UNMC

ENVIRONMENTAL HEALTH
AND SAFETY

HAZARDOUS MATERIAL FACT SHEET
Nebraska Medicine Laser and Laser Systems Classification

All Class 3B and Class 4 lasers and laser systems are required to be enrolled in the UNMC EHS Laser Safety program. Depending on the application, certain classes of less hazardous lasers and laser systems may have requirements such as control measures or training. Please contact unmcehs@unmc.edu for program enrollment or if you have any questions.

Overview

Laser and laser systems have several different applications in the workplace. These systems are sources of non-ionizing radiation which can emit ultraviolet radiation, visible light, and infrared radiation. Lasers and laser systems are classified to describe the ability of the laser beam to cause injury to personnel (e.g. biological damage to the eye or skin). The laser classification scheme ranges from Class 1 lasers like laser printers to Class 4 lasers like an excimer laser used for surgical procedures.

Identifying Your Laser or Laser System Classification

Lasers and laser systems received from manufacturers are required by federal law, 21 CFR Part 1000, to be classified and appropriately labeled by the manufacturer. It should be stressed, however, that the classification may change whenever the laser or laser system is modified to accomplish a given task. Classification information can be found on the laser or laser system equipment label or in the laser or laser system operator manual.

Classification

American National Standards Institute (ANSI) Z136.3 Section 1.2

Laser hazard classification is based only on the accessible laser radiation. For example:

- Class 1 Laser System: Considered to be incapable of producing damaging laser exposure during operation and are, therefore, exempt from any control measures or other forms of surveillance. A common example of a Class 1 laser system is one that contains an embedded higher class laser, but during normal operation does not present a laser radiation hazard to the user.

- Class 1C Laser System: Applicable when the laser radiation is intended to be applied in contact with the intended target and has safeguards that prevent leakage of laser radiation in excess of the accessible emission limits (AEL) of Class 1. Typical Class 1C laser products include those designed explicitly for contact application to the skin or non-ocular tissue, as in surgical procedures, or intended for hair removal, skin wrinkle reduction and acne reduction, including those for home-use.

- Class 1M Laser System: Considered to be incapable of producing hazardous exposure conditions during normal operation unless the beam is viewed with an optical instrument such as an eye-loupe (diverging beam) or a telescope (collimated beam). It is, therefore, exempt from any control measures other than to prevent potentially hazardous optically aided viewing.

- Class 1 Conditions: Frequently the hazard analysis will define an extremely limited nominal hazard zone (NHZ) and procedural controls can provide adequate protection. Class 1 conditions shall be considered as fulfilled for those limited open beam path lasers or laser systems where analysis, including measurements when necessary, confirms that the accessible levels during operation are at or below the maximum permissible exposure (MPE) levels.

- Class 2 Laser System: Emits in the visible portion of the spectrum (400 nm to 700 nm) and eye protection is normally afforded by the aversion response.

- Class 2M Laser System: Emits the visible portion of the spectrum (400 nm to 700 nm) and eye protection is normally afforded by the aversion response for unaided viewing, but is potentially hazardous if viewed with certain optical aids.

- Class 3 Laser Systems (medium-power): Divided into two subclasses, Class 3R and Class 3B. A Class 3 laser system may be hazardous to the eye under direct and specular reflection viewing conditions, but the diffuse reflection is usually not a hazard and it is not a hazard to the skin. A Class 3 laser system is normally not a fire hazard.

- Class 3R Laser System: Relatively low-risk subclass with reduced safety requirements. The Class 3R laser presents a low risk for injury. However, under some direct and specular viewing conditions an individual can sustain an injury if the eye is focused and stable.

- Class 3B Laser System: May be hazardous under direct and specular viewing conditions, but is not normally a diffuse reflection or fire hazard.

- Class 4 Laser Systems (high-power): Are a hazard to the eye or skin from the direct beam, and sometimes from a diffuse reflection, and can also be a fire hazard. A Class 4 laser system may also produce laser generated air contaminants (LGAC) and hazardous plasma radiation.

U.S. FDA Laser Hazard Classification

Class FDA	**Class IEC**	**Laser Product Hazard**	**Product Example**
I	1, 1M	Considered non-hazardous. Hazard increases if viewed with optical aids, including magnifiers, binoculars, or telescopes.	Laser printers CD players DVD players
IIA, II	2, 2M	Hazard increases when viewed	Bar code scanners

		directly for long periods of time. Hazard increases if viewed with optical aids.	
IIIA	3R	Depending on power and beam area, can be can be momentarily hazardous when directly viewed or when staring directly at the beam with an unaided eye. Risk of injury increases when viewed with optical aids.	Laser pointers
IIIB	3B	Immediate skin hazard from direct beam and immediate eye hazard when viewed directly.	Laser light show projectors Industrial lasers Research lasers
IV	4	Immediate skin hazard and eye hazard from exposure to either the direct or reflected beam; may also present a fire hazard.	Laser light show projectors Industrial lasers Research lasers Medical device lasers for eye surgery or skin treatments

Source: https://www.osha.gov/laser-hazards/hazards

ANSI Z136.3 Table 1 - Requirements by Laser Class

Class	Control Measures	Training	Laser Safety Officer	Engineering Controls
1	Not Required	Not Required	Not Required	Not Required
1C	Not Required	Not Required	Not Required	Not Required
1M	Required	Application Dependent [b]	Application Dependent [b]	Application Dependent [a]
2	Not Required [a]	Not Required [a]	Not Required	Not Required [b]
2M	Required	Application Dependent [b]	Application Dependent [b]	Application Dependent [a]
3R	Not Required [a]	Not Required [a]	Not Required [a]	Not Required [b]
3B	Required	Required	Required	Required
4	Required	Required	Required	Required
NOTE – During maintenance and service, the classification associated with the maximum level of accessible laser radiation shall be used to determine the applicable control measures.				

[a] Certain uses of Class 1M or Class 2M lasers or laser systems that exceed Class 1 or Class 2 because they do not satisfy measurement Condition 1 may require hazard evaluation and/or manufacturer's information.
[b] Not required except for conditions of intentional intrabeam exposure applications.