

Procedures for Working with Non-Ionizing Radiation

WCB Regulation - Non-ionizing Radiation

Excerpt:

Lasers 7.47

Exposure to non-ionizing radiation from lasers must be limited to the exposure limits identified in the following standards, where applicable, or other standard acceptable to the board:

- (a) *ANSI Standard Z136.1-1993, Safe Use of Lasers;*
- (b) *ANSI Standard Z136.2-1988, Safe Use of Optical Fiber Communication Systems Utilizing Laser Diode and LED Sources;*
- (c) *ANSI Standard Z136.3-1988, Safe Use of Lasers in Health Care Facilities.*

General Information on Lasers

Most lasers are capable of causing eye injury to anyone who looks directly into the beam or its reflections from a specular (mirror-like) surface. In addition, diffuse reflections of a high-power laser beam can produce permanent eye damage. High-power laser beams can burn exposed skin, ignite flammable materials, and heat materials that release hazardous fumes, gases, debris, or radiation.

Equipment and optical apparatus required to produce and control laser energy may also introduce additional hazards associated with high voltage, high pressure, cryogenics, noise, other forms of radiation, flammable materials, and toxic fluids. Thus, each proposed experiment or operation involving a laser must be evaluated to determine the hazards involved and the appropriate safety measures and controls required.

The Department requires that individuals using lasers set up and operate laser facilities to meet the laser safety guidelines established by the American National Standards Institute (ANSI) standard ANSI Z136.1-1993, American National Standard for the Safe Use of Lasers (See Addendum.)

The Laser Safety Program applies to individuals who operate or work in proximity to Class 2, Class 3 or Class 4 lasers.

Hazard Classification

Commercial lasers are classified and certified by the manufacturer. When a commercial laser is modified or when a new laser is constructed in the laboratory, it is the responsibility of the principal investigator to classify and label the laser per the ANSI Standard. In the Department of Civil Engineering, the Spectra Physics Stabelite 2017 is a Class IV laser product, 4 Watts, Argon-Ion.

Medical Surveillance

Some individuals who operate or work in close proximity to particular Class 3b or Class 4 lasers or laser systems may receive a pre-assignment and a post-assignment eye examination performed by a consulting ophthalmologist if usage parameters indicate this requirement.

Training

Individuals who work with or in close proximity to Class 2, Class 3, or Class 4 lasers must attend laser safety training provided by Dr. Greg Lawrence or designate, and through the Department of

Health, Safety and Environment Laser (Radiation) Safety Officer. This training includes:
fundamentals of laser operation
biological effects of laser radiation on the eye and skin
non-radiation hazards (e.g., fire hazards, chemical exposure)
classification of lasers and laser systems
control measures and personal protective equipment

Individuals who work with or in close proximity to Class 3b or Class 4 lasers may receive additional training from H.S.& E, including:
medical surveillance
relations of specular and diffuse reflections
radiometric units and measurement devices
maximum personal exposure levels of eye and skin under all conditions
laser hazard evaluations and range equations

Roles and Responsibilities

Department:

Identify laser products that are covered by the ANSI Standard and establish procedures to ensure that the recommendations of the Standard are followed.
Ensure individual who work with or around lasers have received the proper laser safety training.
Establish a safety review procedure to determine that adequate hazard analyses and corrective actions have been completed for all applicable laser systems.

Supervisors:

Be knowledgeable of the education and training requirements for laser safety, the potential laser hazards and associated control measures for all lasers under their control.
Report known or suspected accidents to ensure that lasers under their control are not operated or modified without approval of the supervisor or principal investigator.
Ensure that all administrative and engineering controls are followed.
Maintain inventory control and a permanent record of the status of all Class 3b, and Class 4 lasers
Ensure that individuals working with lasers have attended the general laser safety training and provide laser operators with training in the administrative, alignment and standard operating procedures.
Classify and label any unclassified lasers
Attend University's laser safety training programs.
Ensure that laser workers are registered for the medical surveillance program.
Notify immediately in the event of an exposure to a Class 3 or Class 4 laser.
Provide standard operating procedures (SOP), in accordance with ANSI Z136.1-1993 and any established University policy, for all laser operations involving Class 3 and Class 4 lasers detailing alignment, operation and maintenance procedures.

Purchasers

Notify LSO when orders for Class 3 and Class 4 lasers are placed

Safety Committee

Provide assistance in evaluating and controlling hazards.
Maintain records of lasers and laser operators.
Arrange for laser safety training.
Participate in accident investigations involving lasers.
Periodically audit the departmental Laser Safety Program.

