

modernizes the concept of the NCRP standards of 1954, 1957 and 1958, obtainable as NCRP Rept No 39, P O Box 4867, Washington, D C 20008

Lasers

The threshold limit values are for exposure to laser radiation under conditions to which nearly all workers may be exposed without adverse effects. The values should be used as guides in the control of exposures and should not be regarded as fine lines between safe and dangerous levels. They are based on the best available information from experimental studies.

Limiting apertures

The TLVs expressed as radiant exposure or irradiance in this section may be averaged over an aperture of 1 mm except for TLVs for the eye in the spectral range of 400-1400 nm, which should be averaged over a 7 mm limiting aperture (pupil). No modification of the TLVs is permitted for pupil sizes less than 7 mm.

The TLVs for "extended sources" apply to sources which subtend an angle greater than τ (Table 5) which varies with exposure time. This angle is *not* the beam divergence of the source.

Correction factor A (CFA) for eye exposure

All TLVs in Tables 3 and 4 are to be used as given for wavelengths 400 nm to 700 nm. At all wavelengths greater than 1.06 μm and less than 1.4 μm the TLVs are to be increased by a factor of 5. TLV at wavelengths between 700 nm and 1.06 μm are to be increased by a uniformly extrapolated factor as shown in Figure 2.

TABLE 3
THRESHOLD LIMIT VALUE FOR DIRECT OCULAR EXPOSURES
(Intrabeam Viewing) from a Laser Beam

Spectral Region	Wave Length	Exposure Time, (t) Seconds	TLV
UVC	200 nm to 280 nm	10^{-3} to 3×10^4	3 mJ cm^{-2}
UVB	280 nm to 302 nm	"	3 "
	303 nm	"	4 "
	304 nm	"	6 "
	305 nm	"	10 "
	306 nm	"	16 "
	307 nm	"	25 "
	308 nm	"	40 "
	309 nm	"	63 "
	310 nm	"	100 "
	311 nm	"	160 "
	312 nm	"	250 "
	313 nm	"	400 "
	314 nm	"	630 "
	315 nm	"	10 J cm^{-2}
UVA	315 nm to 400 nm	10 to 10^3	10 J cm^{-2}
	"	10^3 to 3×10^4	10 mW cm^{-2}
Light	400 nm to 700 nm	10^{-9} to 1.8×10^{-6}	5×10^{-7} J cm^{-2}
	"	1.8×10^{-6} to 10	$\left[\frac{1.8t}{\sqrt{t}} \right]$ mJ cm^{-2}
	"	10 to 10^4	10 mJ cm^{-2}
	"	10^4 to 3×10^4	10^{-6} W cm^{-2}
Infrared A	700 nm to 1.06 μm	10^{-9} to 10^2	[light TLV's] $\times$ [CFA]
"	1.06 μm to 1.40 μm	10^{-9} to 10^2	(light TLV) $\times$ 5
"	700 nm to 1.06 μm	10^2 to 3×10^4	10^{-4} [CFA] W cm^{-2}
"	1.06 μm to 1.4 μm	"	5×10^{-4} W cm^{-2}
Infrared B & C	1.4 μm to $10^3 \mu\text{m}$	10^{-9} to 10^{-7}	10^{-2} J $\cdot \text{cm}^2$
	"	10^{-7} to 10	$0.56 \sqrt{t}$ J $\cdot \text{cm}^{-2}$
	"	10 to 3×10^4	0.1 W cm^{-2}

NOTE To aid in the determination of TLV's for exposure durations requiring calculations of fractional powers Figures 3, 4, and 6 may be used