



ASRC Laser Safety Plan

TABLE OF CONTENTS

PURPOSE	2
APPLICABILITY/SCOPE	2
RESPONSIBILITIES	2
DEFINITIONS	3
PROCEDURES	4
EMERGENCY CONTACTS	6
RECORD KEEPING	6
LIST OF APPENDICES	6
REFERENCES	6
APPENDICES	7
A. DEFINITIONS	7
B. CLASSES OF LASERS	10
C. OUTLINE FOR SOPs	11
D. LAB SAFETY CONTROL MEASURES	12
E. LASER SAFETY INSPECTION FORM	15
F. LASER REGISTRATION FORM	16

A. Purpose

The purpose of this plan is to establish safe procedures for working with Class 3B and Class 4 lasers used in research, including procurement, registration, inventory, description of beam and non-beam hazards, selection of personal protection equipment (PPE) and other control measures. This policy requires that lasers and laser systems be operated in accordance with the American National Standards Institute (ANSI) Z136.1 2014, "The Safe Use of Lasers," and other applicable federal and state regulations.

B. Applicability/Scope

This plan applies to City University of New York (CUNY) Advanced Science Research Center (ASRC) personnel working with Class 3B and Class 4 lasers. This policy does not include Class 1, 1M, 2, 2M, and 3R lasers or systems with embedded lasers of a higher power where only a Class 1 beam is emitted.

C. Responsibilities

1. Principal Investigator

- a. Enforce the safe work practices outlined in the Laser Safety Program.
- b. Prepare Standard Operating Procedures (SOPs) for Class 3B and/or Class 4 lasers (See Appendix C for recommended SOP outline). The SOP will enable a total hazard evaluation in accordance with the manufacturer's recommendations so that all safety measures are considered.
- c. Maintain and update, as needed, all operating, alignment and emergency procedures for the lasers and facility.
- d. Ensure registration of all Class 3B and 4 lasers (see Appendix F).
- e. Ensure personnel using lasers have attended Laser Safety Training prior to operating a laser.
- f. Perform and document work area specific training for all laser users prior to initial operation.
- g. Comply with Maximum Permissible Exposure (MPE) values for exposure as specified in SOP, in accordance with ANSI Standard Z136.1.
- h. Ensure that required PPE is available and is used by all employees and visitors to the lab during laser operation.
- i. Restrict access to laser facility to only those individuals with authorization to work in (as well as authorized spectators and visitors to) the laser facility to ensure against accidental exposure to laser radiation.
- j. Act as or designate a knowledgeable person to:
 - i. Notify Environmental Health and Safety (EH&S) of any changes in operational status, such as location changes, new purchases, and/or modifications to any laser equipment that may change the classification.
 - ii. Change SOPs in accord with modifications made in the laser.
 - iii. Update all records to reflect changes in personnel or equipment.

- iv. Re-register the laser with the EH&S Officer indicating these changes.
- k. Ensure that all users have reviewed manufacturer's instructions for safe operation prior to use of the equipment.
- l. Report all incidents involving safety violations or injuries to the EH&S Officer.

2. Employee/User

- a. Wear all necessary PPE designated by the PI.
- b. Inspect eyewear prior to use to ensure that it is in good condition.
- c. Comply with all rules and requirements specified in this policy as well as any work area specific laser safe operating procedures (SOPs).
- d. Report laser hazards, including potential exposures to the beam, to the PI and EH&S Officer. Some exposure events also require the employee to have medical evaluation. These events include, but are not limited to:
 - i. Laser exposure to the eye or skin that are greater than the Maximum Permissible Exposure (MPE) for the actual exposure duration.
 - ii. Exposure that cause a burning sensation or a change in the condition of the skin, a visual after image, blurring or obstruction of vision, headaches or other pain.
 - iii. Any injury caused by laser support equipment, such as electric shock or exposure to a dye solution.
- e. "The employee must use good sense in avoiding actions that place themselves or coworkers at risk of laser related injuries. If at any time a user is unsure of the correct procedure to follow, the user should STOP and seek the advice of the laser owner/operator."

3. Laser Safety Officer

- a. Conduct inspections of laser areas and recommend any corrective actions needed in accordance with ANSI Z136.1 and applicable state and federal regulations.
- b. Provide assistance with proper selection of PPE.
- c. Assist PIs or their designated staff with writing SOPs and ensure proper safety assessment is performed.
- d. Respond to inquiries on laser safety procedures and provide technical assistance

4. Environmental Health & Safety

- a. Oversee the Laser Safety Program.
- b. Review and update this plan as necessary to ensure compliance with applicable regulations and change in technology.
- c. Develop a general laser safety training program for laser users.
- d. Maintain records of laser inventories, inspections, and training attendance.

