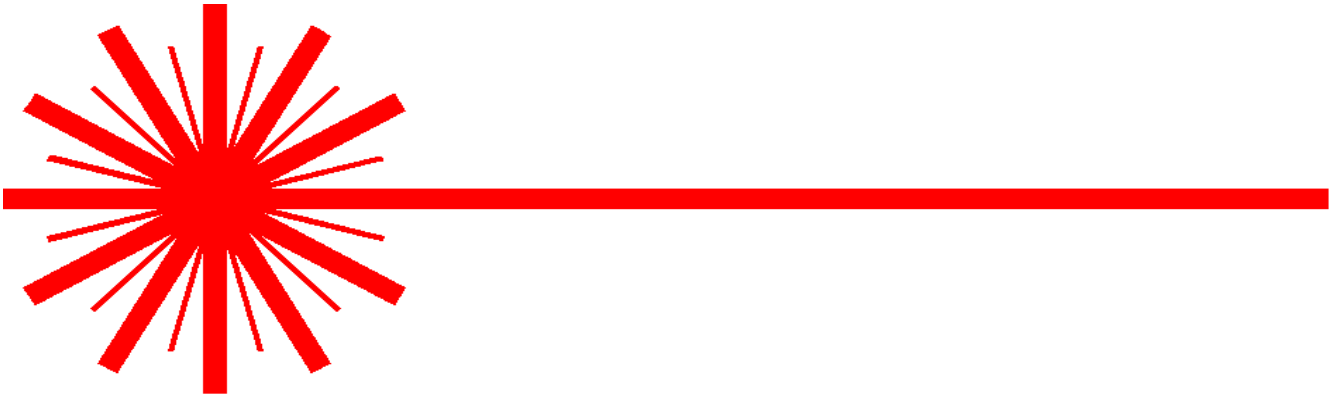
EH&S Radiation Safety

LASER SAFETY MANUAL

UNIVERSITY OF KENTUCKY
POLICIES AND PROCEDURES
FOR LASER USERS



REVISED EDITION 2012

ISSUED BY

UNIVERSITY OF KENTUCKY
RADIATION SAFETY OFFICE

TABLE OF CONTENTS

UNIVERSITY OF KENTUCKY LASER SAFETY POLICY

Policy and Purpose

The University of Kentucky Laser Safety policy is developed from the American National Standard Institute's Standard For The Safe Use of Lasers (ANSI z136.l-2007), which is the laser industry's standard for the safe use of lasers and laser systems that operate at wavelengths between 0.18 um and 1 mm.

Laser Classification

Laser- A device that produces radiant energy predominantly by stimulated emission. Laser radiation may be highly coherent temporally, spatially or both.

Class 1 laser - Poses no threat of biological damage. Exempt from any control measures.

Class 1M laser - Poses no threat of biological damage unless viewed through certain optical aids. Exempt from any control measures other than to prevent optically aided viewing.

Class 2 laser - Emits in the visible spectrum (0.4 to 0.7 um). Eye protection is afforded by the aversion response, (0.25s).

Class 2M laser - Emits in the visible spectrum (0.4 to 0.7 um). Eye protection is afforded by the aversion response, (0.25s) for unaided viewing. However, Class 2M is potentially hazardous if viewed with certain optical aids.

Class 3R laser - Potentially hazardous under some direct and specular reflection viewing conditions if the eye is focused and stable. Does not pose a fire or diffuse reflection hazard.

Class 3B laser - Potentially hazardous under direct and specular reflection viewing conditions. Not normally a fire or diffuse reflection hazard.

Class 4 laser - Is a hazard to the eye and skin under direct and specular reflection viewing conditions. May pose a fire and diffuse reflection hazard. May also produce laser generated air contaminants (LGAC) and hazardous plasma radiation.

Embedded Laser –A laser system which has a lower classification due to engineering controls that limit access to an enclosed laser with a higher classification.

Responsibilities

The responsibilities of **laser companies** that provide laser light entertainment on campus are found in appendix A.

Principle Investigator (P.I.): The Principal Investigator is responsible for safe use of lasers under the P.I.'s authority. The P.I. shall appoint a Laser Supervisor, who may be the P.I. or other appropriate person.

Laser Supervisor: The Laser Supervisor acts as the contact for the Radiation Safety Office and must be registered with the Radiation Safety Office. This may be accomplished by contacting the Laser Safety Officer (LSO) at 323-6777. The Laser Supervisor has the following responsibilities;

1) The supervisor shall ensure that all personnel have completed the Basic Laser Safety Training program prior to operating a Class 3B or Class 4 laser.
2) The supervisor shall ensure that protective equipment (eye wear, clothing, barriers, etc.) is maintained and worn. The supervisor shall not permit the operation of a laser unless there is adequate control of laser hazards to employees and the general public.
3) The supervisor shall submit a current list of personnel who work with lasers to the LSO and submit appropriate medical and training information as requested by the LSO.
4) The supervisor shall report all incidents involving safety violations, accidents or injury to the LSO at 323-6777.
5) If necessary, the supervisor shall assist in obtaining appropriate medical attention for any employee involved in a laser accident.
6) The supervisor shall not permit operation of a new or modified Class 3B or Class 4 laser without the approval of the LSO.
7) The supervisor shall notify the LSO of class 3B or class 4 laser installations, and of any changes in operational status, such as location changes or modifications.
8) The supervisor shall be familiar with the standard operating and emergency procedures of class 3B and class 4 lasers and ensure that they are provided to users of these lasers.

