

It is clear in (a) that Congress' mandate is to protect the public from the harms of electronic product radiation. The word "shall" means that this section is a mandate, and not optional. The FDA currently has no electronic product radiation control program for the visible radiation emitted by non-point source visible radiation emitted by LEDs, in violation of this statute.

¹ <https://www.law.cornell.edu/uscode/text/21/360ii>

- (1)** *pursuant to section 360kk of this title, develop and administer performance standards for electronic products;*

Performance standards for LED products include restrictions for peak luminance, spatial uniformity, inverse square law dispersion, spectral power distribution, square wave flicker, pulse width modulation, and flash characteristics. The FDA currently has published no performance standards for any of these characteristics of LED visible radiation, in violation of this statute.

- (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;*

LED visible radiation is a human health hazard and has been documented to cause seizures, migraines, nausea, agitation, panic attack, fear, anger, eye pain, eye injury, distraction, reduced cognitive functioning, and impaired vision. The FDA has taken few or no steps to minimize the emissions and exposure of visible radiation emitted by LEDs, in violation of this statute.

- (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 made little or no effort to maintain a liaison with the DOE regarding the visible radiation emitted by LEDs. LEDs were invented in the 1960s and this statute mandates that the FDA be aware of “*future potential electronic product radiation.*” DOE and the FDA failed to liaison and ensure that performance standards for LED products were published before the DOE implemented the 45 lumen/watt rule effectively banning the incandescent light bulb.

- (4)** *study and evaluate emissions of, and conditions of exposure to, electronic product radiation and intense magnetic fields;*

The FDA has made little or no effort to study and evaluate visible radiation emissions from LED electronic products, in violation of this statute.

- (5)** *develop, test, and evaluate the effectiveness of procedures and techniques for minimizing exposure to electronic product radiation; and*

The FDA has not developed, tested, or evaluated the effectiveness and techniques for minimizing exposure to LED visible radiation, in violation of this statute. The FDA has not yet publicly acknowledged that LEDs are not a point source, and that LEDs must be regulated by the metric luminance. Nor has the FDA publicly acknowledged that LEDs emit spatially non-uniform luminance in a mathematical Lambertian shape that does not disperse following an inverse square law. The FDA has not developed techniques that are valid and accurate for measuring peak luminance. High-power LED chips already exceed 70,000,000 candela per square meter of peak

luminance, and yet the FDA has not developed any procedures to minimize exposure to this intense visible radiation.

Similarly, the FDA has made little or no effort to evaluate the effectiveness and techniques for minimizing exposure to hazardous blue wavelength light, exposure to square wave flicker, or exposure to pulsed visible radiation such as emitted by LED strobe lights.

- (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.*

DOE and the FDA have not adequately consulted and maintained a liaison on techniques, equipment, or programs of testing and evaluating LED visible radiation, nor have DOE and the FDA developed the required performance standards to control the visible radiation emissions from LEDs, in violation of this statute.

III. 10 CFR – Energy

§ 430.32 Energy and water conservation standards and their compliance dates. – “(dd) *General service lamp. Beginning July 25, 2022 the sale of any general service lamp that does not meet a minimum efficacy standard of 45 lumens per watt is prohibited.*”

The definition of energy efficiency is providing the same quality of light using less energy. The incandescent light bulb has a luminous efficacy of approximately 10 lumens per watt and is thus prohibited by this rule. However, incandescent light bulbs provide the qualities of point source visible radiation, spatially uniform illumination, inverse square law dispersion, a smooth increase in spectral power distribution from low blue to high red and infrared, and analog flicker. By specifying only the energy component of the requirement, without stating the quality component, the replacement GSL is not required to provide the same quality of service as the incandescent light bulb. LEDs are not point source emitters, do not provide uniform illumination, do emit light that disperses following an inverse square law, has a piecewise spectral power distribution, frequently containing extreme peaks of hazardous blue wavelength light, and have square wave flicker. Thus, LED replacement GSLs are not an energy efficient replacement, but rather a low-quality light replacement which harms the public.

LED GSLs have been documented to cause seizures, migraines, eye pain, and eye injury, and blue wavelength light has been documented to disrupt circadian rhythms by suppressing the hormone melatonin, leading to significant increases in risk of cancer, diabetes, heart disease, mood disorders, and early mortality.

No manufacturer has complied with the Administrative Procedure Act of 1946 and petitioned the FDA for authorization to manufacture and sell LED GSLs, in violation of 5 USC 551-559.

The FDA has not vetted or approved any LED products, including LED GSLs, or published performance standards for LED GSLs to ensure the comfort, health, and safety of the public.

DOE's prohibition of the incandescent light bulb has been implemented without following federal procedures and without ensuring that the rule will protect the wellbeing of the citizens.

§ 851.10 General requirements. – *“(a) With respect to a covered workplace for which a contractor is responsible, the contractor must: (1) Provide a place of employment that is free from recognized hazards that are causing or have the potential to cause death or serious physical harm to workers;”*

LEDs are a known human health and safety hazard. The lack of performance standards for LED products creates the potential to cause death or serious harm to workers. Without performance standards for LED products, contractors have no guidance for protecting workers from the harms of LED visible radiation.

§ 1041.130 General prohibitions against discrimination - *“No qualified handicapped person shall, on the basis of handicap, be excluded from participation in, be denied the benefits of, or otherwise be subjected to discrimination under any program or activity conducted by the agency.”*

DOE Rules EERE-2021-BT-STD-0005 and EERE-2021-BT-STD-0012 FOR GENERAL SERVICE LAMPS violate this statute because the rule prohibits the manufacture and sale of the generally safe incandescent light bulb in favor of hazardous LED visible radiation devices which have been documented to trigger life-threatening seizures, debilitating migraines, anxiety, nausea, eye pain, and eye injury. LED GSLs create discriminatory barriers where none previously existed when using incandescent light bulbs, and thus LEDs exclude those with disabilities from participation in, and denied the benefits of, many federal programs. These barriers to access were created by the DOE's rules EERE-2021-BT-STD-0005 and EERE-2021-BT-STD-0012.

