

January 7, 2022

BY EMAIL

Mark Allen, General Counsel
FedEx
mallen@fedex.com

Re: Dangerous and Illegal LED Light Beams

Dear Mark Allen,

The National Highway Transportation Safety Administration has never approved spatially anisotropic visible radiation from a flat surface for use as a vehicle headlight, Daytime Running Light, taillight or flashing light. For aftermarket headlights that are often used on commercial trucks, NHTSA has released a letter confirming that NHTSA has never approved any aftermarket LED headlights¹ Therefore, all LED light beams in use on vehicles are illegal and this creates a significant liability issue for FedEx.

Figure 1 is a photo taken in October, 2021 of a vehicle with LED headlights. This photo is representative of the glare and danger presented by LED headlights.

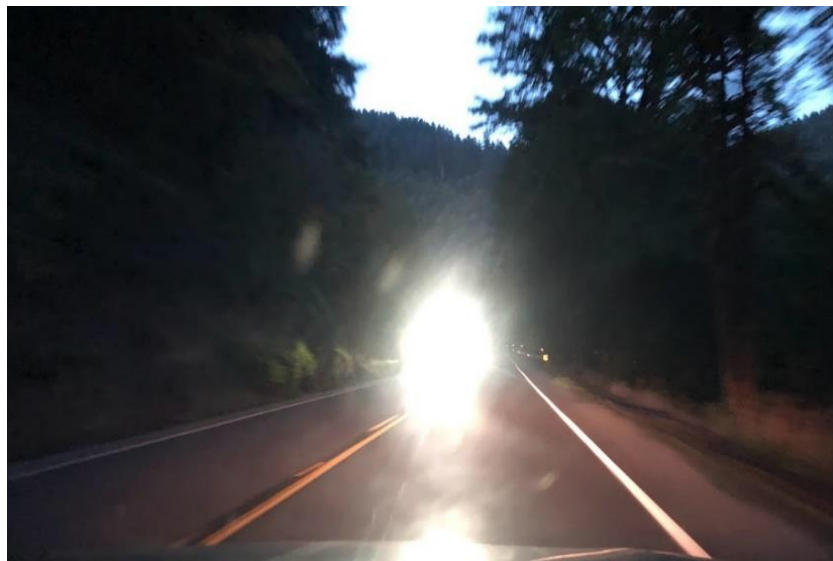


Figure 1 - LED Headlights

¹ <http://www.softlights.org/wp-content/uploads/2021/12/Leroy-Angeles.pdf>

Figure 2 shows an older model truck with aftermarket LED replacement headlights. We know that the headlights are LED because we can see the diodes in the photo.



Figure 2 - Illegal Aftermarket LED Headlights

Light Emitting Diodes produce light beams, rather than spatially uniform light. The result of the emission from 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 and not approved by the government.

The left side of Figure 3 shows a spherical emitter that 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. Every single point on the sphere is the same as any other point. On the other hand, the right side of Figure 3 shows a flat surface emitter such as an LED, which has a middle and edges. This flat surface creates a situation where the middle of the chip has different energy than the edges of the chip. LEDs send light only in the forward direction and 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.

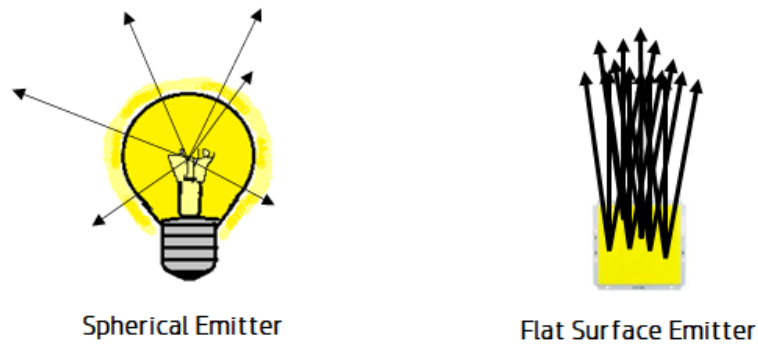


Figure 3 - Spherical vs. Flat Surface Emitter

Figure 4 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.