Employees working with lasers shall have the following minimal responsibilities:

1) An employee shall not work with or near a laser unless authorized by the Laser Supervisor.
2) An employee shall comply with safety precautions and operating procedures prescribed by the supervisor and the LSO. The employee must inform the Laser Supervisor of any apparent safety problems associated with the use of the laser.
3) If an employee knows or suspects that an accident has occurred involving a laser, the employee shall immediately inform the Principal Investigator, Laser Supervisor, U.K. Laser Safety Officer or the U.K. Radiation Safety Officer.

The University of Kentucky Laser Safety Officer (L.S.O.) and the **Radiation Safety Officer** (R.S.O.) have jurisdiction over all aspects of hazard prevention and control of laser radiation and have the authority to suspend, restrict, or terminate any operation that constitutes a radiation health hazard to the equipment operators, University personnel, or the general public.

Procedures

Registration:

- **Laser Registration Form (see Appendix B).** All class 3B and class 4 lasers must be registered with the Radiation Safety Office prior to installation and use. This form is also available from the Radiation Safety Office or on the web site;

  http://www.uky.edu/FiscalAffairs/Environmental/radiation.

- All class 3B and class 4 laser operators must be registered with the Radiation Safety Office prior to working with class 3B and class 4 lasers.

Training:

- Each person using a class 3B or class 4 laser must complete the "**Laser Personnel Training Information Sheet" (Appendix C)**, available from the Radiation Safety Office, or the web site above.
- Exemptions from the laser training program may be granted by the Radiation Safety Officer after reviewing the "Laser Personnel Training Information Sheet" to verify that appropriate training has been completed.

Inspections:

- All newly registered class 3B and class 4 lasers and facilities must be inspected by staff of the Radiation Safety Office prior to operation.
- All investigators must allow inspections of lasers and laser facilities upon request of the L.S.O. or R.S.O.
- All investigators shall notify the Radiation Safety Office prior to any change in the laser or facility arrangement that affects the safety of personnel or property.
- An inspection may be requested by any person in the laboratory who feels one is warranted.

Medical Surveillance:

- All individuals working with class 3B and class 4 lasers should have a baseline eye exam prior to the use or operation of a registered laser. Contact the Radiation Safety Office for further information.

CONTROL MEASURES

Enclosure of the laser equipment or beam path is the preferred method of control.

The minimum laser radiation required for the application should be used.

Lasers should be operated in well lighted areas whenever possible to reduce pupil size and minimize possible eye damage.

Jewelry or any materials capable of specular reflection should be avoided or removed from the laser operating area.

The laser beam must never be intentionally stared into or directed into the eyes.

If a laser operator suspects that a safety hazard may exist, the operator should request the Radiation Safety Office to conduct an immediate laser safety survey.

General Requirements

Class 1 lasers require the following controls:

- Protective housing must be provided for all lasers.
- Viewing portals, screens and collecting optics must incorporate a means to maintain laser radiation emitted through them at or below safe levels. The laser supervisor or principal investigator is responsible for determining the hazard involved and is responsible for taking the proper safety measures

Class 2 and Class 2M lasers require the following additional controls:

- A Class 2 laser must be posted with signal word “Caution” and shall read "Laser Radiation - Do Not Stare Into The Beam".
- A Class 2M laser must be posted with signal word “Caution” and shall read "Laser Radiation - Do Not Stare Into The Beam or View Directly with Optical Instruments”.

Class 3R lasers require the following additional controls:

- A Class 3R laser must be posted with signal word “Danger” and shall read "Laser Radiation – Avoid Direct Eye Exposure".
- An advisory label must be affixed to the protective housing and shall read "Laser Radiation – Avoid Direct Eye Exposure"..

Class 3b and Class 4 lasers require the following additional controls:

- The protective housing must be interlocked to prevent exposure of personnel to unnecessary laser radiation. Interlocks must be checked during routine inspections to ensure they are functioning properly. The interlock must not be overridden during normal operation.

- If the interlocks must be bypassed during maintenance, a temporary Laser Control Area must be established (see below).
- Protective housings and service panels which can be removed for maintenance must be interlocked, or require a tool for removal and have labels indicating defeatable interlocks.
- A Class 3B laser must be posted with signal word “Danger” and shall read "Laser Radiation – Avoid Direct Exposure to Beam".
- A Class 4 laser must be posted with signal word “Danger” and shall read "Laser Radiation – Avoid Eye or Skin Exposure to Direct or Scattered Radiation".
- A master switch (either a key or coded access) must be provided that, when removed, makes the laser inoperable. Authority for access to the master switch must be with the principal investigator and/or the laboratory laser supervisor.
- Beam paths must be oriented so that fully open and partially enclosed beams are operated only in specific laser controlled areas established by the principal investigator and the laboratory laser supervisor in conjunction with the Radiation Safety Office.
- A Class 4 laser must be provided with a permanently attached beam stop or attenuator.
- Written operating, alignment, safety, and emergency procedures must be maintained for Class 4 lasers These SOP’s, and any changes must be forwarded to the Radiation Safety Office upon request.