D. Definitions

See Appendix A

E. Procedures

1. Inventory, Transfer and Disposal

a. Inventory

The PI shall complete the Laser Registration Form (LRF) (See Appendix E) for existing lasers as well as lasers transferred to the ASRC that are to be included in the laser inventory. If a Class 3B or Class 4 laser is fabricated in the lab, the PI shall send an updated LRF describing the changes made. PIs shall also keep a copy of the LRF in their lab. EH&S maintains an inventory of the lasers used in the ASRC.

b. Transfer

The PI shall report to EH&S any lasers that are transferred to another laboratory at the ASRC to update the EH&S database.

Note: *The transfer of a Class 3B or Class 4 laser on campus to a person who does not have appropriate training, who does not understand the hazards of the laser, and/or who does not have the proper PPE, could result in serious injury. Consult EH&S for information on laser hazards, proper safeguards and the necessary training.*

c. Disposal

Before disposing of lasers off-campus, the PI shall consult with EHS to ensure that lasers will be disposed in accordance with applicable regulations.

2. Written Safe Operating Procedures (SOP) (See Appendix C)

The PI should prepare a written Standard Operating Procedures (SOP), including Service and Maintenance Procedure for each Class 3B and Class 4 laser present in their laboratory. Written alignment procedures are to be posted in the area or kept near the equipment. Lasers will be equipped with mandated labels provided by the manufacturer. General exposure guidelines, special precautions, or unusual conditions should be outlined in SOP. The Manufacturer's Manual should also be available to users.

3. Laser Classification, Warning Signs and Labels (see Appendix B)

Laser classification is determined by a formula that takes into account wavelength, power, and accessible emission limits, whether the laser is pulsed or continuous, among other factors. For manufactured (i.e., - not made in a lab) lasers, the manufacturer is responsible for providing the classification of the laser at the time it was purchased. The PI is responsible for the classification of lasers prepared or modified in their lab. Laser warning labels must be affixed on the instrument, close to the source of the laser light. In addition to information about

laser parameters, labels should contain safety information.

4. Posting of Warning Signs (see Appendix B)

Entrances to laser areas must be posted in accordance with ANSI Standards.

The areas must be secured against persons accidentally being exposed to beams, and be posted with a proper warning sign such as an illuminated warning sign outside of the area. Preferably the light should be flashing and lit only when the laser is on. (When a Class 3B or 4 laser is left on and personnel want to leave the room, the door should be locked.) All windows, doorways, and portals should be covered or restricted to reduce transmitted laser beam below the Maximum Permissible Exposure (MPE). The PI is responsible for posting signs and informing laboratory personnel.

For Class 4 lasers that have open beam lines, the ANSI Standards require interlocked doors (or sensors or pressure sensitive doormats), or devices that turn-off or attenuate the laser beam in the event of unexpected entry into the area. However, under special conditions where an interlocked door could interfere with the proposed research activity, and alternate method of protection, such as a curtain or a barrier, should be discussed with EH&S to provide a suitable barrier just inside the door or where ever most appropriate to intercept a beam or scatter it so that a person entering the room will not be exposed above the MPE limits.

5. Laser Safety Training

Before working with lasers, all laser operators must receive laser safety training as required by EH&S and LSO. The PI is responsible for ensuring the training of his/her staff before they are allowed to operate a laser. The training shall include basic instruction on:

- a. The biological effects of laser radiation
- b. Physical principles of lasers
- c. Classification of lasers
- d. Control of laser areas
- e. Medical examination options
- f. Basic safety rules
- g. Use of personal protective equipment (PPE)
- h. Control of non-beam hazards including electrical safety, fire safety, and chemical safety (handling and storage)
- i. Emergency response procedures
- j. On-the-job training for Class 3B and Class 4 laser users shall include a thorough review, by the PI or a designated senior or knowledgeable individual, of the hazards associated with each laser that a person may operate, the protection methods employed by the laboratory, and the emergency contacts.

6. Medical Surveillance

Individuals who may be exposed to Class 3b or Class 4 radiation should contact EH&S for scheduling of ophthalmologic exams. Eye exams must be performed after a suspected eye injury (see next Section Laser Accidents).

