

January 22, 2022

BY EMAIL

Jack Marchbanks, Director
Ohio Department of Transportation
Jack.Marchbanks@dot.ohio.gov

Re: The LED Fraud

Dear Jack Marchbanks.

The purpose of this letter is to formally notify the Ohio Department of Transportation that LED headlights have never been approved for use by the National Highway Transportation Safety Administration and that use of LED headlights, both OEM and aftermarket, are illegal. Because LED headlights are illegal, and because they are toxic, hazardous, and discriminatory, ODOT must enforce the law and take action to remove LED headlights from use on Ohio's roads. For example, ODOT must ensure that headlights are visually inspected during commercial truck inspections and that the discovery of the use of LED headlights would result in a citation by ODOT.

LED electromagnetic radiation devices emit non-uniform radiation that is exceedingly intense in the middle of the chip. While human comfort level is approximately 300 nits of uniform luminance, today's LED chips can have a peak luminance exceeding 100,000,000 nits¹ and an extreme variability between the peak luminance and the edge luminance.

The injuries caused by LEDs is being documented. MarieAnn Cherry is an adult who has epilepsy, a formally recognized disability, and who has been sickened by LED light beams many times. Her exposures to LED light beams, even for a fraction of a second, has led to hundreds of seizures resulting in broken bones, lost teeth, and psychological trauma. MarieAnn has researched the issue and has written up a synopsis of how the safety of LEDs has been ignored by the authorities.² MarieAnn's document also contains links to 40 studies on the toxic effects of LEDs.

MarieAnn has compiled a list of verifiable quotes from persons who have been injured by LED exposure.³ Since it is unethical to directly study whether a technology triggers a life-threatening seizure in humans by exposing the person to the possible trigger and it is also unethical to involuntarily subject

¹ <https://www.laserfocusworld.com/test-measurement/research/article/16555223/nonlaser-light-sources-highluminance-leds-target-emerging-automotive-lighting-applications>

² http://www.softlights.org/wp-content/uploads/2022/01/One-Third-of-us-at-Risk_-The-Medical-science-of-LEDs.pdf

³ <http://www.softlights.org/wp-content/uploads/2022/01/Quotes-from-individuals-harmed-by-LED-exposure.pdf>

humans to medical experiments,⁴ a study does not necessarily have to be carried out in a laboratory. A study of verifiable reports of incidents related to LED light beam exposure is a valid study.

MarieAnn's efforts highlight the toxic effects of LED light beams on people with epilepsy, but the toxicity of spatially non-uniform electromagnetic visible radiation impacts all members of the public and all other creatures such as owls, insects, and fish because of the way it interferes with the proper functioning of nerves, and the damage to the eye caused by chemical and thermal damage.

To assist you with understanding the nature of LED light beams, we provide the following information.

The left side of Figure 1 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 1 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.

