



January 23, 2022

BY EMAIL

David Harkey, President
Insurance Institute for Highway Safety
dharkey@iihs.org

Re: The LED Fraud

Dear David Harkey,

Insurance companies rely on the Insurance Institute for Highway Safety to perform and analyze research to protect their business interests. The IIHS has failed to alert their member groups that LED headlights are dangerous and illegal, and that there is a liability issue that comes from insuring vehicles with illegal headlights.

- 1) NHTSA FMVSS-108 is only applicable to headlights with spatially uniform sources of light plus lenses. A flat-surface chip that produces a spatially anisotropic light beam, rather than uniform light, cannot comply with FMVSS-108. The result is that all LED headlights are illegal in the USA.
- 2) The automakers are fraudulently self-certifying LED headlights as compliant with FMVSS-108. We believe that this is occurring because the engineers are failing to use precision measurements at the picometer or femtometer scale when measuring luminous intensity. The auto industry likely using software that is not calibrated to plot and calculate data at the femtometer scale. The result is that the testing engineers are failing to recognize that the luminous intensity far exceeds maximums set in FMVSS-108.
- 3) LED headlights are not civil and are leading to a breakdown of society because they are causing eye damage, road rage, agitation, distraction, vehicle accidents, neurological disruption, and drivers quitting their jobs.
- 4) The petition to ban LED headlights has tens of thousands of signatures:
<https://www.change.org/p/u-s-dot-ban-blinding-headlights-and-save-lives>
- 5) The insurance industry is facing a major liability situation due to their insured's use of LED headlights which are known to be a dangerous product.

We are including our report titled, The LED Fraud, which details the issues of LEDs that the IIHS, NHTSA, NTSB and others are ignoring. By ignoring the fact that LEDs are toxic, hazardous, dangerous, discriminatory, and unregulated, IIHS has created liabilities for themselves and their members.

Sincerely,

Mark Baker

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President

Soft Lights Foundation

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The LED Fraud

By Soft Lights Foundation

LED electromagnetic radiation devices emit non-uniform light beams that are 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 variance between the peak luminance and the edge luminance. LEDs do not provide the same service as Incandescent or High-Pressure Sodium because LEDs do not provide uniform illumination.

In 2016, the American Medical Association published ground-breaking recommendations regarding LED radiation with their document titled Human and Environmental Effects of Light Emitting Diode (LED) Community Lighting.² This document stunned the world as it alerted the public to the toxicity of LED radiation. The AMA recommended setting limits on this electromagnetic radiation. The LED cartel fought the AMA's recommendations and continues to do so. Since 2016, neither the government nor the LED cartel have taken appropriate steps to address the dangers of LED electromagnetic radiation.

The Energy Efficiency Fraud

The idea that has been sold to the public is that LEDs are energy efficient and save energy compared to incandescent or High-Pressure Sodium and that LED radiation is safe and non-discriminatory. These are fraudulent claims.

LEDs emit electromagnetic radiation from a flat surface which creates a non-uniform geometry of energies, and the result is a low quality, toxic, hazardous, and discriminatory type of human-visible electromagnetic radiation. According to the US Department of Energy's website, energy efficiency means "*using less energy to get the same job done*."³ The job of an illumination device is to provide uniform illumination with minimal harm. LEDs do not produce uniform illumination⁴, but rather they emit radiation from a flat surface which creates a light beam rather than providing uniform illumination. Since LEDs do not do the same job as an incandescent or High-Pressure Sodium, the claim that LEDs are energy efficient cannot be made.

