

Laser Safety Policy

The Central Community College Board of Governors established the Laser Safety Policy to ensure hazards presented by lasers and laser systems are properly evaluated and controlled when in use by CCC programs. The Central Community College board directs the President to designate a Laser Safety Officer (LSO) to recommend compliance with American National Standards Institute (ANSI) Safe Use of Lasers and to provide guidance on appropriate laser applications and to approve current or amended laser projects. Procedures and guidelines will provide laser users with information on classes of laser systems, laser hazards, practices, use, and training to safely operate laser equipment. In accordance with the American National standards Institute (ANSI) Standard ANSI Z136.1-2022, American National Standard for Safe Use of Lasers is the accepted laser standard for the U.S.

Laser Safety Procedure

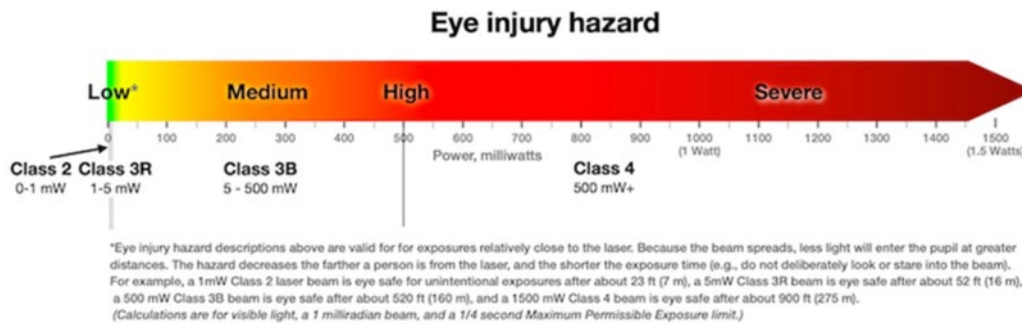
1.0 PURPOSE:

The Laser Safety Procedure is established to ensure hazards presented by lasers and laser systems are properly evaluated and controlled. It defines program requirements for all classes of laser systems. Program requirements ensure that all individuals using lasers in a teaching environment have access to comprehensive information on laser hazards, safe laser use, and laser safety training. American National standards Institute (ANSI) Standard ANSI Z136.1-2022, *American National Standard for Safe Use of Lasers* is the accepted laser standard for the U.S. Lasers pose significant risks to eyes, skin and can ignite flammable materials or release hazardous substances. Under certain conditions a specular/diffuse reflection of the beam may also cause injury.

2.0 SCOPE:

Central Community College has developed this document to provide laser users with information on laser hazards, procedures, safe use, and training to operate laser equipment safely. The laser safety procedure applies to all personnel performing work with lasers or laser systems. The primary purpose of the College Laser Safety Program (LSP) is to ensure that no laser radiation in excess of the maximum permissible exposure (MPE) limit reaches the human eye or skin. All laser users must conduct their work within the requirements of the laser safety program. This laser safety program is not intended to be a fully comprehensive reference for every laser application, but rather as a guide for laser users. Further requirements concerning hazards associated with specific substances, devices, and novel laser applications should be consulted with the Laser Safety Officer (LSO). All employees involved with the purchasing, receiving, handling, use, storage, and disposal of lasers will comply with the procedures in this manual. All new laser projects or amendments to current projects must be approved by the LSO.

The program requirements primarily apply to Class 3B and 4 lasers and laser systems. However, consideration that Class 1 laser devices, such as etching systems, may become Class 3B or 4 laser devices when the protective housing panels are removed during laser operations. An overview of the additional laser classes as well as safety recommendations are found in this procedure-



3.0 ROLES AND RESPONSIBILITIES:

LASER SAFETY OFFICER (LSO): The LSO is an individual designated by the College, in writing, that has the authority and responsibility to effect the knowledgeable evaluation and control of laser hazards and to monitor and enforce the control of such hazards. The LSO provides basic laser safety awareness, hazard analysis and makes sure that training is completed. The Laser Safety Officer is the individual responsible for managing the Laser Safety Program and will conduct periodic and/or annual assessments of all class 3B and class 4 laser (open and enclosed beam) laboratories and any laser laboratory deemed necessary. The laser safety officer Class 3B and class 4 lasers shall be operated only with the written approval of the LSO.

The LSO is responsible for the following but not limited to:

- Assure the proper classification of all lasers.
- Establish and maintain laser safety policies and procedures.
- Ensure safety training of laser personnel has been completed.
- Performing hazard evaluations for all class 3B and 4 lasers and laser work areas.
- Monitoring the laser program and assuring compliance from laser users.
- Ensuring that laser users have proper protective equipment.

