

January 5, 2021

**BY EMAIL**

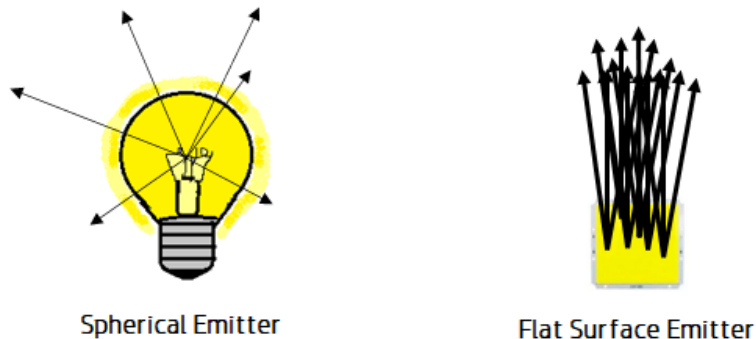
Stephanie Pollack, Deputy Administrator  
Federal Highway Administration  
Stephanie.Pollack@dot.gov

**Re: Regulating LED Light Beams**

Dear Stephanie Pollack,

Light Emitting Diodes produce light beams, rather than spatially uniform light. The result of the flat surface of an LED chip is an exceedingly intense beam from the middle of the chip that exceeds human tolerance levels and is toxic, hazardous, and discriminatory. This spatially non-uniform electromagnetic radiation from LEDs is entirely unregulated by the government.

As shown in Figure 1, a spherical emitter sends light in all directions in space. Because of the curvature of the emitter, the light rays do not overlap, and the radiation is spatially, spectrally, and temporally uniform. On the other hand, a flat surface emitter, such as an LED, sends light only in the forward direction. The light rays are confined to an 'escape angle' which is determined by the physical characteristics of the chip. Thus, there are overlapping rays, with the most overlap being in the center of the chip, and the least overlap being on the edges. The result is that every point in space has different spatial, spectral, and temporal properties.



*Figure 1 - Spherical vs. Flat Surface Emitter*

Figure 2 shows the uniform spatial energy from candles, incandescent and High-Pressure Sodium versus the non-uniform spatial energy from an LED. The intense peak of energy will cause eye damage and will overload the nerve signals to the brain because the information is not uniform.