Individual

Attend laser safety training
Be familiar with specific safety hazards of lasers which is being operated or working near.

Follow standard operating procedures and comply with requirements established by the regulation agencies, Laser Safety Officer representing the University, the Department and the supervisor.

Use Class 3b or Class 4 lasers only if specifically authorized by the supervisor.

Report known or suspected accidents to the supervisor and H. S.& E. and LSO.

Inform spectators about and protect spectators from all potential laser hazards

Register for the medical surveillance program

References

Contact the Laser Safety Officer at 822-7052_for more information.

The resources and training aids (*available in department):

*ANSI Standard Z136.1-1993, American National Standard for the Safe Use of Lasers, 1993
CFR Chapter I, Subpart J, Part 1040 - Performance Standard for Light Emitting Products (the Food and Drug Administration requirement document for light emitting products.

Videocassette: High Powered Lasers in the Lab, Interactive Medica Communications, 1994

Goldman, Leon, Application of the Laser, CRC Press, 1977

Pressley, Robert J., Ph.D., editor, CRC Handbook of Lasers, CRC Press, 1971

Seigman, Anthony E., Lasers, University Science Books, 1986

Mallow, Alex and Leon Chabot, Laser Safety Handbook, Van Nostrand Reinhold, 1978

Departmental Procedures

No one is permitted to use the Class 4 Laser (4 Watt Argon ion) Spectra Physics Stabelite 2017 Laser in Room 138 of the Rusty Hut without receiving training and authorization from Dr. Greg Lawrence, Rm 2026, CEME, 822-5371. The Laser Safety Officer for the University is the Radiation Safety Officer, currently, Craig Smith, 822-7052. Any changes in location or configuration must be reported to the Department Safety Committee and the LSO. The ANSI Standard is in the Addendum of this manual and with laser. Training log must be kept current on-site and in the main office.

Laser Safeguards (Craig Stevens, January 1993)

The programme outlined here is intended to comply with American standard Z136.1-1986. The following have been installed before the laser was fully operational. The section numbers refer to the ANSI standard.

The 4 watt Argon-Ion laser is classified as a class IV laser and therefore is subject to certain requirements.

Protective Housing (§4.3.1)

A protective housing is supplied with the laser and this has warning labels and an interlock in place on the removable housing (§4.3.2 and §4.3.3).

Master Switch (§4.3.4)

A key-switch provides security for the power initiation.

Beam Paths (§4.3.6)

Due to the nature of the application the beam path is totally unenclosed thus requiring a laser controlled area to be delineated (§4.3.11).

Laser Controlled Area (§4.3.1)

The laboratory rm 138 in the Civil/Mechanical Engineering Annex (Rusty Hut) is now the laser controlled area. This includes restricted access during laser operation and the laser will not be used during undergraduate laboratory classes that take place in the room. The laser set up will include:

- i. Remote interlocks on both access doors (§4.3.7)
- ii. Suitable warning signs on outside doors (§4.3.10.2, §4.3.14, §4.7 and figure 1b)

- iii. Flashing light on outside doors (§4.3.10.2)
- iv. Power up emission delay (§4.3.9.1)
- v. Visible emission indicator (§4.3.9.1)
- vi. Beam stop (§4.3.8)
- vii. Emergency switch (§4.3.10.2)

Standard Operating Procedure (§4.4.1)

A standard operating procedure will be displayed on the laser work bench and in the Department Safe Procedures Manual.

Education and Training (§4.4.3)

The laser must be operating by qualified, fully trained and authorized personnel. Education about the intensity of the laser beam with emphasis on care with reflections is necessary. Once aligned for a given application there is little involved in the actual use of the laser. Alignment procedures will need to be developed using highly attenuated bench output.

Eye Protection (§4.4.6 and §4.6.2)

The department has purchased 3 pairs of Glendale protective goggles LGS-A which have optical densities ranging from 5 to 25 in the range of wavelengths produced by the Spectra-Physics Laser. The recommended OD is 4 (§4.6.2.5), thus the goggles will be sufficient. More than 3 people viewing the experiments would only occur during a major demonstration, in which case all reflected beams would be blocked and the viewing would only be of dyes fluorescing due to the incident laser (§4.4.7). The goggles are surround fit so that eyeglass wearers may use them, the side pieces are of the same material as the lenses so that users will still have protected peripheral vision. Information about the goggles will be included with the data/operating instructions.

Protective Clothing (§4.6.3)

There is no UV output from this machine so this is not a concern.