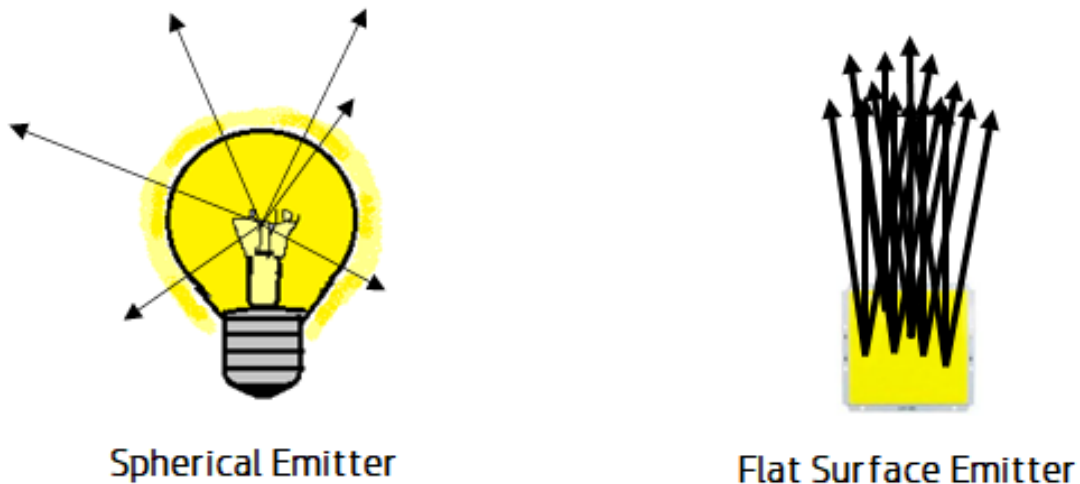


Figure 1 - Spherical vs. Flat Surface Emitter

⁴ https://media.tghn.org/medialibrary/2011/04/BMJ_No_7070_Volume_313_The_Nuremberg_Code.pdf

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. These negative outcomes are the effects of the toxicity of LEDs.