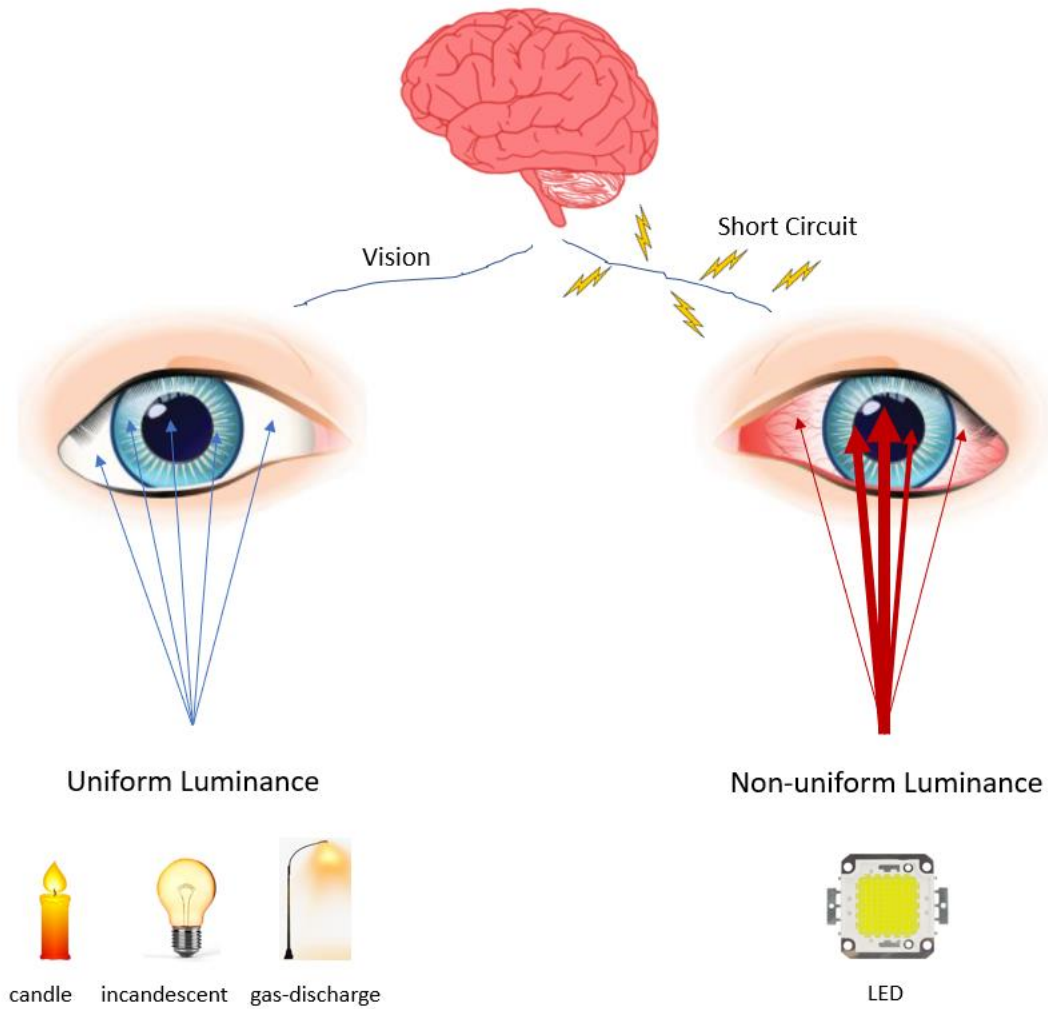


Figure 2 - Spatially Uniform v. Non-Uniform Radiation

Figure 3 is a diagram showing the categorization of radiation and shows that *light* and *illumination* are spatially isotropic radiation in the human visible portion of the electromagnetic spectrum. Radiation emitted by LEDs do meet the regulatory meaning of or comply with standards for the use of light as illumination.

## Regulatory Meaning of Light and Illumination

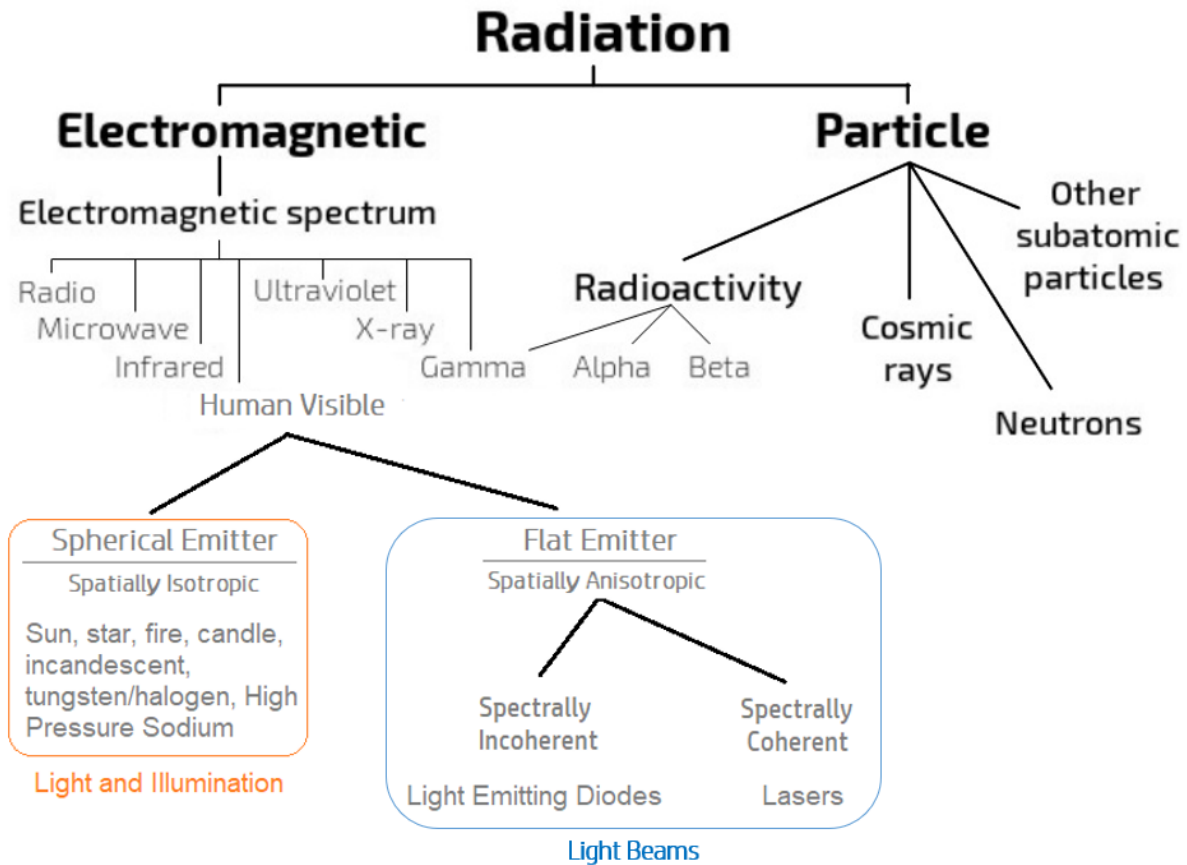
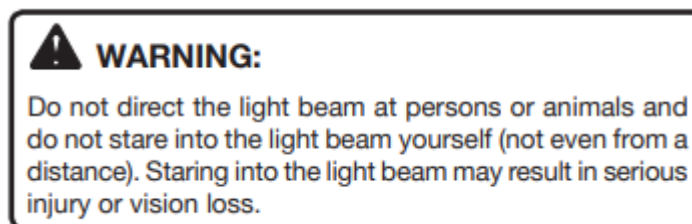


