Soft Lights Foundation

9450 SW Gemini Drive
PMB 44671
Beaverton, OR 97008

December 2, 2021

BY EMAIL

Steven Croley, General Counsel
Ford Motor Company
scroley@ford.com

Re: Spatially Anisotropic Visible Radiation Devices

Dear Steven Croley,

We wish to alert Ford Motor Company of liability issues related to the use of LED radiation devices such as LED headlights. The Soft Lights Foundation has been notifying NHTSA for several years that LED headlights do not comply with FMVSS-108 due to the implicit requirement of uniform illumination and because LED headlights exceed the maximum limits for luminous intensity.

The substance emitted by LEDs is spatially anisotropic visible radiation. Specifically, the shape of the radiation is a Lambertian ball which is created because the source of the radiation is a flat surface.[1] The radiation energy from an LED is different at every point in space, which is very different than the spatially uniform energy of *light* as used in regulatory filings. The substance emitted by LEDs has theoretically unlimited peak radiance which causes eye damage, interferes with the nervous system, and causes pain, epileptic seizures, migraines, psychiatric trauma, reduced vision, and thoughts of suicide.

Figure 1 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 for light, and LEDs are not suitable or regulated for the purpose of illumination.

[1] https://ieeexplore.ieee.org/document/8879542

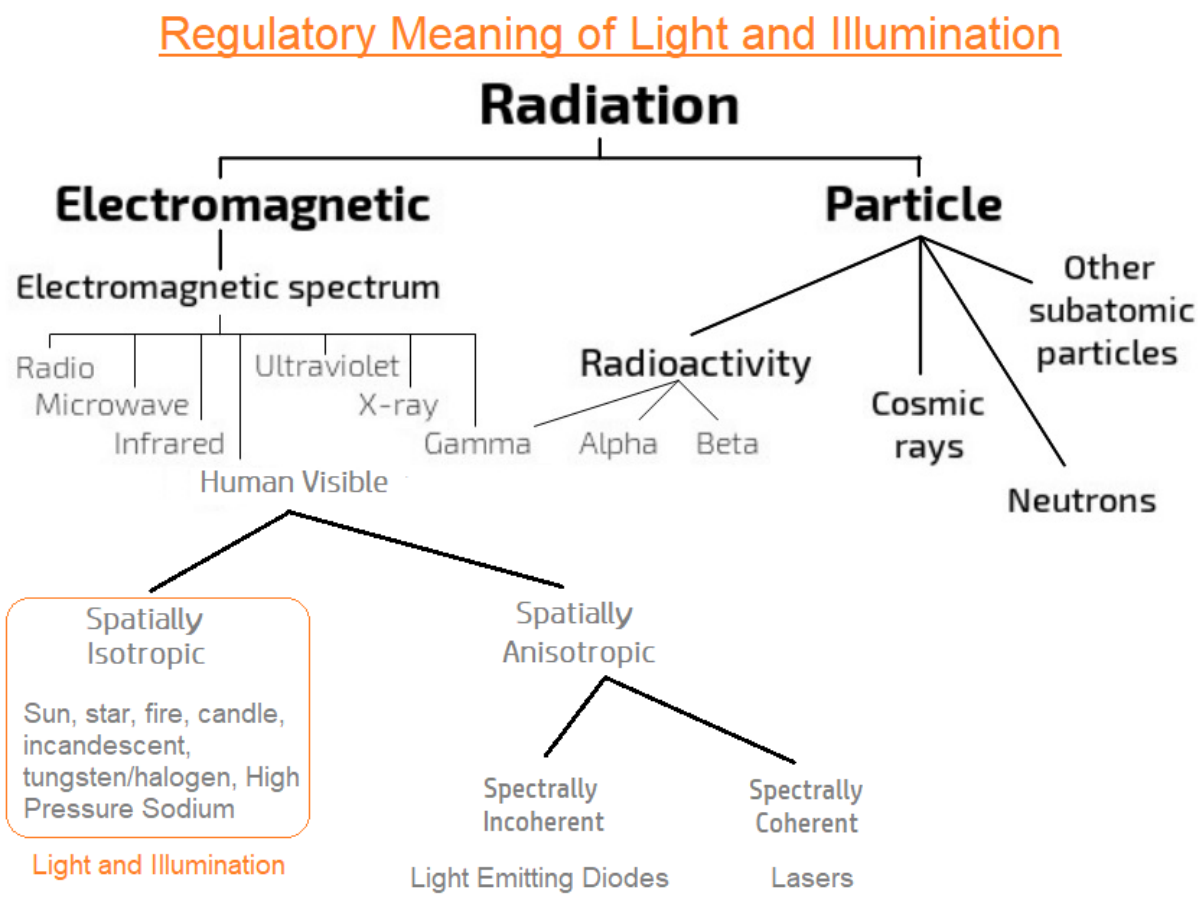

Figure 1 - Radiation Types

The National Highway Transportation Safety Administration publishes FMVSS-108 which regulates vehicle headlights. FMVSS-108 was originally written in 1967 and is applicable to *spatially isotropic radiation in the human-visible portion of the electromagnetic spectrum*. FMVSS-108 is not applicable to radiation particles, microwaves, x-rays, or spatially anisotropic radiation such as from lasers or LEDs. NHTSA has never approved any type of visible radiation device where the radiance is non-uniform.