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 a different energy than

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

² <https://www.ama-assn.org/sites/ama-assn.org/files/corp/media-browser/public/about-ama/councils/Council%20Reports/council-on-science-public-health/a16-csaph2.pdf>

³ https://www.energystar.gov/about/about_energy_efficiency

⁴ <https://ieeexplore.ieee.org/document/8879542>

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. **An energy efficiency comparison between an incandescent or High-Pressure Sodium and an LED cannot be made, and thus LEDs are not "energy efficient".**

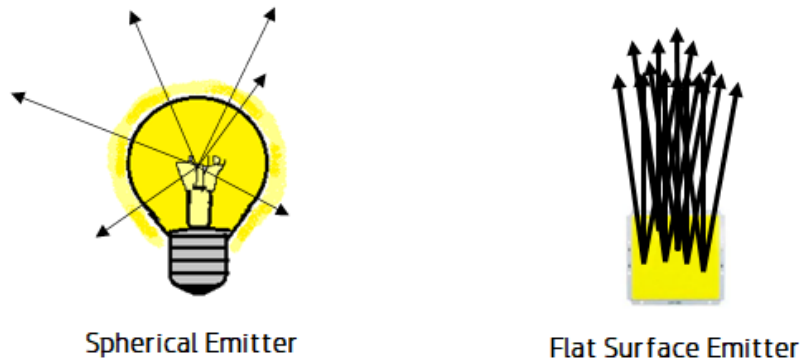


Figure 1 - Spherical vs. Flat Surface Emitter

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 the non-uniformity 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.

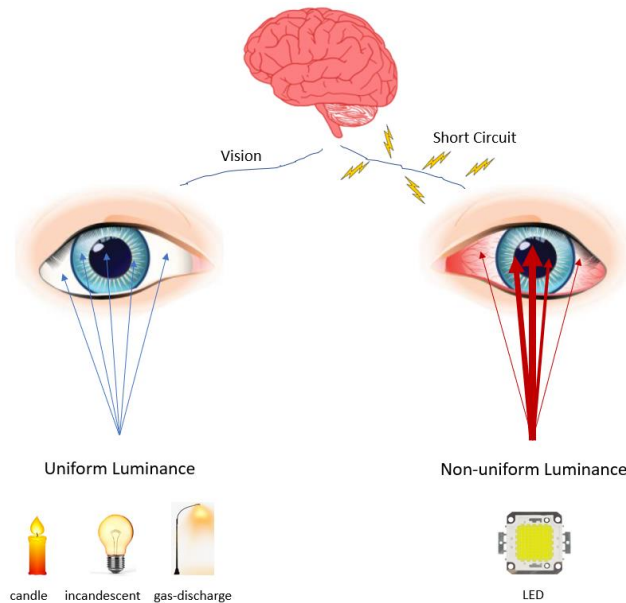


Figure 2 - Spatially Uniform v. Non-Uniform Radiation

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. Radiation emitted by LEDs do meet the regulatory meaning of or comply with standards for the use of light as illumination. For example, both the Illuminating Engineering Society IES RP-8-18 for Roadway Lighting and the National Highway Transportation Safety Administration FMVSS-108 for vehicle lighting are only applicable for uniform emitters and cannot be used for LED light beams.