Figure 3 - Radiation Types

As an example of how dangerous LED radiation is, the operator's manual for the Ryobi P705 Flashlight includes the following: "**WARNING: Do not direct the light beam at persons or animals and do not stare into the beam yourself (not even from a distance) Staring into the light beam may result in serious injury or vision loss.**" The warning also refers to children, who along with infants are an identified high-risk population vulnerable to LED-exposure harm. Babies often lack an adult's automatic, self-protective aversion response to bright or intense light, and will stare directly at the source.



LED flashing lights turn on and off instantly and have a dangerous peak radiance. These LED flashing lights are being used on stop signs, yield signs, police cars, ambulances, utility trucks, tow trucks, and fire engines. The non-uniform radiation and intense peak radiance triggers seizures, causes migraines, interferes with human nerve functioning, reduces vision, increases agitation, and endangers the lives of the public and first responders.

Figure 4 is a diagram showing why the spatial distribution of LED radiation is so toxic and dangerous. The peak luminance of an LED can be hundreds of thousands or even hundreds of millions of nits, far exceeding human thresholds, and the non-uniform shape interferes with the human nervous system.

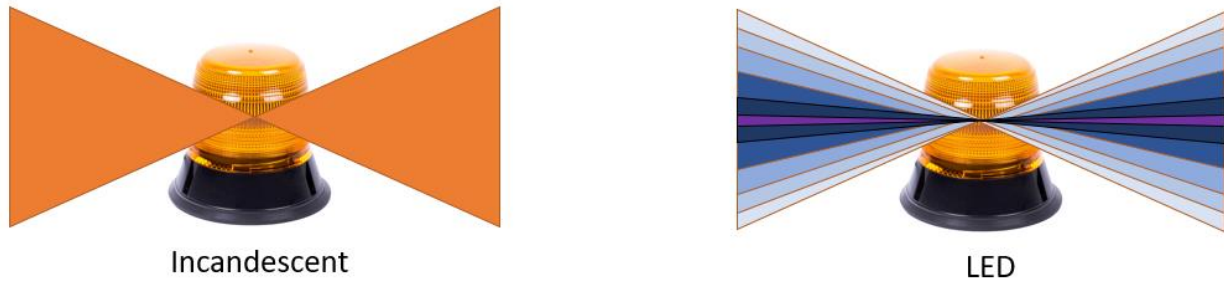


Figure 4 - Incandescent vs. LED Flashing Lights

The first video example below shows how incandescent hazard lights work. They give a slow, general, soft warning and let people know that the vehicle is in an unusual situation without detracting from the task of driving or walking.

