A. **Scope of the Program**

Lasers are used on the UC Irvine campus for numerous applications in a variety of fields of research, including medicine, biophysics, engineering, chemistry, and physics. While the use of lasers is not without its risks, safe use is readily achieved by following nationally-recognized standards such as the *American National Standard (ANSI Standard) for Safe Use of Lasers (Z136.1; 2007)*.

The goal of the UC Irvine Laser Safety Program is to provide reasonable and adequate guidance for the safe use of lasers by all personnel who can be impacted by lasers on campus; this includes faculty, staff, students, visitors, and the general public. The scope of the program includes:

a) Providing information dealing with the recognition, evaluation and control of the hazards associated with lasers;

b) Training all laser users regarding the principles of laser safety;

c) Inspecting all hazardous laser operations on campus on at least an annual basis;

d) Maintaining an inventory of all hazardous laser systems on campus;

e) Assisting laser users in identifying and purchasing appropriate laser safety supplies.

B. **Definitions**

Useful laser safety terminology is presented below:

*Beam*
A collection of rays which may be parallel, divergent, or convergent.

*Coherent*
A light beam is said to be coherent when the electric vector at any point in it is related to that at any other point by a definite continuous sinusoidal function.

*Continuous Wave (CW)*
The output of a laser which is operated in a continuous rather than a pulsed mode. A laser operating with a continuous output for a period greater than or equal to 0.25 sec is regarded as a CW laser.

*Laser*
A device which produces an intense, coherent, directional beam of radiation by stimulating electronic or molecular transitions to lower energy levels. Also, an acronym for "Light Amplification by Stimulated Emission of Radiation".
**Laser Safety Officer (LSO)**
One who is knowledgeable in the evaluation and control of laser hazards, and who has authority for supervision of the control of laser hazards.

**Maximum Permissible Exposure (MPE)**
The maximum level of laser radiation to which a person may be exposed without hazardous effect or adverse biological changes in the eye or skin.

**Optical Density (OD)**
Logarithm to the base ten of the reciprocal of the transmittance. The optical density is a measure of the ability of laser safety eyewear to attenuate/filter laser radiation.

**Power**
The time rate at which energy is emitted, transferred, or received; usually expressed in Watts (i.e., Joules/second).

**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 must be less than 0.25 sec, or the laser is a continuous wave (CW) laser.

**Wavelength (\(\lambda\))**
The distance between two successive points in a periodic electromagnetic wave which have the same phase.

C. **Responsibilities**

1. **EH&S Personnel**

   The UC Irvine Radiation Safety Officer (RSO) has oversight responsibility for the administration of the Laser Safety Program on campus and to ensure that all hazards related to the use of lasers are adequately controlled.

   The RSO supervises the UC Irvine Laser Safety Officer (LSO), who is an EH&S staff member who has acquired the knowledge and training needed to perform specific laser safety functions on campus.

   The LSO provides laser safety training and consultative services related to the recognition, evaluation and control of laser hazards (including non-beam hazards), and establishes and maintains appropriate laser safety rules and guidelines for the campus.

   The LSO maintains an inventory of all Class 3b and Class 4 lasers on campus.
The LSO, in conjunction with the Principal Investigator (PI) for each laser facility, ascertains what protective equipment (including laser safety eyewear, protective barriers, indirect beam viewing supplies, etc.) and warning devices (signs, alarms, etc.) are necessary, and assists in the selection of the equipment and devices that need to be used. The LSO performs all optical density calculations to ensure that the eyewear chosen is adequately protective.

Safety inspections of laser facilities are performed by the LSO at least yearly or as frequently as deemed necessary to maintain adequate hazard control.

The LSO is capable of assisting PIs regarding the re-classification of modified laser systems.

All laser equipment purchase requisitions are reviewed by the LSO to ensure that facilities receiving Class 3b or Class 4 lasers have adequate safety supplies and hazard controls, and to make sure all laser users are sufficiently trained.