USER RESPONSIBILITY:

It is the ultimate responsibility of the Course Instructor to perform evaluations and safety over his or her laser(s) and/or laser system(s). The Course Instructor is directly responsible for ensuring adherence to the laser safety program. This includes but not limited:

- Registering every class 3B and class 4 laser system by submitting a laser registration form to EH&S/LSO.
- Procurement of personal protective equipment (PPE), ensure its availability and effectiveness (correct wavelength and optical density of glasses, shields) for all lasers and/or laser systems.
- Notification of the acquisition, relocation, transfer or disposal of any Class 3B or Class 4 laser and/or laser system should be submitted in a timely fashion.
- Establish and maintain lab specific laser safety policies and procedures.

- Maintain an updated roster of laser users and that they have completed their training requirements as outlined in the training requirements section of this manual.
- Inform the LSO of any new laser projects or amendments to existing laser projects.
- Notify the LSO and laser users of any new suspected hazards or changes to how a laser system is operated.
- Ensure that lasers are operated as intended within established safety procedures.
- Ensure proper laser signs are posted, and additional safety systems installed as applicable.
- Maintain all current SOPs/JHAs for their lab.
- Immediately inform the LSO of any accidental exposure to direct or indirect laser radiation.

4.0 HAZARD CLASSIFICATION

Lasers are divided into classes depending upon the power or energy of the beam, the wavelength of the emitted radiation and the exposure duration. Any completely enclosed laser is classified as a Class 1 laser if emissions from the enclosure do not exceed the MPE values under any conditions inherent to the laser design. However, during service procedures or if the enclosure panels are opened during laser operation, the appropriate control measures are temporarily required for the class of laser contained within the enclosure.

Class 1 Laser Systems: Are incapable of producing damaging radiation levels during operation and are exempt from any control measures and training

Class 1M Laser Systems: Are considered incapable of producing hazardous exposure conditions during normal operation unless the beam is viewed with collection optics such as microscopes and telescopes. Class 1M laser and laser systems are exempt from any control measures other than to prevent potentially hazardous optically aided viewing.

Class 2 Laser Systems: Class 2 lasers emit in the visible portion of the spectrum (400-700 nm) and eye protection is normally afforded by the human eye aversion response. Prolonged exposure can result in eye damage if the beam is stared at longer than the normal aversion response time to bright light (0.25 seconds). Upper limit for continuous wave lasers is one 910 milliwatt (mW). Class 2 lasers are commonly used in alignment procedures.

Class 2M Laser Systems: Class 2M lasers emit in the visible portion of the spectrum (400-700 nm) and eye protection is normally afforded by the human eye aversion response. However, like Class 1M, Class 2M lasers are potentially hazardous if viewed with collecting optics.

Class 3R Laser Systems: Class 3R have a reduced control requirement and are potentially hazardous under some direct and specular reflection viewing conditions if the eye is focused and stable. The probability of an actual injury is small and the laser will not pose either a fire hazard or diffuse reflection hazard. Class 3R lasers and laser systems have an accessible output between 1-5 mW for continuous wave systems.

Class 3B Laser Systems: Medium-powered lasers (visible or invisible regions) that present a potential eye hazard for intrabeam (direct) or specular (mirror-like) conditions. Normally not a fire hazard. Class 3B lasers and laser systems have an accessible output between 5 – 500 mW for

continuous wave systems and less than 0.03 Joule (J) for pulsed lasers that have a pulse width of less than 0.25 seconds. Engineering controls are required for Class 3B lasers.

Class 4 Laser Systems: High-powered lasers (visible or invisible regions) considered to present potential acute hazard to the eye and skin for both direct (intrabeam) and scatter (diffused) conditions. They may pose a fire hazard and many also produce LGAC and hazardous plasma radiation. Class 4 lasers and laser systems have an accessible output of greater than 500 mW for continuous wave systems and greater than 0.03 J for pulsed laser systems. Significant engineering controls are required for all Class 4 lasers.

Embedded Laser Systems: An enclosed laser or laser system is defined as a higher classification that the laser system in which it is incorporated, where the system's lower classification is appropriate due to the engineering controls limiting accessible emission.

5.0 REQUIREMENTS FOR CLASS 3B AND 4 LASERS:

Adjustment during operation, service, testing, or maintenance of a laser containing interlocks shall not cause the interlocks to become inoperative.