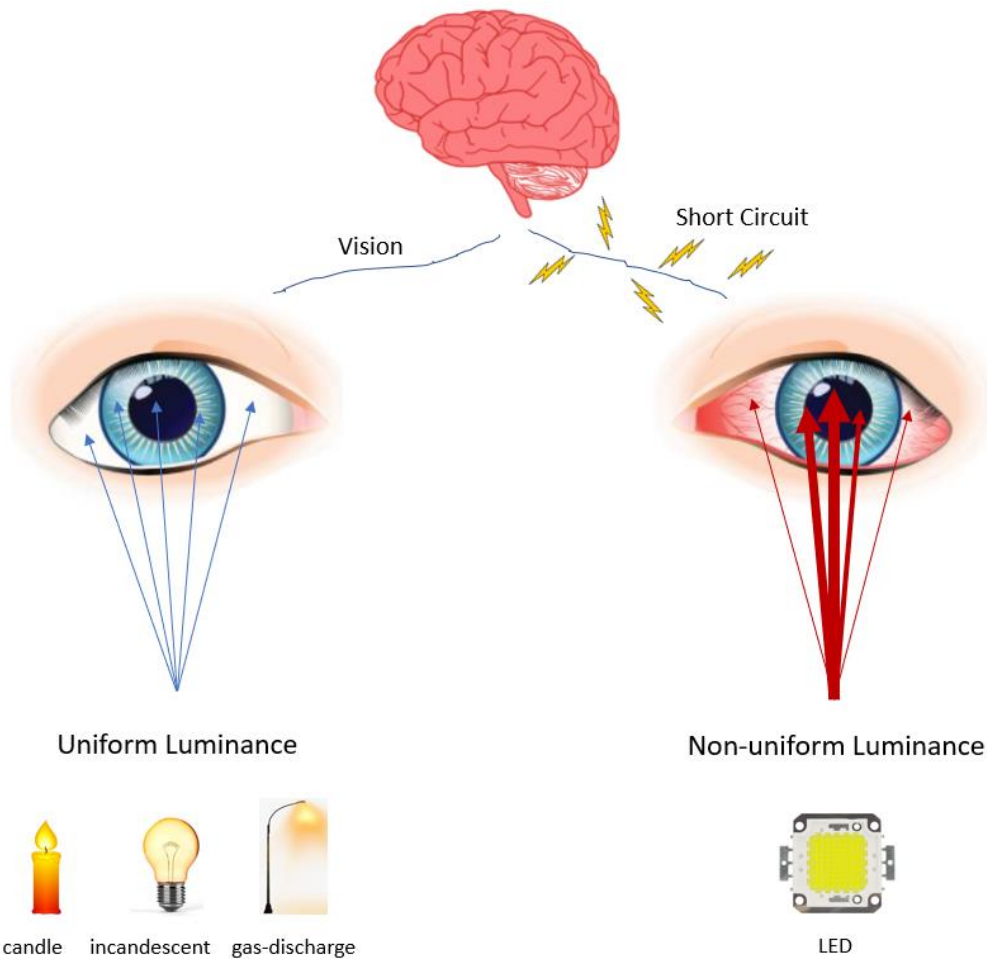


Figure 4 - Spatially Uniform v. Non-Uniform Radiation

Figure 5 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

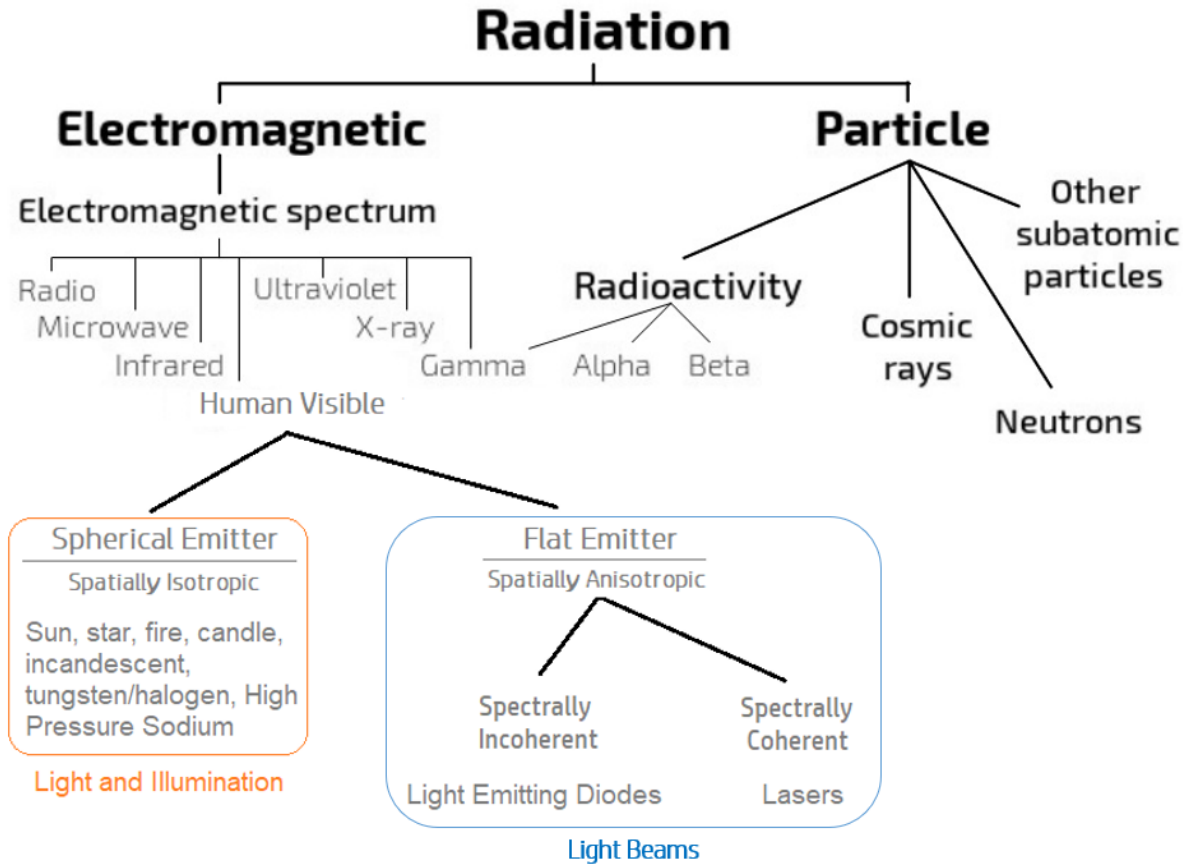
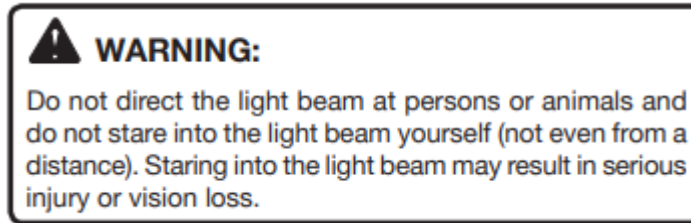


Figure 5 - Radiation Types

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. 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 FedEx employees.

Figure 6 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.

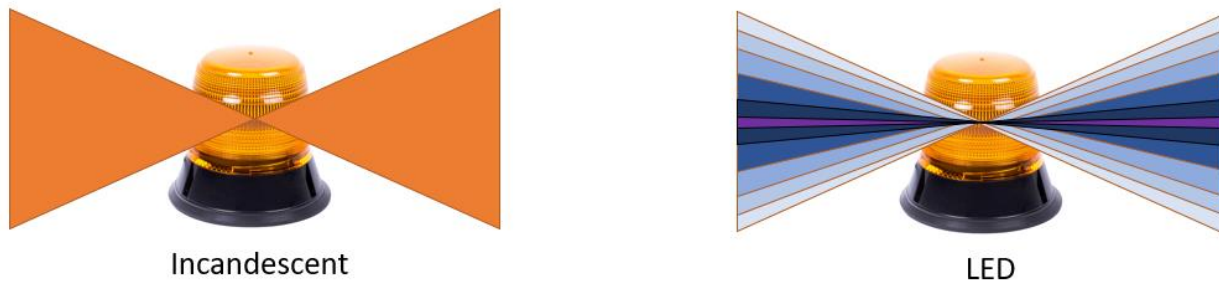


Figure 6 - Incandescent vs. LED Flashing Lights

The 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 7 - Non-LED Hazard Lights

The video below shows 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/0MLDA6too1Q>



Figure 8 - Utility Truck

To protect the health and safety of FedEx employees and the public, and to reduce liability, FedEx must eliminate all LED light beam devices from their vehicles, including LED headlights, LED tail lights, LED Daytime Running Lights, and LED flashing lights, so that the vehicles are compliant with the spatially uniform luminance requirements of NHTSA FMVSS-108 and so that LED light beams do not harm, injure or discriminate.

Sincerely,

Mark Baker

Mark Baker
President

Soft Lights Foundation
mbaker@softlights.org

9450 SW Gemini Drive PMB 44671
Beaverton, OR 97008