A laser controlled area for Class 3b and Class 4 lasers must meet the following criteria:

- A Laser Control Area must be under the direct supervision of the laboratory laser supervisor.
- The Laser Control Area must be posted with appropriate warning signs.
- The beam path must be controlled and well defined.
- Hazardous beams must terminate in an appropriate beam stop.
- Except as required for medical use, the laser beam path should be configured such that the exposed beam is above or below eye level of a person in standing or seated position. Example: The beam path remains above 6.5 feet or below 3.5 feet off the floor.
- Only diffusely reflecting materials may be near the beam path.
- Effective eye protection must be available and worn by all individuals who have access to the laser radiation.
- All openings (windows, doors) from the Laser Control Area must be covered or restricted to prevent unnecessary exposure to laser radiation.
- There must be a visual or audible indicator that is activated prior to emission of the beam.
- Entryway safety controls must be designed to allow rapid egress and admittance under emergency conditions.

Additional Requirements

The Radiation Safety Officer or Laser Safety Officer may apply additional safety requirements as deemed necessary by the Radiation Safety Office to protect the health of the operators, University personnel, or the general public.

REFERENCES

American National Standards Institute, Inc., American National Standard for the Safe Use of Lasers, ANSI Z136.l-2007.

Appendix A

LASER LIGHT ENTERTAINMENT

PURPOSE

The Radiation Safety Office has developed these procedures to ensure safety of University of Kentucky faculty, staff, students and the general public during performances by companies providing laser light entertainment.

INSPECTIONS

Inspections will be conducted at all performances which use class 3b or class 4 lasers at the University of Kentucky Campus whenever the U.K. Laser Safety Officer or U.K. Radiation Safety Officer deems necessary.

RESPONSIBILITIES

The U.K. staff member in charge of hosting the laser light performance must:

- Notify the Radiation Safety Office when a laser company is scheduled to provide entertainment on U.K. property.
- Notify the laser company of the U.K. Radiation Safety Office's requirements for notification.
- Provide access to the laser light performance location to representatives of the U.K. Radiation Safety Office prior to and during laser performances.

The laser company and/or laser operator must:

- Provide the information outlined in the required information sheet.
- Meet with the Laser Safety Officer prior to the show to discuss laser details.

The laser operator must provide information to the U.K. Radiation Safety Office prior to the day of the show regarding:

Operator training.
Emission levels of beams.
Type of communication between operator and surveillance personnel.
Name of contact person between the laser company and performers.
Emergency procedures.
Safety procedures.
Briefing of security personnel of hazards associated with lasers.
Detailed description of each effect.
Distance of separation of beams from audience.
Time that the alignment procedure will be performed.

- Demonstrate the effects during alignment at full power with the lights off.
- Perform alignment check between acts (when possible) if more than one act is performing.
- Terminate any effect which the representative of the U.K. Radiation Safety Office feels unsafe.
- Meet with the representative of the U.K. Radiation Safety Office after the show to discuss findings.

The U.K. Radiation Safety Office will:

- Set up an interview with the operator to discuss show details.
- Observe alignment procedures and make recommendations.
- Notify the operator during the show of any unsafe conditions and require the termination of all effects if necessary.
- After the show, discuss with the operator any problems encountered.

Appendix B

UNIVERSITY OF KENTUCKY
RADIATION SAFETY OFFICE
LASER REGISTRATION FORM

INSTRUCTIONS: Complete the form, and send to the Radiation Safety Office, 102 Dimock Animal Pathology Bldg. 0076

Principle Investigator: _____ Phone # _____

Laser Supervisor:_____ Phone #_____

Other Users: _____ _____Phone # _____

Other Users: _____ Phone # _____

Other Users: _____ Phone # _____

Other Users: _____ Phone # _____

Department: _____ Address: _____

Type of Laser: _____ Manufacturer _____

Power: _____ Class: _____Wavelength:_____

Location of Laser: _____

Use: _____

Current Status: _____

P.I. Signature: _____ Date: _____

For Radiation Safety Office Use:

Comments: _____
_____
_____

Appendix C

UNIVERSITY OF KENTUCKY
RADIATION SAFETY OFFICE
LASER SAFETY
PERSONNEL TRAINING INFORMATION

INSTRUCTIONS: Complete and forward all information requested to the Radiation Safety Office, Attention: David Rich, L.S.O., 102 Dimock Animal Pathology Bldg. 0076

Name: _____

Department: _____ Work Phone #_____

Building/Room # _____

Principle Investigator _____

Laser Superviser:_____

List all laser or laser safety training course work you have completed. Note all the titles, dates completed, duration (hours of course) and location.

_____

_____

_____

_____

_____

_____

_____

_____

SIGNATURE: _____
(laser operator/user)

SIGNATURE: _____
(Principal Investigator or Laser Supervisor)