Regulatory Meaning of Light and Illumination

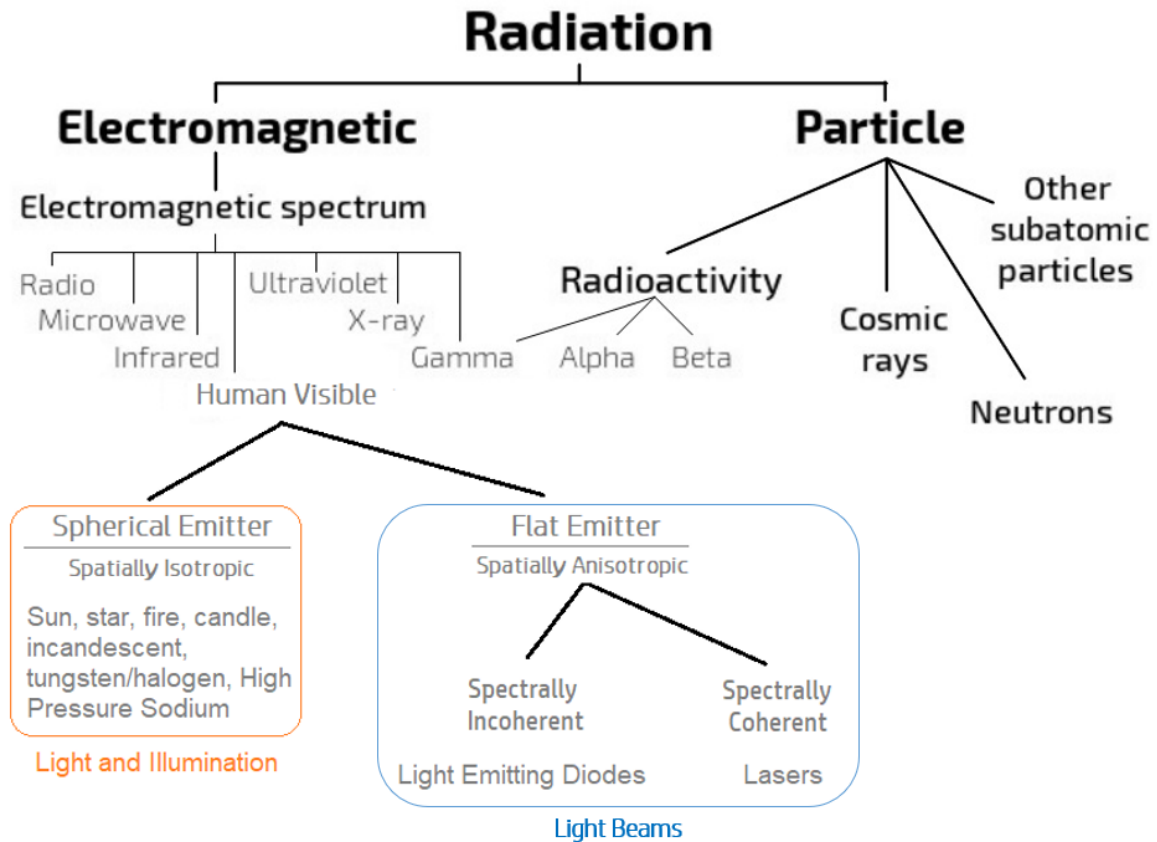


Figure 3 - Radiation Types

The IES and Underwriters Laboratories claim that LEDs are “point sources”.⁵ This is not a true statement since LEDs are flat surface emitters that cannot ever be modeled as a point source. The extreme variance in radiance values between the peak output and the edge output from an LED chip precludes any effort to claim that an LED is a point source. For a discussion on the shape of LED electromagnetic radiation and the mathematical proof that LEDs produce a Lambertian shape, refer to the IEEE paper by Dr. Nisa Khan.⁶ Figure 4 shows the Lambertian shape. **The false claim that LEDs are**

⁵ <https://www.ul.com/news/shedding-light-led-testing>

⁶ <https://ieeexplore.ieee.org/document/8879542>

point sources is a major source of liability for IES and UL and for any organizations that rely on this false claim.