Real or suspected accidents resulting from laser operations on the UC Irvine campus are investigated by the LSO, and appropriate corrective actions are taken.

2. **Principal Investigator (PI) of the Laser Facility**

   It is the responsibility of the PI, in consultation with the LSO, to provide for adequate instructions on laser use, laser hazards and their control to all personnel who work with lasers that are operated under his/her supervision.

   The PI must not permit the operation of a laser unless there is adequate control of hazards for employees, visitors, students and the general public. This includes the proper utilization of engineering control measures, administrative controls, and laser safety eyewear.

   Only the PI, or his/her designated representative, may authorize the use of the laser equipment for which he/she is responsible.

   In the event that deficiencies in laser hazard controls or laser safety training are identified by the LSO during a safety evaluation of his/her laboratory, the PI must take appropriate corrective actions immediately.

   No laboratory personnel or visitors may be present during the operation of a Class 3b or Class 4 laser unless permission has been granted by the PI or his/her designated representative. Casual visitors are not permitted.

   When the PI knows of or suspects an accident resulting from the use of a laser operated under his/her supervision has occurred, the LSO must be notified immediately! If necessary, assistance will be given in obtaining appropriate medical attention for the individual involved in the accident.
The PI must not permit the modification of a laser system to be made which may result in an additional hazard, nor will he/she give permission to energize a new system, without ensuring that all necessary and appropriate control measures are in place.

The PI ensures that all maintenance and repair work is only performed by qualified, trained individuals in a safe manner.

3. **Laser Operators, and Others Working Near Lasers**

A person is not to energize a Class 3b or Class 4 laser, or work with or near such a laser, unless authorization has been given by the PI of the laser facility, or his/her designated representative.

All persons must be adequately trained regarding, and comply with, the campus laser safety requirements and procedures (including those dealing with the use of appropriate eyewear), and the rules prescribed by the PI.

When a person knows or suspects that an accident has occurred involving a laser operated by himself/herself or other persons responsible to the PI, that person must immediately inform the PI, and if the PI is not available, the person is to notify the LSO.

D. **Program Components**

The major elements of the UC Irvine Laser Safety Program are listed below, together with other related UC Irvine laser safety documents:

a) Providing information to campus laser personnel dealing with the recognition, evaluation and control of laser hazards.

- UCI Laser Safety Manual
- UCI Laser Safety Factsheet
- Safety Related Considerations When Installing a Research Laser
- UCI Laser Safety Newsletters (~ two per year)

b) Training laser users regarding the principles of laser safety.

- Online Laser Safety Course
- Laser Safety Seminars (upon request)

c) Inspecting all hazardous laser operations on campus on an annual basis.

- UCI Laser Safety Inspection Form
- Laser Safety Reports
d) Maintaining an inventory of all Class 3b and Class 4 laser systems on campus.
    UCI Laser Registration Form
    Word-based Laser Inventory List

e) Assisting laser users in identifying and purchasing appropriate laser safety supplies.
    Laser Protective Eyewear Evaluation Form

E. Reporting Requirements

The UC Irvine LSO must be notified whenever a Class 3b or Class 4 laser is brought onto campus, unless the laser is purchased through UC Irvine Purchasing, in which case the LSO is notified when the order is placed and needs to approve each such purchase.

If a laser system is modified such that the hazards attendant to the use of the laser are substantially increased, the LSO needs to be notified in order to ensure that enhanced laser safety controls are in place before the laser is operated.

If a person knows or suspects that he/she has been injured by a laser, the LSO must be notified as soon as possible.

If somebody is observed to be operating a laser in an irresponsible manner, the LSO needs to be notified immediately.

F. Eye Exams

No eye exams are required for laser users at UC Irvine. The need for eye exams is now indicated in the ANSI laser standard as a “should” issue instead of a “shall” issue.

G. Information

For information on laser safety, contact:

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Updated April 30, 2008