

## Calculation of Solar Ultraviolet Irradiant Exposure of the Cornea through Sunglasses

**Authors :** Mauro Masili, Fernanda O. Duarte, Liliane Ventura

**Abstract :** Ultraviolet (UV) radiation is electromagnetic waves from 100 - 400 nm wavelength. The World Health Organization and the International Commission on Non-Ionizing Radiation Protection (ICNIRP) recommend guidelines on the exposure of the eyes to UV radiation because it is correlated to ophthalmic diseases. Those exposure limits for an 8-h period are 1) UV radiant exposure should not exceed 30 J/m<sup>2</sup> when irradiance is spectrally weighted using an actinic action spectrum; 2) unweighted radiant exposure in the UV-A spectral region 315 - 400 nm should not exceed 10 kJ/m<sup>2</sup>. Sunglasses play an important role in preventing eye injuries related to Sun exposure. We have calculated the direct and diffuse solar UV irradiance in a geometry that refers to an individual wearing a sunglass, in which the solar rays strike on a vertical surface. The diffuse rays are those scattered from the atmosphere and from the local environment. The calculations used the open-source SMARTS2 spectral model, in which we assumed a clear sky condition, aside from information about site location, date, time, ozone column, aerosols, and turbidity. In addition, we measured the spectral transmittance of a typical sunglasses lens and the global solar irradiance was weighted with the spectral transmittance profile of the lens. The radiant exposure incident on the eye's surface was calculated in the UV and UV-A ranges following the ICNIRP's recommendations for each day of the year. The tested lens failed the UV-A safe limit, while the UV limit failed to comply with this limit after the aging process. Hence, the ICNIRP safe limits should be considered in the standards to increase the protection against UV radiation on the eye.

**Keywords :** ICNIRP safe limits, ISO-12312-1, sunglasses, ultraviolet radiation

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