7. Laser Accidents

a. Response/ Reporting Procedures

- i. All accidents/exposures are to be reported to supervisor and LSO as soon as possible.
- ii. For health-threatening injuries/ illnesses, call CCNY Public Safety at 212-650-7777 to request medical attention
- iii. Supervisor or LSO is to also notify EH&S and report nature of injury or illness.

8. Hazardous Waste Disposal

Certain types of research activities with lasers use organic solvents and toxic dyes. All waste mixtures must be collected and disposed of as hazardous waste through EH&S. Collect waste solvent/dyes in compatible containers (usually polypropylene) and label with a hazardous waste label as soon as the first material is added to the container. Do not attempt to evaporate waste in a fume hood to reduce the volume, or to drain-dispose of the waste.

F. Emergency Contacts

PI must ensure that lab personnel have access to reach him/her during an emergency. Such information should be conveyed to all lab personnel.

G. Recordkeeping

A copy of laser training records shall be forwarded to and maintained by EH&S Officer

Also, a record of hands-on/orientation shall be kept by the PI or Lab Manager.

H. Appendices

1. Appendix A: Definitions
2. Appendix B: Classes of Lasers
3. Appendix C: An Outline for Standard Operating Procedures (SOPs)
4. Appendix D: Laser Safety Control Measures
5. Appendix E: Laser Safety Inspection Form
6. Appendix F: Laser Registration Form

I. References

1. American National Standard for Safe Use of Lasers, ANSI Z136.1-2007, The

Laser Institute of America, 2007

2. OSHA Guidelines for Laser Safety and Hazard Assessment. STD 01-05-001 [Pub. 8-1.7] (1991, August 5)
3. New York State Department of Labor. Part 50. Effective March 2, 1994.

Appendix A Definitions

1. **Absorption:** transformation of radiant energy to a different form of energy by interaction with matter.
2. **Accessible emission limit (AEL):** the maximum accessible emission level permitted within a particular class.
3. **Attenuation:** the decrease in the radiant flux as it passes through an absorbing or scattering medium.
4. **Average power:** the total energy imparted during exposure divided by the exposure duration.
5. **Aversion response:** movement of the eyelid or the head to avoid an exposure to a noxious stimulant or bright light. It can occur within 0.25 seconds and can also be called the blink reflex time.
6. **Beam:** a collection of rays, which may be parallel, divergent, or convergent.
7. **Beam diameter:** the distance between diametrically opposed points in that cross-section of a beam where the power per unit area is $1/e$ (0.368) times that of the peak power per unit area.
8. **Beam divergence:** The full angle of laser beam, usually measured at the half power points in radians or milliradians.
9. **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 function.
10. **Continuous wave (C.W. laser):** the output of a laser, which is operated in a continuous rather than a pulsed mode. In this program, a laser operating with a continuous output for a period of 0.25 sec is regarded as a CW laser.
11. **Controlled area:** an area where the presence and activity of those within it is subject to control and supervision for the purpose of protection from laser radiation hazards.
12. **Cornea:** the transparent outer coat of the human eye, which covers the iris and the crystalline lens. The cornea is the main refracting element of the eye.
13. **Designated Individual:** An individual selected and directed by a laser safety officer to supervise the operation of a laser
14. **Diffuse reflection:** change of the spatial distribution of a beam of radiation when it is reflected in many directions by a surface or by a medium.
15. **Divergence:** the increase in the diameter of the laser beam with distance from the exit aperture. The value gives the full angle at the point where the laser energy or irradiance is $1/e$ (36.8%) of the maximum value. For the purposes of this program, divergence is taken as the full angle, expressed in radians of the beam diameter measured between those points which include laser energy or irradiance equal to $1/e$ of the maximum value of the angular extend of a beam

which contains all the radius vectors of the polar curve of radiant intensity that have length rated at 36.8% of the maximum. Sometimes this is also referred to as beam spread.