Non-LED Hazard Lights: <https://youtu.be/DHJZTb7qXQo>



Figure 5 - Non-LED Hazard Lights

The remaining videos show the misuse of technology, where flashing LED light beams do not carefully warn, but rather assault people, violating their civil rights, damaging their eyes, interfering with the functioning of their nerves, and endangering their lives.

Utility Truck: <https://youtu.be/ma0hGwHivO4>

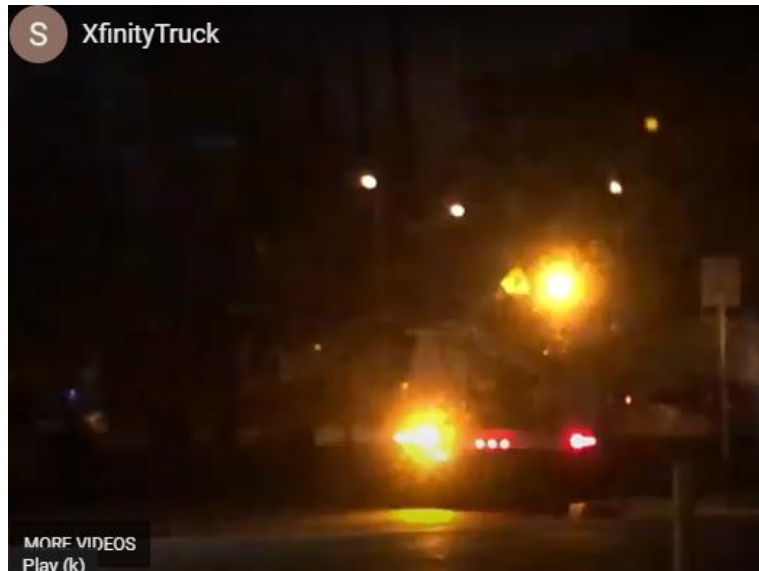


Figure 6 – Utility Truck

Flashing Stop Sign: <https://youtu.be/dLv9bqMFaXY>

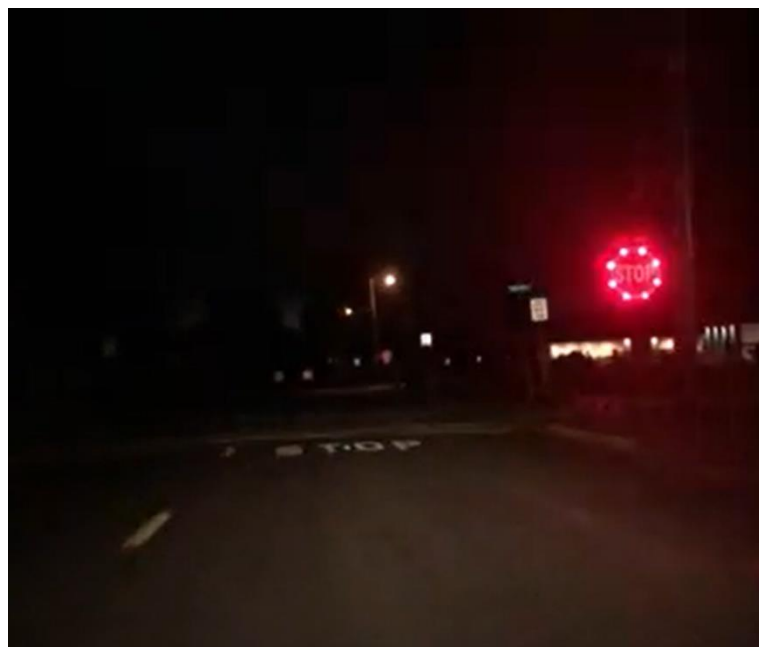


Figure 7 - Flashing Stop Sign

Highway Patrol: <https://youtu.be/bhEkxtKbtks>

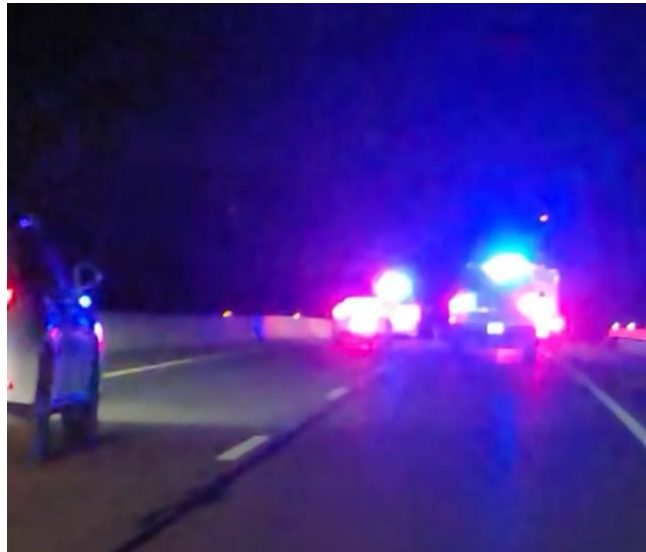


Figure 8 - Highway Patrol

Rectangular Rapid Flashing Beacon: <https://youtu.be/KBltx0Argag>



Figure 9 - RRFB

Fire Truck: [https://youtu.be/910\\_J5xhTtk](https://youtu.be/910_J5xhTtk)



Figure 10 - Fire Truck

Tow Truck: <https://youtu.be/cJKgMtXJ-IE>



Figure 11 - Tow Truck



Ambulance: <https://youtu.be/S6-wZdTMfA>



Figure 12 - Ambulance

Utility Truck: <https://youtu.be/0MLDA6too1Q>



Figure 13 - Utility Truck



In addition to the spatial characteristics of LED radiation, the spectral and temporal characteristics also make LED radiation dangerous. LEDs turn on and off immediately, giving the brain no time to adapt to change. An LED can also have a peak of 450nm blue wavelength that causes glare and eye damage.

The FHWA currently has no regulations for protecting human eyes and nerves from LED light beams. The Manual of Uniform Traffic Control Devices is not updated to properly address LED light beams, although Rectangular Rapid Flashing Beacons have been allowed provisionally. The temporary authorization of RRFBs was based on a single study by the Texas A&M Transportation Institute.<sup>1</sup> This poorly designed study made no effort to measure the impacts of LED light beams on the human eye and no effort to measure the impacts on human nerves and the psychological impacts of being subjected to intense LED electromagnetic radiation which could lead to seizures or road rage.