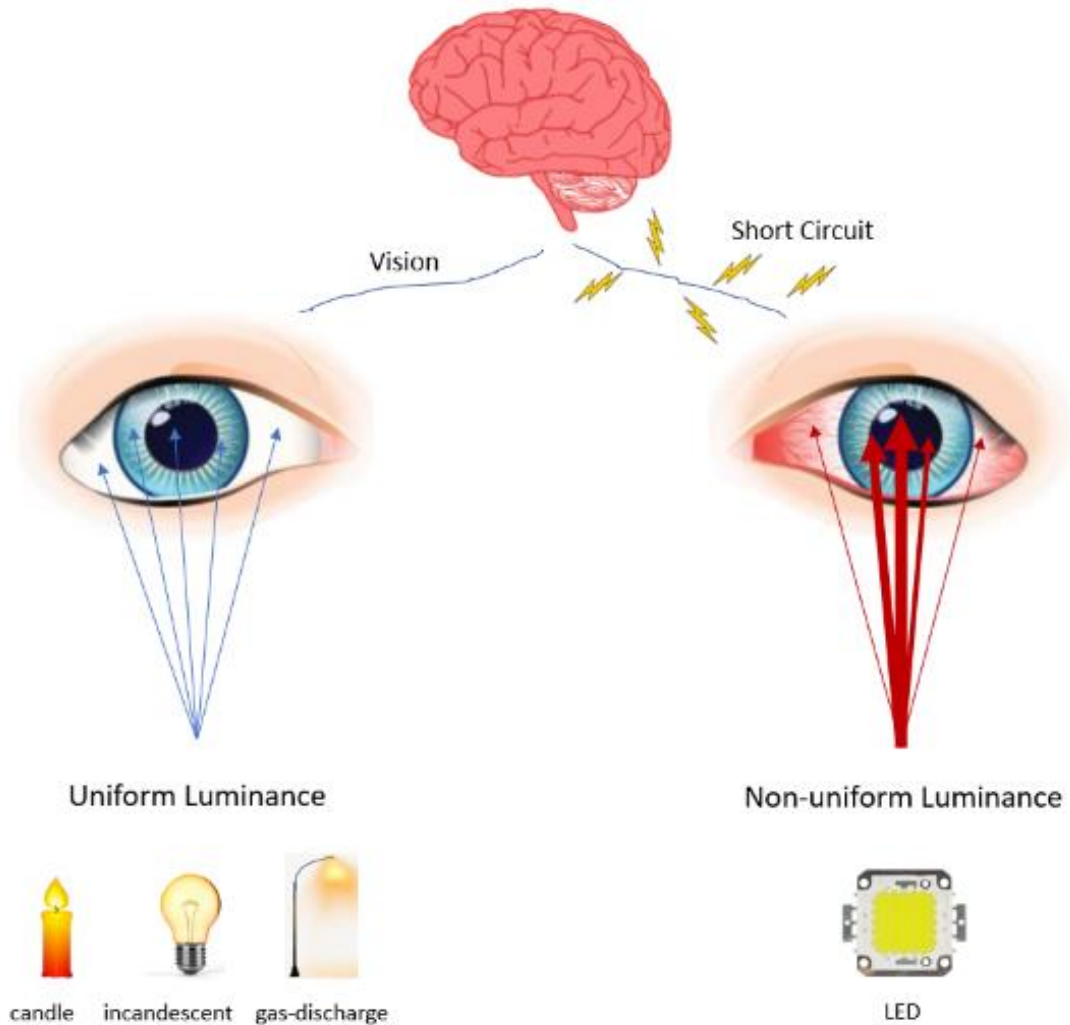


Figure 2 - Spatially Uniform v. Non-Uniform Radiation

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. Electromagnetic radiation emitted by LEDs do meet the regulatory meaning of or comply with standards for the use of light as illumination. For example, the Illuminating Engineering Society IES RP-8-18 for Roadway Lighting is only applicable for uniform emitters and cannot be used for LED light beams.

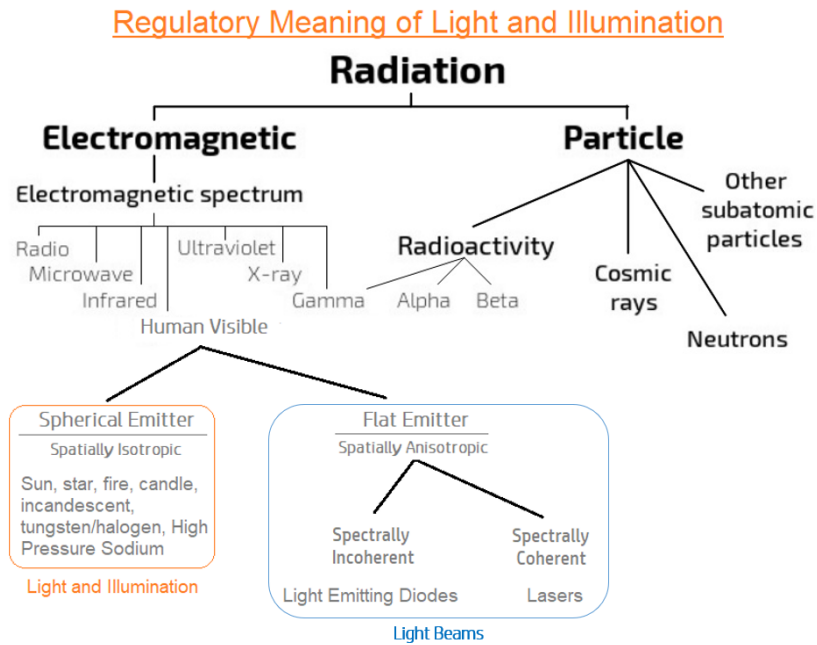


Figure 3 - Radiation Types

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. The parenthetical “(not even from a distance)” indicates a high level of danger and alludes to the physics that LEDs are light beams, not uniform light.

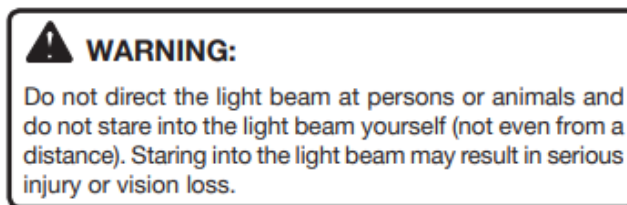


Figure 4 - LED Warning Label

An example of the difference between Tungsten and LED headlights is shown in Figure 5. A tungsten light falls uniformly onto the eye, not counting lensing. LEDs emit an extreme variability in luminance values, such that the difference between luminance values at each angle is different, and the difference between the peak luminance and the edge luminance is extreme.

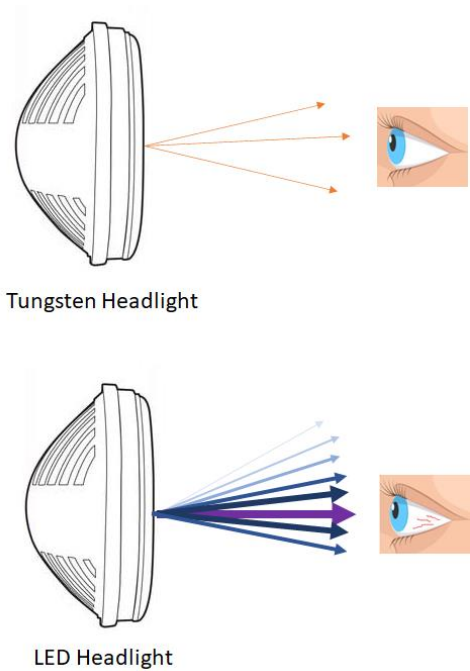


Figure 5 - Headlight Comparison

Figure 6 is a photograph taken in October 2021 showing the impacts of using LED headlights.