16. **Diffraction:** deviation of part of a beam determined by the wave nature of radiation and occurring when the radiation passes the edge of an opaque obstacle.
17. **Duty factor:** the product of the pulse duration and the pulse repetition rate.
18. **Electromagnetic radiation:** the flow of energy consisting of orthogonally vibrating electric and magnetic fields lying transverse to the direction of propagation. X-ray, ultraviolet, visible, infrared, and radio waves occupy various portions of the electromagnetic spectrum and differ only in frequency and wavelength.
19. **Embedded laser:** an enclosed laser with an assigned class number higher than the inherent capability of the laser system in which it is incorporated, where the system's lower classification is appropriate due to the engineering features limiting accessible emission.
20. **Enclosed laser:** a laser that is contained within a protective housing of itself or of the laser system in which it is incorporated. Opening or removal of the protective housing provides additional access to laser radiation above the applicable MPE than possible with the protective housing in place.
21. **Hertz (Hz):** the unit, which expresses the frequency of a periodic oscillation in cycles per second.
22. **Infrared radiation:** invisible, electromagnetic radiation beyond red light on the spectrum, with wavelengths greater than 0.7 microns.
23. **Irradiance (E) at a point of a surface:** quotient of the radiant flux incident on an element of surface containing the point at which the area of that element measures irradiance. Units are watt per square centimeter (W-cm⁻²).
24. **Joule (J):** a unit of energy. 1 joule = 1 watt-second = 10⁷ erg.
25. **Laser:** a device which produces an intense, coherent, directional beam of light by stimulating electronic or molecular transitions to lower energy levels. Laser: An acronym for Light Amplification Stimulated by Emission of Radiation.
26. **Laser Safety Officer:** An individual, designated at a particular laser installation or for a particular mobile laser, who is qualified by training and experience in the safe operation of lasers to evaluate the radiation hazards of such laser installation or mobile laser and who is qualified to establish and administer a laser radiation protection program for such laser installation or mobile laser.
27. **Limiting aperture:** the maximum diameter of a circle over which irradiance and radiant exposure can be averaged.
28. **Maximum permissible exposure (MPE):** the level of laser radiation to which a person may be exposed without hazardous effect or adverse biological changes in the eye or skin.
29. **Nominal hazard zone (NHZ):** the space within which the level of direct, reflected, or scattered radiation during normal operation exceeds the applicable MPE. Exposure levels beyond the boundary of the NHZ are below the appropriate MPE level.
30. **Nominal ocular hazard distance (NOHD):** the distance along the axis of the

unobstructed beam from a laser, fiber end, or connector to the human eye beyond which the irradiance or radiant exposure, during normal operation or service, is not expected to exceed the appropriate MPE.

31. **Protective housing:** an enclosure that surrounds the laser or laser system that prevents access to laser radiation above the applicable MPE level. The aperture through which the useful beam is emitted is not part of the protective housing. The protective housing may enclose associated optics and a work station and shall limit access to other associated radiant energy emissions and to electrical hazards associated with components and terminals.
32. **Pulse duration:** the duration of a laser pulse, usually measured as the time interval between the half- power points on the leading and trailing edges of the pulse.
33. **Pupil:** the variable aperture in the iris through which light travels to the interior of the eye.
34. **Q-switch:** a device that produces very short (~30 ns) intense laser pulses by means of enhancing the storage and dumping of electronic energy in and out of the lasing medium.
35. **Radian (rad):** a unit of angular measure equal to the angle subtended at the center of a circle by an arc whose length is equal to the radius of the circle. 1 radian = 57.3 degrees; 2 radians = 360 degrees.
36. **Radiance (L):** radiant flux or power output per unit solid angle per unit area. Unit: Watts per centimeter squared per Steradian (W-cm-2-sr-1).
37. **Radiant energy (Q):** energy emitted, transferred or received in the form of radiation. Unit: joule (J).
38. **Radiant exposure (H):** surface density of the radiant energy received. Unit: joules per centimeter squared (J-cm-2).
39. **Radiant flux (W):** power emitted, transferred or received in the form of radiation. Unit: watt (W). Also called radiant power.
40. **Specular reflection:** a mirror-like reflection of a laser beam.
41. **Standard Operating Procedure (SOP):** formal written description of the safety- and administrative procedures to be followed in performing a specific task (e.g. beam alignment). Development of laser SOPs is the responsibility of the Principal Investigator (PI).
42. **Transmission:** passage of radiation through a medium.
43. **Transmittance:** the ratio of transmitted power to incident power.
44. **Ultraviolet radiation:** an electromagnetic radiation having the wavelengths below 400 nm.
45. **Uncontrolled area:** an area where the occupancy and activity of those within is not subject to control and supervision for the purpose of protection from laser radiation hazards.
46. **Visible radiation (visible light):** light in wavelengths that can be seen by the human eye, 0.4 to 0.7 microns.

