

The ACGIH UV Guidelines: Development, Application and Issues

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The ACGIH

- The American Conference of Governmental Industrial Hygienists (ACGIH) is a private, not-for-profit, non-governmental corporation ...dedicated to promote health and safety within the workplace.
- Publishes Threshold Limit Values (TLVs) for chemical, physical and biological agents.
- WWW.acgih.org



ACGIH UV Guidelines

- First exposure guideline for UV (1972)
- Based on UV effects on the eye (photokeratitis and cataracts) and the skin (erythema).
- Not based on skin cancer but close to levels at which DNA repair level is observed (using p53 gene)
- Adopted by NIOSH and ICNIRP

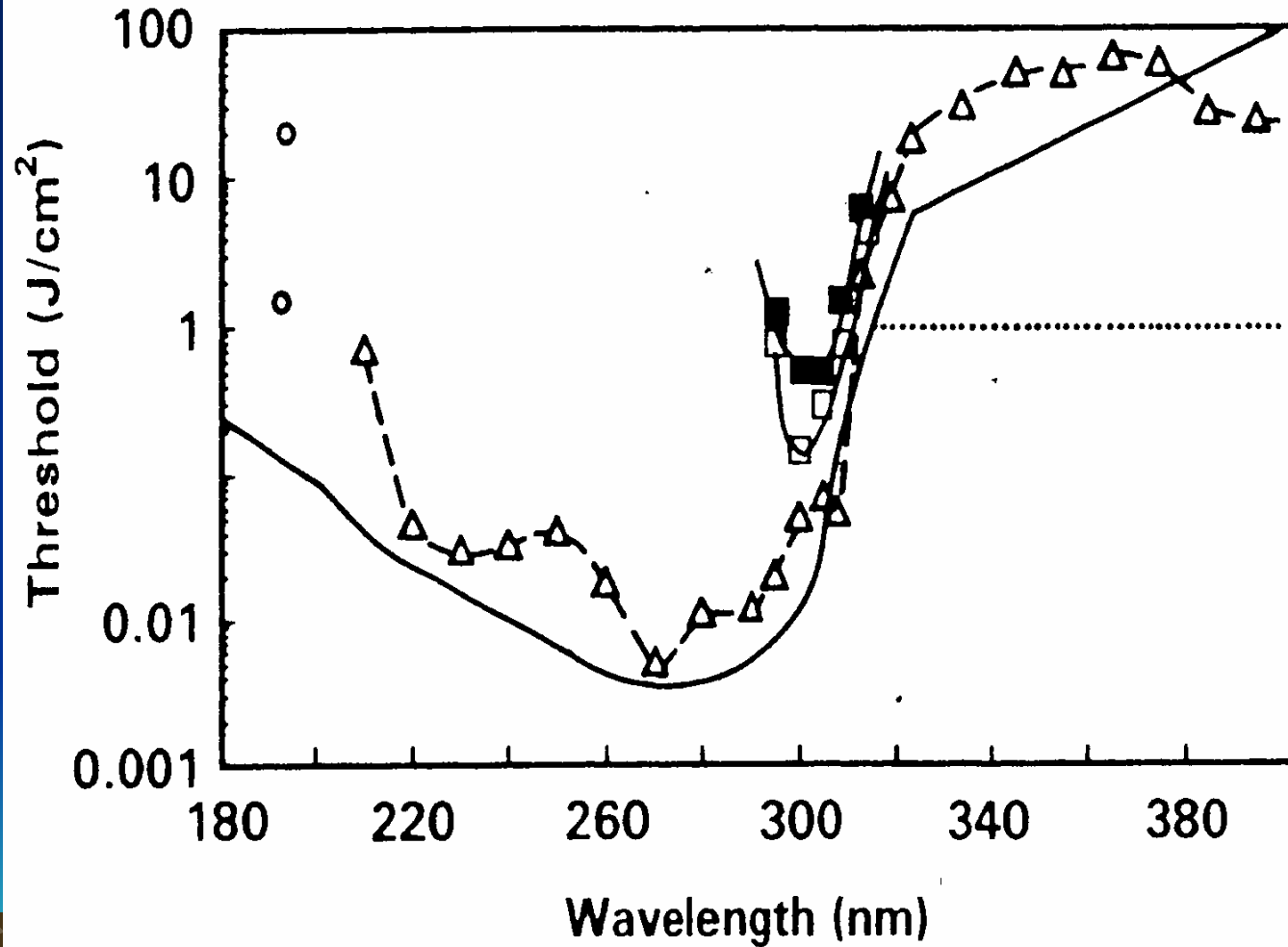


Action Spectra and Spectral Effectiveness

- UV of different wavelengths have different effects in the eye and the skin
- The “action spectrum” for each effect charts the biological response as a function of wavelength
- The reciprocal normalized envelope of relevant action spectra provides the Relative Spectral Effectiveness $S(\lambda)$



UVR Photokeratitis



○ 193 nm thresholds △ Pitts thresholds — ACGH TLV Eye

RELATIVE SPECTRAL EFFECTIVENESS: S_{λ} (?)

