BLUE LIGHT HAZARD
QUICK REFERENCE SHEET

This document was developed by the AIHA NIR Committee. The intent is to provide general information to practicing Industrial Hygienists on NIR topics and to determine next steps for assessing and controlling NIR hazards. For additional, detailed information please refer to the reference section.

Characteristics – The term "blue light hazard" refers to photochemical damage to the retina caused by light. Light in the wavelength range of 400-500 nm (violet, blue, and blue-green) is most detrimental, but all visible light as well as UV-A radiation can contribute to photochemical injury. The risk is related to the radiance (brightness) of the light source as well as the size of the image of the source that is projected onto the retina.

Units of Measure – The radiance of a light source is measured as the power emitted per unit area of the source, per unit solid angle. Solid angle is measured in steradians (sr), and can be pictured as a cone with its apex at the source. Radiance is typically expressed in units of W/cm^2-sr. Irradiance, or power per unit area received at a surface, is typically expressed as mW/cm^2. Radiant exposure, or energy per unit area received at a surface, is typically expressed as mJ/cm^2. Wavelength is expressed in nanometers (nm).

Significant Sources – Blue LED arrays, intense white light sources (such as projection lamps, floodlights, microscope lights, welding arcs), strong sunlight.

Biological Effects – Absorption of short-wave visible light by some retinal pigments triggers photochemical reactions that can lead to retinal cell death. Though retinal damage from blue light has been amply demonstrated in experimental studies on animals, the epidemiologic evidence for an association in humans between chronic blue-light exposure and retinal damage such as macular degeneration is not yet conclusive.

Exposure Guidelines – The ACGIH TLV® for the blue-light hazard is harmonized with the International Commission on Non-Ionizing Radiation Protection (ICNIRP) guidelines. The time-integrated radiance, weighted by the blue-light hazard function, should not exceed 100 J/cm^2-sr over a total viewing time of 167 minutes in a day. If the viewing duration is longer than 167, the radiance weighted by the blue-light hazard function should not exceed 10 mW/cm^2-sr. If the light source subtends an angle less than 0.011 radians (for example, if a light source 1.1 cm in length were viewed at a distance of 1 meter), the irradiance measured at the eye, weighted by the blue-light hazard function, should not exceed 100 $\mu W/cm^2$ for viewing times longer than 100 seconds, and the radiant exposure at the eye, weighted by the blue-light hazard function, should not exceed 10 mJ/cm^2 for viewing times shorter than 100 seconds.

Exposure Assessment – Blue-light radiance measurements should be performed with a broadband detector that has a spectral response well matched to the ACGIH/ICNIRP/IESNA blue-light hazard function. The detector's field of view should be 0.011 radians.

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Control Measures – When possible, enclose or orient intense short-wavelength light sources so they cannot be viewed. If viewing cannot be avoided, amber-tinted eyeglasses or goggles should be worn.

References and Additional Information

ACGIH: Light and Near-Infrared Radiation TLV Documentation, 2008.

American National Standards Institute/Illuminating Engineering Society of North America (ANSI/IESNA), Recommended Practice for Photobiological Safety for Lamps and Lamp Systems – Measurement Techniques, (ANSI/IESNA RP-27.2-00), New York: IESNA, 2000.

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