Appendix B CLASSES OF LASERS

The American National Standards Institute (ANSI) has established a laser hazard classification system in publication ANSI Z136.1-2014, Safe Use of Lasers. Certified laser manufactures are required to label their products as to the Class type as of September 19, 1985 (21 CFR Part 1040). Information regarding appropriate eyewear for a specific laser may be obtained from the manufacturer at time of purchase. The following table summarizes this laser classification scheme and the hazard capabilities associated with each class of laser.

Class of Laser	Hazards
1	Eye safe lasers; may not produce hazardous radiation
1M	Continuous intrabeam viewing can cause eye damage; momentary intrabeam exposure (< 0.25 sec) is not damaging to the eye; visible radiation only
2	Continuous intrabeam viewing can cause eye damage when viewed with an optical aid; the accessible radiation shall not exceed Class 1 accessible emission limit (AEL) for an exposure duration of 1000 seconds
2M	Continuous intrabeam viewing can cause eye damage when viewed with an optical aid; the accessible radiation shall not exceed Class 1 accessible emission limit (AEL) for an exposure duration of 1000 seconds
3R	Invisible lasers having an output power < 5x the Class 1 AEL or visible laser having an output power < 5 mW; capable of causing damage through intrabeam viewing, with optical instruments or through viewing a specular reflection for < 0.25 sec
3B	Invisible lasers having output power <500 mW; as with 3R lasers, 3B lasers can cause injury through intrabeam viewing, viewing with optical instruments, or through viewing a specular reflection
4	Beam power > 500 mW; intrabeam exposure, exposure to specular- and diffuse reflections capable of causing eye- and skin damage; fire hazard due to their power density

Appendix C
Outline for Standard Operating Procedures (SOPs)

- A. Purpose:
- B. Applicability: state the name of lab for which these SOP is being developed and the type of employees/users covered by this SOP.
- C. Procedures:
 - i. **Registration** - PI will complete laser registration form and send it to LSO and EH&S.
 - ii. **Information** – Location of operating manual and other instructions and notification of employees, including collection and location of Safety Data Sheets (SDSs) how employees will be notified.
 - iii. **Emergency Contacts** - Who to contact -Supervisor- give telephone Home and Cell #; CCNY Public Safety phone numbers, what to do, what information to provide when calling, etc.
 - iv. **Equipment Tagging** - How to ensure that the equipment reported NOT working is properly tagged, method to notify other users of its unavailability, responsibility assigned for its repair, and notice to others after the equipment is operational.
 - v. **Repairs** - Who will coordinate any repairs with the vendor, who will ensure they are done, paper work is maintained and users are notified that it is working, etc.
 - vi. **Routine Maintenance** - How often, who will do it and who in the lab will coordinate them, who and where the paper work will be kept, etc.
 - vii. **Training** - who will ensure that all employees are trained before they use lasers
 - viii. **Supplies** – What supplies are needed for routine operations and where they are located and who will check to ensure stocking and continuous availability?
 - ix. **Accident** - what to do in case of an accident, who should be contacted, and where to go for medical assistance/evaluation, what to carry with you when going to medical facility, who should accompany the victim, who will complete the accident report form, etc.
 - x. **Visitors** - what PPE visitors must have on before entering the lab.
 - xi. **Signs** - what signs need to be placed on the front door, on the instrument, etc. who will ensure their placements and replacement when needed.
 - xii. **Inspections** - who will do semi-annual survey of the lasers and interlock systems using inspection form, where the forms will be maintained, who will ensure that deficiencies discovered during survey are corrected in a timely manner, etc.

Appendix D
LASER SAFETY CONTROL MEASURES

A. Class 1 Controls

1. No specific user safety rules are necessary but general precautions should be observed.
2. All Class 1 lasers must be labeled

B. Class 1M Controls

1. To prevent injury, the beam should not be viewed with a magnification device.
2. All Class 1M lasers must be labeled

C. Class 2 and 2M Controls

1. All Class 2 and 2M lasers must be labeled
2. The laser beam should not be purposefully directed toward the eye of any person. Alignment of the laser optical systems (mirrors, lenses, beam deflectors, etc.) should be performed in such a manner that the primary beam, or specular reflection of the primary beam, does not expose the eye to a level above the MPE for direct irradiation of the eye.
3. The work area should be posted with a warning label or sign cautioning users to avoid staring into the beam or directing the beam toward the eye of individuals.
4. If the MPE is exceeded, design viewing portals and/or display screens to reduce exposure to acceptable levels.
5. If the Class 2 laser has an enclosed Class 3b or 4 laser, interlocks should be provided on any removable parts of the housing, or the laser should have a service access panel that is either interlocked or requires a tool for removal. If the protective housing is removed, control measures appropriate for the enclosed laser class should be followed.