Biological effectiveness of different wavelengths normalized to unity at 270 nm

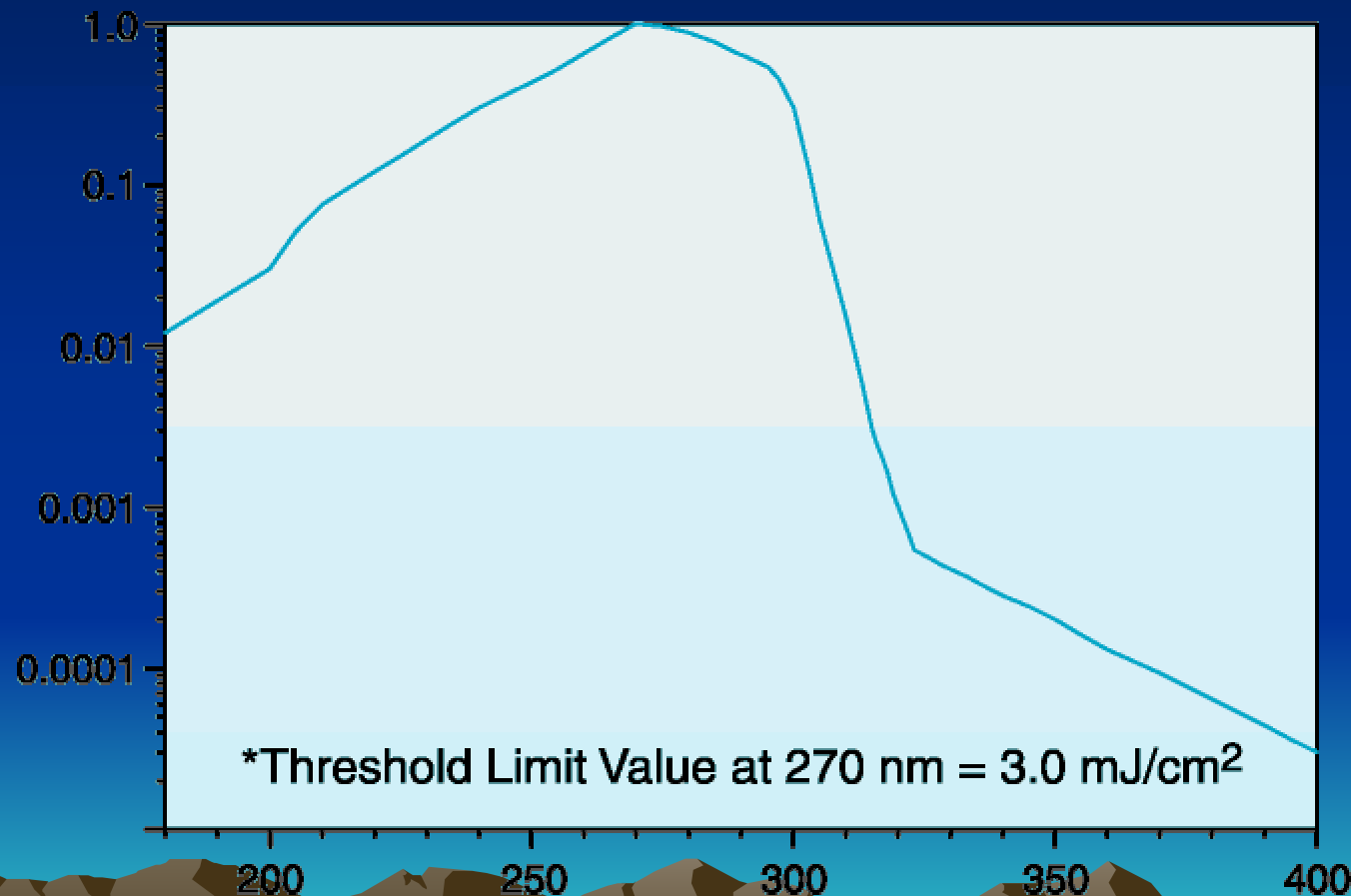


Fig. 2.4 ACGIH UV relative spectral effectiveness, S_{λ}

Effective Irradiance E_{eff}

- $E_{\text{eff}} [W m^{-2}] = S E_{\lambda} S(?) ??$
 - E_{λ} = Spectral Irradiance [$W/(cm^2 nm)$]
 - $S(?)$ = Relative Spectral Effectiveness
 - $??$ = band width in nm
 - Summed between 100 and 400 nm



ACGIH UV Threshold Limit Value (TLV)

- UV (180 to 400 nm) exposure of the unprotected eye and skin should not exceed:
- $T_{\max} = 0.003 \text{ [J/cm}^2\text{]} / E_{\text{eff}} \text{ [W/cm}^2\text{]}$
- $T_{\max}$ = maximum exposure time in secs
- E_{eff} = Effective Irradiance



Minimal Erythematous Dose

- Biologically Effective Radiant Exposure or Dose
[J m⁻²]_{eff}
- Dose = E_{eff} x exposure time [Joule/m²]
- Minimal Erythematous Dose
 - Minimal dose that will produce an erythema in previously unexposed skin 24 hours post-exposure
 - Varies with skin type, observations, etc.
- MED conventionally defined as 200 Joule/m²
- TLV = 1/3 MED







The application of UV guidelines

- Ontario Ministry of Labour adopted ACGIH guidelines for workers exposed to solar and artificial UV radiation.
- People pursuing tanning routinely expose themselves to doses significantly higher than guidelines designed to protect workers.
- Issue is voluntary exposure vs. occupational exposure



