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**BY EMAIL**

Ann Carlson, Acting Director  
National Highway Traffic Safety Administration  
[ann.carlson@dot.gov](mailto:ann.carlson@dot.gov)

**Re: Petition to Publish Performance Standards for LED Vehicle Lighting**

Dear Ann Carlson,

Pursuant to CFR Title 49, Subtitle B, Chapter V, Part 552, Subpart A Petitions for Rulemaking, Defect, and Non-Compliance Orders, the Soft Lights Foundation hereby submits this petition requesting that NHTSA coordinate with the Food and Drug Administration to develop and publish performance standards for the visible radiation emitted by Light Emitting Diodes used in vehicles. 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](mailto:mbaker@softlights.org)

# Petition To Publish Performance Standards for the Visible Radiation emitted by Light Emitting Diodes used in Vehicles.

## 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.<sup>1</sup>

Health and Human Services, Food and Drug Administration, Department of Transportation, and National Highway Traffic Safety Administration have not complied with this statute and have not coordinated to develop and publish performance standards for the visible radiation emitted by Light Emitting Diodes on vehicles. There are no published performance standards for LED headlights, LED taillights, LED brake lights, LED Daytime Running Lights, LED turn signals, LED backup lights, LED strobe lights, LED displays, or LED indicator lights, all of which are used in vehicles.

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 NHTSA 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

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

radiation emitted by non-point source visible radiation emitted by LEDs, in violation of this statute.

*(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 NHTSA 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.*” NHTSA and the FDA failed to liaison and ensure that performance standards for LED products were published before they were used in vehicles.

*(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. LED chips for vehicle headlights 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.*

NHTSA 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 NHTSA and the FDA developed the required performance standards to control the visible radiation emissions from LEDs, in violation of this statute.

### III. 49 CFR Section 1.94 – The National Highway Traffic Safety Administration

CFR Title 49, Subtitle A, Part 1, Subpart D, Section 194(b) states that NHTSA is responsible for, “**In motor vehicle safety**, *establishing and enforcing safety standards and regulations for the manufacture and importation of motor vehicles and motor vehicle equipment; conducting research, development, and testing concerning motor vehicle safety, including vehicle-to-vehicle and vehicle-to-infrastructure technologies and other new or advanced vehicle technologies; and investigating safety-related defects and non-compliance in motor vehicles and motor vehicle equipment and administering related recalls.*”

NHTSA is currently not complying with this statute by not investigating the safety-related defects caused using non-compliant LED headlights, LED Daytime Running Lights, LED strobe lights, LED displays, and other LED visible radiation devices and by not collaborating with the FDA to research, develop and test equipment and programs for non-point source LED visible radiation devices, and by not recalling vehicles with unregulated, unapproved LED headlights.

### IV. LEDs on Vehicles

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

## A. LED Headlights

Unregulated LED headlights are unsafe. 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. Thus, it may be technically infeasible to adjust the peak luminance of LED headlights to be comfortable or safe.

The visible radiation emitted by LEDs does not gently disperse following an inverse square law. Thus, the intensity is nearly as intense at the source as it is at the eye. There are no known techniques used by NHTSA to accurately measure the peak luminance at the eye at the required femtometer or picometer precision. People have reported that LED light is difficult to see through, creates a distraction, and captures the thoughts of the person.

LED headlights typically have a Correlated Color Temperature of 6500 Kelvin. The extreme peak of blue wavelength light creates dangerous disability glare. Many research studies have shown that blue wavelength light is a photobiological safety hazard.

LED headlights often exhibit square wave flicker, either from poorly designed electronics or purposely engineered to use pulse width modulation to dim the headlight. Square wave flicker is a significant human health hazard.

## B. LED Taillights and LED Brake Lights

Unregulated LED taillights and LED brake lights are excessively intense. For example, the intensity of an LED taillight on a vehicle that is far away can distract a driver from their task at hand. The intensity of the taillight should only be enough to alert the driver who is close enough to need the information conveyed by the light, but not so intense as to interfere with a driver who is far enough behind that extra light is a distraction. As noted in 21 USC Section 360ii, visible radiation must be minimized to reduce risk.

When a driver is close behind another vehicle, such as stopped at a signal, an LED taillight or brake light can be debilitating, causing the driver to put their hands up to protect their eyes. Taillights and brake lights should not be so intense as to create discomfort or pain.

## C. LED Backup Lights

LED backup lights are excessively intense. The backup light should be used only to notify a driver or person in the immediate vicinity of the back of the vehicle. Excessively intense LED light can trigger seizures, migraines, and eye pain. The public should not have to endure these adverse health impacts from the simple act of driving a vehicle in reverse.

## D. LED Turn Signals

The excessive intensity and digital nature of the on/off flashing of LED turn signals makes them an unsafe distraction. Turn signals should be low intensity and should have long ramp-up and decay times so as not to interfere with neurological functioning.

#### E. LED Daytime Running Lights

LED DRLs are a safety hazard. Because of the intensity of LED visible radiation and because LED light does not gently disperse following an inverse square law, and because of the excessive peak of blue wavelength light from 6500K DRLs, the original intent of DRLs to improve safety has now been lost. During the daytime, drivers use the reflected light from the sun to see vehicles, children, dogs, signs, etc. The use of LED DRLs impairs vision and reduces awareness of the surroundings, creating an unsafe environment.

#### F. LED Indicator Lights

The purpose of an indicator light is to provide the viewer with quick notification about the status of an electronic device. Due to lack of regulation, LED indicator lights now cause eye pain, causing people to take actions to avoid looking at the indicator.

#### G. LED Displays

There is a major trend by the manufacturers to remove physical controls and replace them with user interface elements on an LED screen. LED screens are a dangerous distraction. In addition, many individuals cannot neurologically process the visible radiation emitted by LED screens. For example, these individuals cannot use an LED phone or LED computer display. Thus, vehicles that use LED displays create discriminatory barriers that prevent equal access for all citizens. LED screens can be far too intense, interfering with driver vision and causing eye and brain fatigue.

#### H. LED Strobe Lights

Currently NHTSA does not regulate flashing lights and leaves that regulation up to the states. However, with the introduction of unregulated LED flashing/strobing lights on emergency vehicles, utility trucks, tow trucks, garbage trucks, and other vehicles, it is critical that NHTSA publish performance standards to regulate the flash characteristics of LED strobe lights on vehicles. Since the use of LED strobe lights has a high correlation with photosensitive seizures, migraines, and panic attacks, impaired vision, and reduced cognitive functioning, it is likely that NHTSA must prohibit the use of LED strobe lights on vehicles.

### 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 vehicle headlights are currently rated at 6500K for Correlated Color Temperature which causes blinding glare and eye pain. Cumulative exposure 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 NHTSA 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 used on vehicles and to publish performance standards for all categories of LEDs use on vehicles, in accordance with 21 USC Section 360ii and 49 CFR Section 1.94, that will ensure the comfort, health and safety of the public, including children, the elderly, those with disabilities, and the generally healthy population.