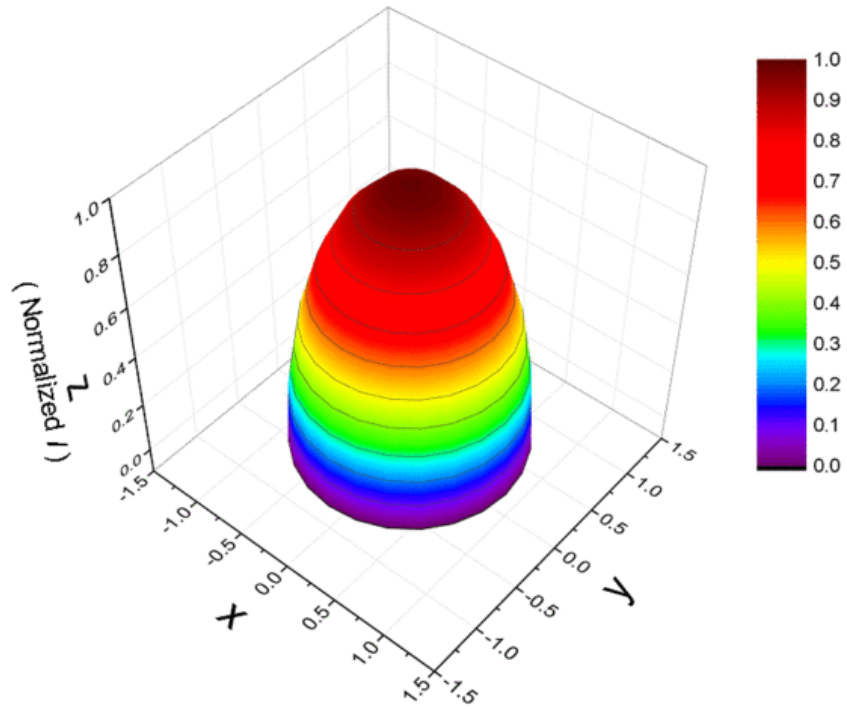


Figure 4 - Lambertian Shape of LED Emissions⁷

Figure 5 is a quote from Underwriters Laboratories.⁸ The statement that an LED has superior energy efficiency is a fraudulent claim, as energy use by an HPS and an LED cannot be compared because they don't provide the same service. Incandescent and HPS provide uniform illumination, while LEDs are a light beam incapable of providing uniform illumination.

Executive Summary

For more than a century, incandescent bulbs have been the dominant technology for producing artificial light. Though the efficiency of modern incandescent bulbs has improved, other lighting technologies have been rapidly replacing them in most applications. Fluorescents and CFLs exhibit improvement in efficiency relative to incandescent lighting but, in recent years, have been supplanted by light emitting diode (LED) technologies. This is due to the superior energy efficiency, controllable light spectral output, instant-on performance, and longevity of LEDs.

Figure 5 – Underwriters Laboratories Fraudulent Statement

⁷ <https://ieeexplore.ieee.org/document/8879542>

⁸ <https://www.ul.com/news/laser-diode-lighting-potential-future-high-efficiency-solid-state-illumination-new-ul-white>

Figure 6 highlights the fraudulent claims. A uniform illumination device that is compatible with the human nervous system is shown on the left side of the diagram. In the middle portion of Figure 6 is what the LED Cartel fraudulently claims is the shape of the LED light beam. The LED Cartel claims that the beam is directed, but uniform, therefore saving energy. The reason this claim is fraudulent is because the LED Cartel knows that this middle diagram is not a truthful representation of the actual shape of the LED light beam. The real pattern of an LED light beam is shown on the right side of the figure which demonstrates the non-uniformity of the light and shows that the middle of the light beam is exceedingly intense, far beyond human tolerance levels and that there is extreme variance between the peak luminance in the middle, and the luminance at the edges.

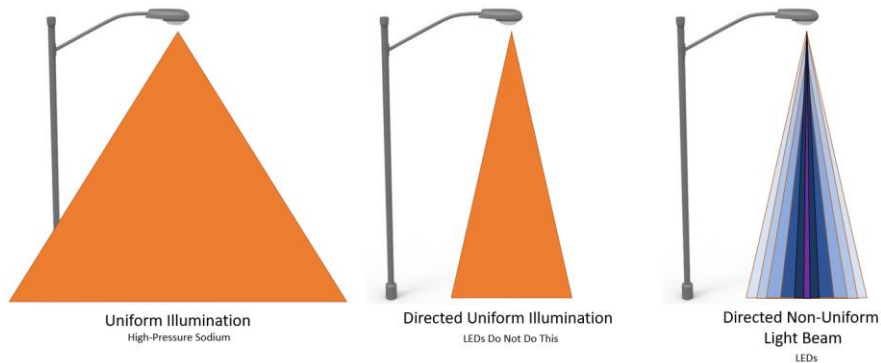


Figure 6 - Streetlight Comparison

LED Headlights

Figure 7 is a photograph taken in October 2021 showing the impacts of using LED headlights.