D. Class 3R Controls

1. Class 3a lasers must be labeled accordingly.
2. The work area should be posted with a warning label or sign cautioning users to avoid staring into the beam or directing the beam toward the eye of individuals.
3. Removable parts of the housing and service access panels should have interlocks to prevent accidental exposure.
4. A permanent beam stop or attenuator may also be used.
5. If the MPE is exceeded, design viewing portals and/or display screens to reduce exposure to acceptable levels.
6. Alignment procedures should be designed to ensure the MPE is not exceeded.

E. Class 3B Controls

1. Class 3b lasers and laser systems must be labeled accordingly.
2. These lasers are used in areas where entry by unauthorized individuals can be controlled.
3. If an individual who has not been trained in laser safety must enter the area, the laser operator or supervisor should first instruct the individual as to safety requirements and must provide protective eyewear, if required.
4. If the entire beam is not enclosed or if a limited open beam exists, the laser

operator, supervisor or laser safety officer should determine a Nominal Hazard Zone (NHZ).

5. An alarm, warning light or verbal countdown should be used during use or startup of the laser.
6. The controlled area should
 - i. Have limited access to spectators,
 - ii. Have beam stops to terminate potentially dangerous laser beams,
 - iii. Be designed to reduce diffuse and specular reflections,
 - iv. Have eye protection for all personnel,
 - v. Not have a laser beam at eye level,
 - vi. Have restrictions on windows and doorways to reduce exposure to levels below the MPE, and
 - vii. Require storage or disabling of the laser when it is not being used.
7. If the MPE is exceeded, design viewing portals and/or display screens to reduce exposure to acceptable levels.
8. Alignment procedures and collecting optics should be designed to ensure the MPE is not exceeded.
9. Only authorized, trained individuals should service the laser.
10. Approved, written standard operating, maintenance and service procedures should be developed and followed.

F. Class 4 Controls

1. In addition to the control measures described for Class 3b, Class 4 lasers should be operated by trained individuals in areas dedicated to their use.
2. Failsafe interlocks should be used to prevent unexpected entry into the controlled area, and access should be limited by the laser operator to persons who have been instructed as to the safety procedures and who are wearing proper laser protection eyewear when the laser is capable of emission.
3. Laser operators are responsible for providing information and safety protection to untrained personnel who may enter the laser controlled areas as visitors.
4. The laser area should be
 - i. Restricted to authorized personnel only designed to allow for rapid emergency egress
 - ii. Equipped with a device that allows for deactivation of the laser or reduction of the output to below the MPE
 - iii. Designed to fulfill Class 3b controlled area requirements
 - iv. Designed with entry safe controls
 - v. Designed such that the laser may be monitored and fired from a remote location
 - vi. For pulsed systems: have interlocks designed to prevent firing of the laser by dumping the stored energy into a dummy load
 - vii. For continuous wave systems: have interlocks designed to turn off the power supply or interrupt the beam by means of shutters.
5. The beam path must be free of specularly reflective surfaces and combustible objects and the beam terminated in a non-combustible, non-reflective barrier or beam stop.

G. General Safety Procedures

1. Do not work with or near a laser unless you have been authorized to do so.
2. Do not enter a room or area where a laser is being energized unless authorized to do so.
3. Before energizing a laser, verify that prescribed safety devices for the unit are being properly employed. These may include opaque shielding, non-reflecting and/or fire resistant surfaces, goggles and/or face shields, door interlocks, and ventilation for toxic material.
4. Make sure that a pulsed laser unit cannot be energized inadvertently. Discharge capacitors and turn off power before leaving the laser unit unattended.
5. Do not stare directly into the laser beam. Use appropriate eyewear during beam alignment and laser operation. Beam alignment procedures should be performed at lowest practical power levels.
6. Control access to the laser facility. This can be done by clearly designating those who have access to the laser room. Implement access control by locking the door and installing warning lights and signs on the outside of the door.
7. Never leave the laser unattended when it is in operation.
8. Remove any jewelry to avoid inadvertent reflections.