Figure 6 - LED Headlight Glare

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, NHTSA has released a letter confirming that NHTSA has never approved any aftermarket LED headlights⁵ Therefore, all LED use as headlights and Daytime Running Lights on vehicles are illegal.

Figure 7 shows a commercial truck with LED headlights. The use of LED headlights is immediately obvious because the diodes are clearly visible.



Figure 7 - LED Headlights on Commerical Truck

The link to the video for Figure 8 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.

⁵ <http://www.softlights.org/wp-content/uploads/2021/12/Leroy-Angeles.pdf>

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



Figure 8 - Non-LED Hazard Lights

The links to the videos for Figure 9, Figure 10, and Figure 11 show the misuse of technology, where flashing LED radiation devices 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.

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



Figure 9 - RRFB

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



Figure 10 – Utility Truck

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



Figure 11 - Utility Truck

Figure 12 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 and extreme variability of luminance interferes with the human nervous system.

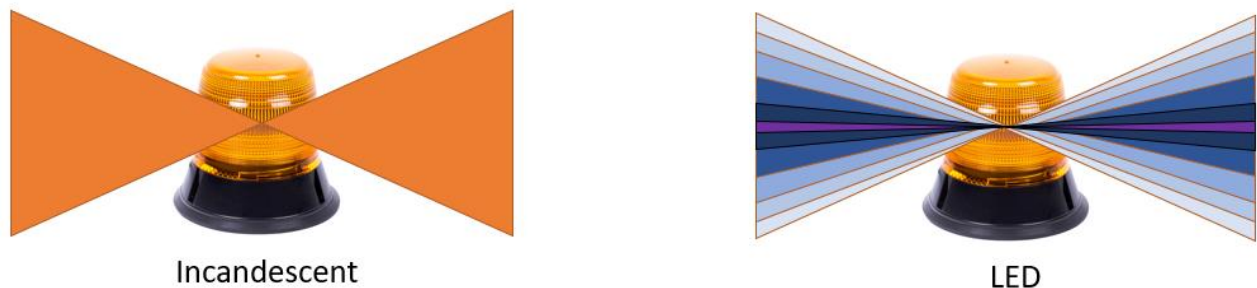


Figure 12 - Incandescent vs. LED Flashing Lights

In addition to the spatial characteristics of LED radiation, the spectral and temporal characteristics also make LED radiation dangerous. LEDs turn on and off almost 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 extreme variability between the exceedingly dense peak radiance and the edge radiance triggers seizures, causes migraines, interferes with human nerve functioning, reduces vision, increases agitation, and endangers the lives of the public and first responders.


Neither the FHWA nor NHTSA currently have regulations for the quantity of LED flashing devices, their flash rate, peak radiance, or protection for eyes, vision, or neurology and neither agency has made an 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 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. Electromagnetic LED radiation prevents safe access to public services such as roads, sidewalks, and government facilities. Use of LED electromagnetic radiation devices violates the federal Americans with Disabilities Act.

The Ohio Department of Transportation has a duty to protect the residents and guests of Ohio from illegal and dangerous LED headlights. For commercial trucking, ODOT must add an LED headlight inspection step to the standard inspection process. For private vehicles, ODOT is advised to ensure that vehicle headlights are inspected every two years at an inspection station. Failure of ODOT to enforce the existing laws, none of which allow LED headlights, puts lives at risk and creates a liability for ODOT.

Sincerely,



Mark Baker
President

Soft Lights Foundation

www.softlights.org

mbaker@softlights.org

9450 SW Gemini Drive PMB 44671

Beaverton, OR 97008