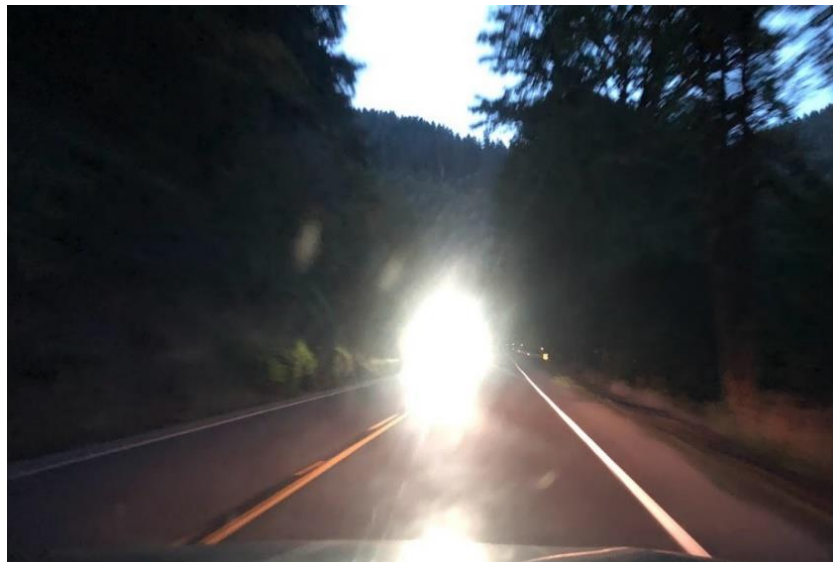


Figure 7 - LED Headlight Glare

An example of the difference between Tungsten and LED headlights is shown in Figure 8. A tungsten light, unless lensed, falls uniformly onto the eye. LEDs, on the other hand, 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.

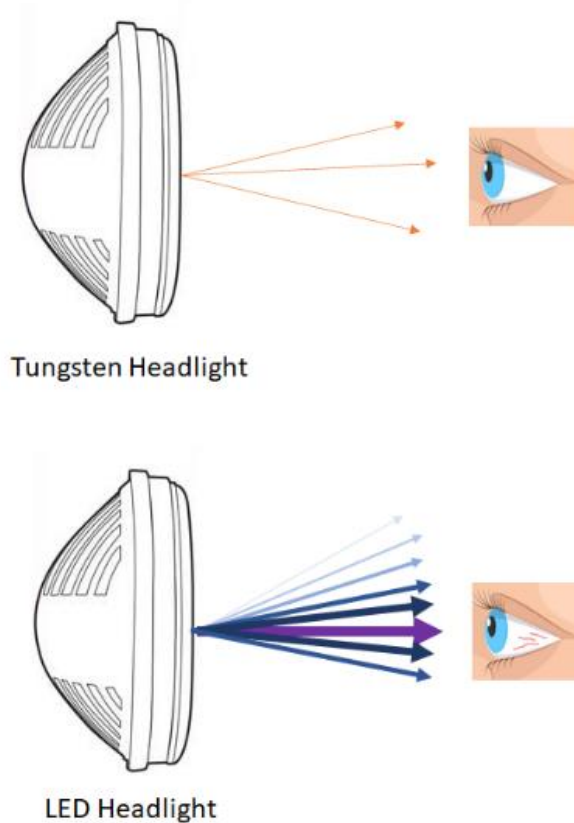


Figure 8 - Headlight Comparison

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 headlights⁹ The auto industry fraudulently self-certifies LED headlights by failing to measure with enough precision. If the auto industry measured at the picometer or femtometer scale, the readings would clearly show that the luminous intensity far exceeds the maximums set in NHTSA FMVSS-108. Therefore, all LED headlights and Daytime Running Lights are illegal.

⁹ <http://www.softlights.org/wp-content/uploads/2021/12/Leroy-Angeles.pdf>

LED Flashing Lights

LED flashing lights meet the legal definition of assault.¹⁰ They violate basic human rights. LED flashing lights turn on and off nearly instantly and have a dangerous peak radiance. These LED flashing lights are being used on radio towers, utility vehicles, police cars, ambulances, fire engines, stop signs, and bridges. The non-uniform electromagnetic radiation and extreme variance between peak radiance and 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. Multiple encounters with LED flashing lights will lead likely to Complex PTSD.

