

UNIVERSITY OF KANSAS - LAWRENCE CAMPUS

LABORATORY SAFETY MANUAL

PART V - LASER SAFETY PLAN

Appendix 8.1) Glossary of Terms Used in Laser Methodology

Authorized (Laser) Laboratory Supervisor: The authorized laser user who assumes responsibility for the control and safe use of a laser or laser system.

Authorized (Laser) User: An individual who has met all applicable laser safety training, and approval requirements for operating a laser or laser system.

Authorized Resident (Laser) User: An individual who has met all applicable laser safety training, and approval requirements for operating a laser or laser system and who is a user of the laser facility on a regular basis for a period of at least three months.

Aversion response: Movement of the eyelid or the head to avoid an exposure to a noxious stimulant or bright light. It can occur within 0.25 s, including the blink reflex time.

Continuous wave (cw): The output of a laser which is operated in a continuous rather than a pulsed mode. For purposes of safety evaluation, a laser operating with a continuous output for a period > 0.25 s is regarded as a cw laser.

Controlled area: An area where the occupancy and activity of those within is subject to control and supervision for the purpose of protection from laser radiation and related hazards.

Diffuse reflection: Change of the spatial distribution of a beam of radiation when it is reflected in many directions by a surface or by a medium.

Embedded Laser: An enclosed laser with an assigned class number higher than the inherent capability of the laser system in which it is incorporated, where the systems lower classification is appropriate due to the engineering features limiting accessible emission.

Energy (Q): The capacity for doing work. Energy content is commonly used to characterize the output from pulsed lasers and is generally expressed in joules (J).

Exempt Laser: Class 1 lasers which are used as designed and on which no maintenance is performed that would expose any laser beam which has been enclosed by the manufacturer are exempt from the Laser Safety Plan. These lasers are covered by guidelines in the University Health and Safety Manual.

Failsafe interlock: An interlock where the failure of a single mechanical or electrical component of the interlock will cause the system to go into, or remain in, a safe mode.

Infrared radiation: Electromagnetic radiation with wavelengths which lie within the range 0.7 μ m to 1 mm.

Intra-beam viewing: The viewing condition whereby the eye is exposed to all or part of a laser beam.

Irradiance (E) (at a point of a surface): Quotient of the radiant flux incident on an element of the surface containing the point at which irradiance is measured, by the area of that element. Unit: watt per cm^2 .

Laser: A device which produces an intense, coherent, directional beam of light by stimulating electronic or molecular transitions to lower energy levels. An acronym for Light Amplification by Stimulated Emission of Radiation.

Laser Operator: See Authorized Laser User.

Laser Safety Officer (LSO): One who has the authority to monitor and enforce the control of laser hazards and effect the knowledgeable evaluation and control of laser hazards.

Laser System: An assembly of electrical, mechanical, and optical components which includes one or more lasers.

Maximum Permissible Exposure (MPE): The level of laser radiation to which a person may be exposed without hazardous effect or adverse biological changes in the eye or skin. MPE is expressed in terms of either radiant exposure ($\text{joules}/\text{cm}^2$) or irradiance (watts/cm^2). The criteria for MPE are detailed in Section 8 of ANSI Z136.1.

Nominal Hazard Zone (NHZ): The nominal hazard zone describes the space within which the level of the direct, reflected, or scattered radiation during normal operation exceeds the applicable MPE. Exposure levels beyond the boundary of the NHZ are below the appropriate MPE level.

Non-Exempt Lasers: All lasers *except* for Class 1 lasers which are used as designed and on which no maintenance is performed that would expose any laser beam which has been enclosed by the manufacturer.

Optical Density (D₁): Logarithm to the base ten of the reciprocal of the transmittance: $D_1 = -\log T$, where T is the transmittance.

Power: The rate at which energy is emitted, transferred, or received. Unit: watts (joules per second). Also called radiant power.

Prf: Abbreviation for pulse repetition frequency. (See repetitively pulsed laser.)

Pulsed laser: A laser which delivers its energy in the form of a single pulse or a train of pulses. The duration of a pulse is regarded to be < 0.25 s.

Q-Switched Laser: A laser that emits short (~ 30 ns), high-power pulses by means of a Q-switch.

Radiant Exposure (H): Surface density of the radiant energy received. Unit: joules per cm^2 .

Radiant Flux: Power emitted, transferred, or received in the form of radiation. Unit: joule (J).

Repetitively Pulsed Laser: A laser with multiple pulses of radiant energy occurring in sequence with a $\text{prf} > 1$ Hz.

Specular Reflection: A mirror-like reflection.

Transmittance (T): The ratio of total transmitted radiant power to total incident radiant power.

Ultraviolet Radiation: Electromagnetic radiation with wavelengths smaller than those of visible radiation; for the purpose of this section on laser safety, 0.2 to 0.4 μm .

Visible Radiation (Light): Electromagnetic radiation which can be detected by the human eye. This term is commonly used to describe wavelengths which lie in the range 0.4 to 0.7 μm .

Wavelength (λ): The distance between two successive points on a periodic wave which have the same phase.