Laser Hazard Classification

Introduction

Lasers and laser systems are classified by the FDA/CDRH based on their potential to cause injury. The most relevant parameters used to classify a laser are the laser output energy, or power and wavelengths. Information on lasers and laser system classifications can be found in ANSI Z136.1-2014, "American National Standard for Safe Use of Lasers", Section 3. The designated classification of a laser or laser system can be found on the laser hazard label of the instrument and in the manufacturer's operating instructions. Lasers without classification labels or lasers constructed or modified in the laboratory must be reviewed by the Radiation Safety Office (617-496-3797) for appropriate classification.

The following is a summary of laser classification taken from ANSI Z136.1-2014.

Class 1 Lasers

A Class 1 laser is considered to be incapable of producing damaging radiation levels and is therefore considered safe under normal working conditions. These lasers are exempt from most control measures. Many lasers in this class are lasers which are embedded in an enclosure that prohibits or limits access to the laser radiation.

Class 2 Lasers

Class 2 lasers are low power lasers that emit visible radiation and do not exceed a power output of 1 mW. For this laser class, the normal human aversion response of (0.25 second) to bright radiant sources affords eye protection if the beam is viewed directly. The potential for eye hazard exists if this normal reflex motion is overcome and the exposure time is greater than 0.25 second.

Class 1M Lasers

A Class 1M laser is 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 or a telescope.

Class 2M Lasers

A Class 2M laser emits visible radiation (400 to 700 nm) with a power output below 1 mW. Like Class 2 laser products, Class 2M lasers pose ocular hazards to the unaided eye, but are potentially hazardous when viewed with optical aids.

Class 3R Lasers

Class 3R lasers are potentially hazardous under some direct and specular reflection viewing conditions, but the probability of an injury is small. Class 3R lasers do not pose either a fire hazard or diffuse-reflection hazard. The output power of a Class 3R laser is between 1 and 5 times the Class 1 power limit for wavelengths shorter than 400 nm (UV lasers) or longer than 700 nm (IR lasers), or an output power of 5 mW for 400 nm to 700 nm wavelengths (visible lasers).

Class 3B Lasers

Class 3B lasers are medium power lasers that have an output power of 5 mW – 500 mW. Viewing these lasers under direct beam and specular reflection conditions are hazardous. The diffuse reflection is usually not a hazard except for higher power Class 3B lasers. A Class 3B laser is not normally a fire hazard.

Class 4 Lasers

Class 4 lasers are high power lasers with a power output above 500mW. Exposure to the direct beam, specular reflections, or diffuse reflections presents a hazard to both the eye and skin. A Class 4 laser may be a fire hazard (radiant power > 2 W/cm^2 is an ignition hazard). In addition, these lasers can create hazardous airborne contaminants and have a potentially lethal high voltage power supply. Always enclose the entire laser beam path, if possible, or enclose most of the beam path to reduce the potential hazards.