



International Commission on Illumination
Commission Internationale de l'Eclairage
Internationale Beleuchtungskommission

CIE Position Statement on the Blue Light Hazard

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There have been a number of reports in the media about the risk to human health following exposure to light from sources such as light emitting diodes (LEDs), referring to the term “blue light hazard” (BLH). This term has been inaccurately used to represent the risk of actual eye damage and the influence on general well-being.

The term “blue light hazard” should only be used when considering the photochemical risk to the retinal tissues of the eye (technically referred to as “photomaculopathy”), usually associated with staring into bright sources, such as the sun or welding arcs. “Blue” is included in the term because the risk of photochemical injury is wavelength-dependent, peaking in the blue part of the optical radiation spectrum around 435 nm to 440 nm. The International Commission on Non-Ionizing Radiation Protection (ICNIRP) have published the “blue light hazard function”, a wavelength-dependent weighting function, and guideline exposure limits [1]. The CIE has standardized this function as part of the CIE S 009:2002 “Photobiological safety of lamps and lamp systems”, now published as IEC 62471:2006/CIE S 009:2002 [2]. There is no evidence in humans of any adverse health effects from occasional exposure to optical radiation at the exposure limits.

Lamps, including LEDs, which emit primarily white light will usually contain a proportion of light at wavelengths that are relevant to the assessment of the blue light hazard. Lamps that are “cooler”, or attributed to a high colour temperature, are likely to contain a higher proportion of blue light than sources that are “warmer” or of a lower colour temperature. Indeed the blue light hazard exposure limit from incandescent and LED lamps for general lighting is similar for similar colour temperatures. Practical assessments have shown that the blue light hazard exposure limits are not exceeded under all reasonably foreseeable use conditions. Furthermore, the exposure levels are often lower than experienced from viewing a blue sky.

It is also important to consider eye exposures in practice [3]. A number of studies have been published, with associated media coverage, which claim adverse effects from white-light sources. Most of these studies have unusual conditions, including:

- long-term exposure,
- high colour temperature LEDs (i.e. a very high blue component),
- exposures significantly in excess of the ICNIRP exposure limit,
- fixation on the light source,
- the use of nocturnal animal models or human cells *in vitro*.

It is fundamental to appreciate that a white-light source emitting blue light at levels sufficient to approach the blue light hazard exposure limit would be extremely bright, thus producing discomfort glare, and that to stare into such sources would be considered unusual behaviour. Also, very high colour temperature lighting is perceived by most people as unpleasant and uncomfortable, particularly for lighting of homes. It is recognized that during normal behaviour, we experience transient exposures to high light levels, and may get many such exposures per day. However, accumulation of these exposures over the day will not result in the exposure limits being exceeded.

Whilst the CIE considers that the “blue light hazard” is not an issue for white-light sources used in general lighting, even for those that are blue-enriched, caution is suggested for circumstances occurring over many days with continuous exposure to optical radiation, at levels that approach the blue light hazard exposure limit. Indeed such exposure should be avoided. Such exposure is unlikely for white-light sources, but may be possible with sources that primarily emit blue light.

It should also be recognized that the use of sources emitting primarily blue light are a cause of concern for exposure to children’s eyes. Even if the blue light hazard exposure limit is not exceeded, such sources may be dazzlingly bright to youngsters. For this reason, the use of blue indicator lamps is not recommended for toys and other devices that may be viewed by children. Where blue-light sources are used in such products, the blue light hazard exposure limit should be reduced by a factor of 10. This is even more important for light sources emitting violet and deep-violet radiation.

There have been claims that exposure to blue light may be linked to the risk of age-related macular degeneration. Such claims are currently speculative and are not supported by the peer-reviewed literature.

The term "blue light hazard" should not be used when referring to circadian rhythm disruption or sleep disturbance. However, the CIE recognizes that there is public concern over the non-visual influences of blue light on human health and has previously issued a position statement on this [4]. An update on this will be issued in due course taking into account, for example, the new international standard CIE S 026:2018 [5].

References

- [1] ICNIRP *Guidelines on Limits of exposure to incoherent visible and infrared radiation*. *Health Physics*. 105(1):74-96; 2013 (available from www.icnirp.org).
- [2] [IEC 62471:2006/CIE S 009:2002](#) Photobiological safety of lamps and lamp systems (bilingual edition) / Sécurité photobiologique des lampes et des appareils utilisant des lampes.
- [3] Sliney, D H, Bergman, R and O’Hagan, J. Photobiological Risk Classification of Lamps and Lamp Systems—History and Rationale. *LEUKOS*, 12:4, 213-234, 2016, DOI: 10.1080/15502724.2016.1145551.
- [4] [CIE Position Statement on Non-Visual Effects of Light](#) – *Recommending Proper Light at the Proper Time*, June 28, 2015.
- [5] [CIE S 026/E:2018](#) *CIE System for Metrology of Optical Radiation for ipRGC-Influenced Responses to Light*.

About the CIE and its Position Statements

The International Commission on Illumination – also known as the CIE from its French title, the Commission Internationale de l’Eclairage – is devoted to worldwide cooperation and the exchange of information on all matters relating to the science and art of light and lighting, colour and vision, photobiology and image technology.

With strong technical, scientific and cultural foundations, the CIE is an independent, non-profit organization that serves member countries on a voluntary basis. Since its inception in 1913, it has been accepted as representing the best authority on the subject matter of its scope. As such the CIE is recognized by ISO as an international standardization body, publishing global standards on the fundamentals of light and lighting.

CIE position statements are approved by the CIE Board of Administration, which includes the Directors of all the CIE Divisions (the bodies that carry out the scientific work of the CIE), after first ensuring agreement with the relevant CIE Technical Committees.

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