The link to the video for Figure 9 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 9 - Non-LED Hazard Lights

The links to the videos for Figure 10, Figure 11, Figure 12, and Figure 13 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. A civil society cannot function if the society allows uncivil use of technology.

¹⁰ <https://www.law.cornell.edu/wex/assault>

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



Figure 10 - RRFB

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



Figure 11 – Utility Truck

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



Figure 12 - Utility Truck

Ambulances: <https://youtu.be/amoR1QSiBHw>



Figure 13 - New York City Ambulances

Figure 14 is a diagram showing why the spatial distribution of LED light beams causes LED flashing lights to be 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 variance of luminance interferes with the human nervous system.

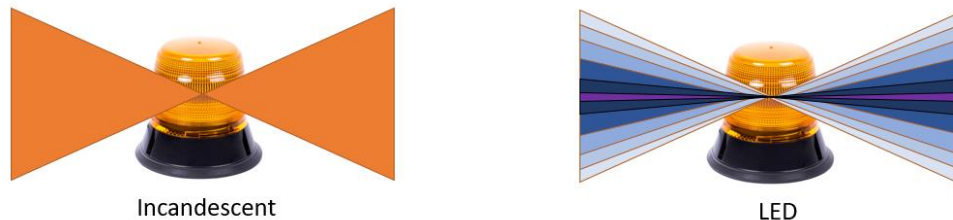


Figure 14 - Incandescent vs. LED Flashing Lights

Neither the FHWA nor NHTSA currently have regulations for the LED flashing lights, including a lack of regulation for flash rate, quantity of devices, peak radiance, or protection for eyes, vision, or neurology, and neither agency has tried to ensure that LED flashing lights do not discriminate and comply with 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.

LED Dangers and Health Impacts

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.

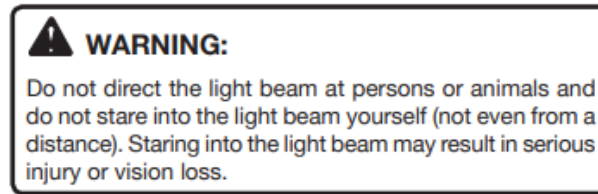


Figure 15 - LED Warning Label

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.¹¹ 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.¹² 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 humans to medical experiments,¹³ 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 also impacts all members of the public and other creatures such as owls and insects because of the way it interferes with the proper functioning of nerves, and the chemical and thermal damage to the eye.

LED light beams, whether the light beam is static or flashing, can trigger epileptic seizures. Businesses that wish to protect themselves from liability may place a sign at the entry way to their business to alert people with epilepsy of the danger. For liability reasons, every location that uses an LED must also necessarily display this sign.

¹¹ http://www.softlights.org/wp-content/uploads/2022/01/One-Third-of-us-at-Risk_-The-Medical-science-of-LEDs.pdf

¹² <http://www.softlights.org/wp-content/uploads/2022/01/Quotes-from-individuals-harmed-by-LED-exposure.pdf>

¹³ https://media.tghn.org/medialibrary/2011/04/BMJ_No_7070_Volume_313_The_Nuremberg_Code.pdf



Figure 16 - Epilepsy Warning Sign

The result of exposure to LED electromagnetic radiation, both static and flashing, 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.

This electromagnetic visible radiation from LEDs 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. The LED lights and LED flashing lights greatly increase violence and endanger the lives of the public who cannot adequately see, think, or concentrate when inundated by LED light beams.

Summary

- LEDs do not save energy; that claim is a fraud.
- LEDs are toxic; they cause chemical and thermal eye damage.
- LEDs are hazardous; they decrease vision and increase neurological trauma.
- LEDs are discriminatory; they prevent people with disabilities from seeing, thinking, and concentrating.
- LEDs violate basic United Nations human rights.
- LEDs are unregulated; there are no restrictions on peak radiance, no restrictions on sub-sensory flicker, and no restrictions on spectral power distribution.
- LEDs are a liability.
- LEDs do not comply with NHTSA FMVSS-108.
- LEDs do not comply with IES RP-8-18.
- LEDs are not civil.

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