Appendix E: Laser Safety Inspection Form

Laser Safety Inspection Form

Building _____ Room _____ Date _____

PI _____ Performed by _____

GENERAL	COMMENTS
<input type="radio"/> Y <input type="radio"/> N <input type="radio"/> N/A 1. Lasers are classified appropriately	1 1M 2 2M 3 3R 4
<input type="radio"/> Y <input type="radio"/> N <input type="radio"/> N/A 2. Beam attenuator present	
<input type="radio"/> Y <input type="radio"/> N <input type="radio"/> N/A 3. Beam is enclosed as much as possible	
<input type="radio"/> Y <input type="radio"/> N <input type="radio"/> N/A 4. Beam is not directed toward doors or windows	
<input type="radio"/> Y <input type="radio"/> N <input type="radio"/> N/A 5. Beams are terminated with fire-resistant blocks or curtains	
<input type="radio"/> Y <input type="radio"/> N <input type="radio"/> N/A 6. Surfaces minimize reflections (specular and Diffuse)	
<input type="radio"/> Y <input type="radio"/> N <input type="radio"/> N/A 7. Laser may be fired remotely	
<input type="radio"/> Y <input type="radio"/> N <input type="radio"/> N/A 8. Lasers are included in the inventory	
SAFETY PRECAUTIONS	
<input type="radio"/> Y <input type="radio"/> N <input type="radio"/> N/A 9. Standard operating procedures are available	
<input type="radio"/> Y <input type="radio"/> N <input type="radio"/> N/A 10. Laser users have attended appropriate training (EHS/ Site Specific)	
<input type="radio"/> Y <input type="radio"/> N <input type="radio"/> N/A 11. Open laser is below or above eye level of a person sitting or standing	
<input type="radio"/> Y <input type="radio"/> N <input type="radio"/> N/A 12. EYE protection is appropriate for wavelengths and is labeled appropriately	
<input type="radio"/> Y <input type="radio"/> N <input type="radio"/> N/A 13. Warning or indicator lights can be seen through protective filters and lens	
<input type="radio"/> Y <input type="radio"/> N <input type="radio"/> N/A 14. Viewing cards or like are used for alignment with proper PPE and power Levels	
<input type="radio"/> Y <input type="radio"/> N <input type="radio"/> N/A 15. Controls are located so that the operator is not exposed to beam hazards	
<input type="radio"/> Y <input type="radio"/> N <input type="radio"/> N/A 16. Operators do not wear watches or reflective jewelry while laser is operating	
<input type="radio"/> Y <input type="radio"/> N <input type="radio"/> N/A 17. Viewing portals are present where the MPE is exceeded	
<input type="radio"/> Y <input type="radio"/> N <input type="radio"/> N/A 18. Protective housing is present and in good condition	
<input type="radio"/> Y <input type="radio"/> N <input type="radio"/> N/A 19. Interlocks on protective housing are present and undefeated	
<input type="radio"/> Y <input type="radio"/> N <input type="radio"/> N/A 20. Service access panel present	
<input type="radio"/> Y <input type="radio"/> N <input type="radio"/> N/A 21. Fire extinguisher present with a current tag	
LABELING	
<input type="radio"/> Y <input type="radio"/> N <input type="radio"/> N/A 22. Certification Label present	
<input type="radio"/> Y <input type="radio"/> N <input type="radio"/> N/A 23. Class designation and appropriate warning label present	
<input type="radio"/> Y <input type="radio"/> N <input type="radio"/> N/A 24. Radiation output information is on label	
<input type="radio"/> Y <input type="radio"/> N <input type="radio"/> N/A 25. Aperture label present	
<input type="radio"/> Y <input type="radio"/> N <input type="radio"/> N/A 26. Appropriate sign at entrance to laser area	
<input type="radio"/> Y <input type="radio"/> N <input type="radio"/> N/A 27. Warning posted for invisible radiation	
LOCATION	
<input type="radio"/> Y <input type="radio"/> N <input type="radio"/> N/A 28. Area restricted to authorized personnel	
<input type="radio"/> Y <input type="radio"/> N <input type="radio"/> N/A 29. Limited access to spectators	
<input type="radio"/> Y <input type="radio"/> N <input type="radio"/> N/A 30. Failsafe interlocks or equivalent at entry to controlled area	
<input type="radio"/> Y <input type="radio"/> N <input type="radio"/> N/A 31. Nominal hazard zone determined	

Appendix F Laser Registration Form