IV. LED Products

LEDs are used in many locations and for many functions. Each of these different uses requires explicit performance standards to ensure the comfort, health, and safety of the public and wildlife, and to ensure accessibility for all individuals, especially those who are highly sensitive to LED visible radiation.

A. LED General Service Lamps

Unregulated LED General Service Lamps are unsafe for certain individuals. With LED chips emitting more than 70,000,000 candela per square meter of peak luminance and human comfort level being only 300 candela per square meter, there is an astronomical difference between the intensity emitted by the LED chip and the tolerance of humans to absorb this radiation. DOE has published no restrictions on the maximum peak luminance of LED GSLs to ensure photobiological and neurological safety.

Current labeling requirements for LED light bulbs do not include the key metric “peak luminance” to allow consumers to understand the intensity of the emitted visible radiation. This is an issue that must be fixed.

While Correlated Color Temperature conveys some sense of the amount of hazardous blue wavelength light, this single value does not sufficiently convey the spectral power distribution of LED visible radiation for a given LED lightbulb. A spectral power distribution chart for the visible radiation at peak luminance should be provided to the consumer.

LED light bulb packaging does not contain information about the amount of square wave flicker produced by the product. Square wave flicker information is a necessity for consumers to be able to make informed decisions.

DOE and FDA must establish regulations that ensure that consumers know what they are buying.

Because the visible radiation emitted by LED GSLs cannot be neurologically tolerated by many individuals, the DOE must provide a mechanism for these individuals to purchase incandescent light bulbs.

B. LED Streetlights

Unregulated LED streetlights are a human health hazard. The extreme intensity, the lack of uniform illumination, and the use of hazardous blue wavelength light make LED streetlights an unsafe option. LED streetlights trigger photosensitive seizures for certain individuals, endangering their lives, and creating discriminatory barriers, in violation of disability and civil rights laws.

Light pollution is now increasing at a rate of 10% per year, as compared to the 2% per year increase prior to the introduction of LED streetlights.² Light pollution is responsible for serious adverse health impacts such as increased risk of prostate, thyroid, and breast cancer, diabetes, obesity, mood disorders, and early mortality.³ Blue wavelength light has been shown to greatly increase insect mortality.⁴

The luminous efficacy of Low-Pressure Sodium streetlights is approximately 180 lumens/watt, which exceeds the approximately 120 lumens/watt luminous efficacy of LED

² <https://www.science.org/doi/10.1126/science.adf4952>

³ <http://www.softlights.org/human-health/>

⁴ <https://www.science.org/doi/10.1126/sciadv.abi8322>

streetlights. LPS is thus a safer and less energy intensive product as compared to LED streetlights.

Neither the DOE nor the FDA have developed or published performance standards to ensure that citizens and wildlife are not harmed by LED streetlights.

V. Characteristics of LED Visible Radiation

The characteristics of LED visible radiation that require performance standards includes:

- **Peak luminance** – A maximum luminance value in candela per square meter must be set for each LED product to ensure that the light is safe and comfortable for all individuals, especially those who are most sensitive.
- **Inverse Square Law Dispersion** – Since LEDs emit light from a flat surface, the light does not disperse following an inverse square law. Restrictions must be created to ensure that the light gently and safely disperses.
- **Spatial Uniformity** – The beam of light emitted by an LED is mathematically described as a Lambertian, meaning that the light energy within the beam is not homogeneous. LEDs create a non-uniform illumination pattern that can lead to unsafe conditions and neurological harm. Regulations must ensure uniform illumination from devices that are designed to illuminate a volume of space.
- **Spectral Power Distribution** – LEDs frequently contain a large spike of hazardous blue wavelength light and piecewise spectral power distribution that can cause serious ocular damage which can be permanent. LED products with a high Correlated Color Temperature can cause blinding glare and eye pain. Cumulative exposure to blue wavelength light will likely result in eye cell death, leading to diseases such as macular degeneration. Restrictions must be set to ensure that the spectral power distribution is harmless.
- **Square Wave Flicker** – An LED is a digital device, and the LED requires electronics to cause the LED to emit visible radiation. The square wave flicker can be a health hazard for all individuals, with reactions ranging from mild annoyance to nausea, to migraine, and to seizure. Flicker rates as high as 10,000 Hertz can be neurologically detected. Thus, as per 21 USC Section 360ii, the temporal characteristics of LED visible radiation must be restricted to minimize harm for all individuals, especially those who are most sensitive.
- **Flash Characteristics** – For flashing and strobing LEDs, the square wave on/off is neurologically hazardous because it can change too quickly, and the nerves and brain do not have the necessary capacity to process this type of energy. At a minimum, LED strobe lights are a dangerous distraction, but they also can violate civil rights and trigger agitation, anger, debilitating seizures, and life-threatening seizures. Restrictions must be set on LED strobe lights to ensure that the LED strobe light does not trigger a seizure, migraine, or panic attack, or decrease vision or impair cognitive abilities.

VI. Requested Action

Petitioner requests that DOE consult and liaison with the FDA to minimize the risk of harm to all individuals, especially those who are most sensitive, from LED visible radiation devices and to publish performance standards for all categories of LED products, in accordance with 21 USC Section 360ii and 10 CFR Sections 851.10 and 1041.130, , that will ensure the comfort, health, safety, and equal access rights of the public, including children, the elderly, those with disabilities, and the generally healthy population.