- 5.1 Each class 4 laser shall be provided with a master switch. This master switch shall be operated by a key, or by a coded access (such as a computer code). Each class 3B shall be provided with a key switch or coded access. Exceptions to this requirement shall be considered by the LSO during the laser hazard evaluation.
- 5.2 Each person who operates or works with class 3B or 4 lasers shall complete training in laser safety provided by LSO-approved equivalent and shall complete specific campus laser safety training. No person may work with a laser prior to completing this laser safety training.
- 5.3 Class 3B or 4 lasers shall provide visual or audible indication during the emission of accessible laser radiation. The indication shall occur prior to emission of radiation with sufficient time to allow appropriate action to avoid exposure. Any visual indication shall be visible through protective eyewear for the wavelength of the laser.
- 5.4 Class 3B and 4 lasers shall only be operated in a Controlled Area. A Controlled area shall be established by the Permittee to limit access of personnel to laser radiation. Each Controlled Area shall be posted conspicuously with signs as specified in the ANSI standard. Access to the Controlled Area shall be controlled by a door, blocking barrier, screen, or curtain, which attenuates the laser radiation to below the maximum permissible exposure (MPE), and individuals who enter the Controlled area shall not experience radiation above the MPE immediately upon entry.
- 5.5 Safety Interlocks- The protective housing shall be interlocked such that removal of the protective housing will prevent exposure to laser radiation greater than the MPE. Interlocks shall not be defeated or overridden during normal operation of the laser. For pulsed lasers, interlocks shall be designed to prevent unintentional firing of the laser. For continuous wave (CW) lasers, the interlocks shall turn off the power supply or interrupt the beam. Service access panels that allow access to the beam during normal operation shall either be interlocked or require a special tool for removal and have an appropriate warning label.

Class 3B lasers should be provided with a remote interlock connector. Class 4 lasers

shall have a remote interlock connector. The remote interlock connector will decrease the laser beam power to a safe level when activated.

5.6 Alternate controls may be considered during the laser hazard evaluation and, if accepted, will be documented in the SOP. Where safety latches or interlocks are not feasible or are inappropriate, the following shall apply:

- All authorized personnel shall be trained in laser safety and appropriate personal protective equipment shall be provided upon entry.
- A door, blocking barrier, screen, or curtains shall be used to block, screen, or attenuate the laser radiation at the entryway.
- The level at the exterior of these devices shall not exceed the applicable MPE, nor shall personnel experience any exposure above the MPE immediately upon entry.
- At the entryway there shall be a visible or audible signal indicating that the laser is energized and operating at Class 4 levels.
- A lighted laser warning sign, flashing light and other appropriate signage are acceptable methods to accomplish this requirement.

6.0 PERSONAL PROTECTIVE EQUIPMENT:

6.1 Each Permittee shall provide protective eyewear that meets the requirements of ANSI Z136.1-2022.

6.2 The eyewear shall be located where persons who operate the laser have unrestricted access to the eyewear.

6.3 The eyewear shall be worn for alignment and operation where the laser beam is not enclosed.

6.3.1 No person shall operate a class 3B or 4 laser without protective eyewear specific for the laser and the appropriate training for the specific eyewear.

6.3.2 Protective eyewear shall meet the following requirements:

- Provide a comfortable and appropriate fit all around the area of the eye.
- Be in proper condition to ensure the optical filter(s) and holder provide the optical density or greater at the specific wavelength of the laser and retain all protective properties during its use.
- Be of optical density adequate for the laser energy involved.
- Have the optical density or densities and associated wavelengths permanently and prominently labeled on the filters or eyewear.
- Be examined at intervals not to exceed 12 months, to ensure the reliability of the protective filters and integrity of the holders. Unreliable eyewear shall be discarded and replaced.

- The Optical Density of the protective eyewear shall be appropriate for the specific frequency and pulse length of the laser beam, and shall provide reduction of the incident energy to less than the MPE of the laser.

7.0 STANDARD OPERATING PROCEDURES

- 7.1.1 Each laser shall have a Standard Operating Procedure (SOP) written for its operation. A SOP in this use is the same as a laboratory/laser/lab specific protocol that specifies safe use and procedures for the laser system.
- 7.1.2 The SOP must be present at the operating console or control panel of the laser.
- 7.1.3 The SOP shall include at a minimum, operating instructions, safety eyewear parameters and instructions for proper use, interlock instructions, and checklist for operation.
- 7.1.4 The SOP shall include clear warnings to avoid possible exposure to laser and collateral radiation in excess of the MPE.
- 7.1.5 The SOP shall be available for inspection by the LSO or his/her designate at any time.

8.0 NOMINAL HAZARD ZONES

For all open beam class 3B and 4 lasers the MPE will be assumed to be exceeded and appropriate precautions taken. The NHZ (nominal hazard zone) will therefore comprise the enclosure (room or area the beam is restricted to by virtue of walls, curtains, or other barriers) in which the laser(s) is operating.

9.0 SURVEYS

- 9.1.1 The LSO should re-evaluate the laboratory containing the laser(s) for which the instructor is responsible at intervals not to exceed 12 months.
- 9.1.2 The evaluation shall include a determination that all warning devices are functioning within their design specifications.
- 9.1.3 The evaluation shall include a determination that the controlled area is properly controlled and posted with accurate warning signs.
- 9.1.4 The evaluation shall include a reevaluation of potential hazards from surfaces that may be associated with beam paths.
- 9.1.5 Additional evaluations may be required to assess the primary and collateral radiation hazard incident to the use of lasers.
- 9.1.6 Evaluation records shall be retained for inspection by the Laser Safety Officer.