The FHWA currently has no regulations for the quantity of LED flashing devices on a vehicle or in a geographic location, their flash rate, peak radiance, or protection for eyes, vision, or neurology and FHWA has made no effort to ensure that LED flashing lights do not violate the Americans with Disabilities Act.

Both human drivers and Artificial Intelligence drivers rely on sensors to receive input from the world about them and a communication channel to send that input to a processing center. LED flashing lights interfere with this system, degrading vision, and increasing the likelihood of vehicle crashes, injury, and death.

The result of exposure to LED electromagnetic radiation is immediate sickness in the form of headaches, nausea, eye pain, loss of balance, migraines, panic response, altered vision, epileptic seizures, disorientation, and other neurological disturbances. Each of these symptoms is being verifiably reported by an increasing number of individuals and constitute medical evidence of LED-induced harm. LED visible radiation exposure is causing catastrophic physical harm, subjecting at-risk individuals to illness and injury, and plunging formerly healthy, independent people into crisis levels of stress, hopelessness, psychological trauma, and persistent thoughts of suicide.

LED radiation is discriminatory because it interferes with human nerves and disrupts major life functions such as seeing, thinking, and concentrating for people with disabilities, such as those with epilepsy, autism, PTSD, migraines, bipolar disorder, and others. LED radiation prevents safe access to public services such as roads, sidewalks, and government facilities. Use of LED radiation devices violates the federal Americans with Disabilities Act.

The FHWA must act in 2022 to prohibit unsafe and discriminatory LED flashing lights on signs and vehicles.

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<sup>1</sup> <https://www.fhwa.dot.gov/publications/research/safety/15041/15041.pdf>

Sincerely,

*Mark Baker*

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