Figure 2 is a photo taken in October, 2021 of a vehicle with LED headlights. This vehicle is not necessarily a Ford but is representative of the glare and danger presented by LED headlights. Both OEM and aftermarket LED headlights are illegal.

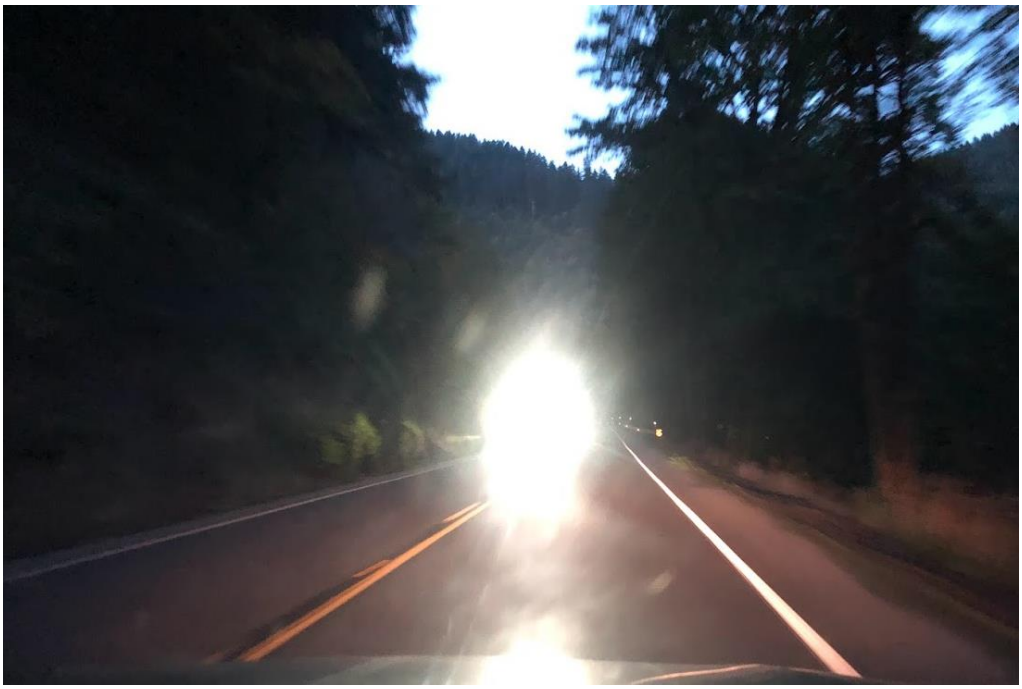

Figure 2 - LED Headlights

To our knowledge, there are no ocular exposure standards for LEDs. In his 2009 presentation, Senior Engineer Michael Shulman of Underwriters Laboratories wrote, "Currently, neither the U.S. nor Canada have mandatory standards or regulations for ocular exposure to LEDs emitting incoherent visible light."[2] In the research article, titled Light Emitting Diode Induced Retinal Damage[3] the authors state, "*Excessive LED light exposure presents a potential hazard to retinal function.*" In other research, those in Risk Group 3 (those with epilepsy, autism, migraines, photophobia, etc.) are often purposely ignored during the research, invalidating results that might have shown that LEDs are safe.

LEDs are not "energy efficient". To be energy efficient, a technology must provide the same quality of service and perform the same task as the previous technology[4]. The task in this situation is to provide *light* and uniform illumination while using less energy and not causing harm. Since LEDs do not emit spatially isotropic radiation, LEDs are not illumination devices, as the radiation that LEDs emit is not uniform. Instead, LEDs emit spatially anisotropic visible radiation that causes sickness and eye damage, endangers lives, and violates civil rights. The claim of "energy efficiency" by the LED lighting industry is fraudulent.

As an example of how dangerous LED radiation is, consider this warning shown in Figure 3 from the company Gear Light. LED chip makers exceeded 100,000,000 nits of peak luminance as of 2018.[5]

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[2] http://www.softlights.org/wp-content/uploads/2021/10/MichaelShulman_LEDFireElectricalSafety.pdf
[3] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5313540/
[4] https://www.energystar.gov/about/about_energy_efficiency
[5] focusworld.com/test-measurement/research/article/16555223/nonlaser-light-sources-highluminance-leds-target-emerging-automotive-lighting-applications

Figure 3 - LED Flashlight

The fact that LEDs are unregulated and lack standards, cause sickness and eye damage, interfere with the human nervous system, discriminate against people with light sensitivity disabilities, endanger public safety, and are illegal, makes Ford liable for the harm and discrimination caused by their vehicles that emit LED radiation.

To protect human health, comply with federal regulations, and reduce liability, Ford must only sell vehicles with headlights, daytime running lights, taillights and brake lights that comply with federal regulation FMVSS-108.

Sincerely,

Mark Baker

Mark Baker
President
Soft Lights Foundation
mbaker@softlights.org
9450 SW Gemini Drive PMB 44671
Beaverton, OR 97008