ARKANSAS STATE UNIVERSITY
GOVERNING PRINCIPLES AND PROCEDURES FOR LASER SAFETY

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1.0 INTRODUCTION

Arkansas State University (ASU) is committed to the safety and well-being of its employees, students, and affiliated workers and to complying with all national standards in the use of lasers in its research and educational programs.

2.0 PURPOSE

The purpose of this manual is to ensure the safe use of lasers at ASU by identifying hazards, providing medical surveillance, and providing laser safety training for individuals using lasers.

3.0 DEFINITIONS

ANSI. American National Standards Institute

Class 1 Laser. Low-power lasers and laser systems that cannot emit laser radiation levels greater than the Maximum Permissible Exposure (MPE). Class 1 lasers and laser systems are incapable of causing eye damage.

Class 2 Lasers. Visible, low power lasers or laser systems that are incapable of causing eye damage unless they are viewed directly for an extended period (greater than 1000 seconds).

Class 3 Lasers. Medium-power lasers and laser systems capable of causing eye damage with short duration (<0.25 s) exposures to the direct or specularly reflected beam. Includes Class 3a and 3b lasers.

Class 3a Lasers. Lasers or laser systems that normally would not be hazardous if viewed for only momentary periods with the unaided eye. They may present a hazard if viewed using collecting optics.

Class 3b Lasers. Laser or laser systems that can be hazardous if viewed directly. This includes intrabeam viewing or specular reflections.

Class 4 Lasers. High powered lasers and laser systems capable of causing severe eye damage with short-duration (<0.25 s) exposures to the direct, specularly reflected, or diffusely reflected beam. Class 4 lasers and laser systems are also capable of causing severe skin damage and igniting flammable and combustible materials.

Laser Safety Officer (LSO). The individual with responsibility for ensuring laser safety on the ASU campus. S/he is a member of the Radiation Safety Committee.

Laser System Groupings. Lasers and laser systems are grouped according to their capacity to cause injury, and specific controls are then described for each group.[1] Information on the label must include class, the maximum output power, the pulsed duration (if pulsed), and the laser medium or emitted wavelengths.

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. The criteria for MPE for the eye and skin are detailed in Section 8 of ANSI Z136.1-1993.

MSDS. Material Safety Data Sheet – available on the Environmental Health and Safety (EH&S) homepage.

Radiation Safety Committee (RSC). The RSC has responsibility for monitoring laser use on the ASU-Jonesboro campus.

Standard Operating Procedures. Established procedure to be followed in use of lasers in each of the given categories.

4.0 APPLICABILITY

The requirements and recommended details of this policy are applicable to all lasers used by ASU employees, students, and unaffiliated workers in research and instructional laboratories

5.0 REGULATIONS

ASU has adopted the American National Standard for the Safe Use of Lasers:ANSIZ136.1-1993. ANSI Z136.1-1993 is recognized as a minimum standard for laser safety. A copy of the ASU Laser Safety Manual must be available in each department using Class 3b or Class 4 lasers. A copy of ANSI 2136.1-1993 or later applicable edition is available in the Radiation Safety Office and in the Office of Environmental Health and Safety.

Radiation Safety Governing Principles and Procedures

5.0 GOVERNING PRINCIPLES

5.1 Radiation Safety Committee

The Radiation Safety Committee (RSC) has responsibility for overseeing laser safety at ASU. Please refer to the Radiation Safety Governing Principles for information concerning the RSC.

5.2 Compliance Standards

[1]Lasers manufactured after August 1, 1976, are classified and labeled by the manufacturer.

Before using lasers on the ASU-Jonesboro campus, investigators are required to provide the RSC with Standard Operating Procedures for Class 3b and Class 4 lasers, as well as a plan to control other hazards (Appendix A).

5.3 Training

Only qualified and authorized personnel are permitted to operate lasers. All employees, students, and/or unaffiliated workers who are required to operate lasers must read the Laser Safety Governing Principles and Procedures and receive initial and annual laser safety training. The Principal Investigator determines the employee's operational qualification from departmental or technical training or other acceptable learning experience.

Before operating a Class 3 or Class 4 laser, or a Class 1 laser system that encloses a Class 3 or Class 4 laser, a person must review the Laser Safety Governing Principles and Procedures. The Principal Investigator or Lab Supervisor must provide a thorough review of the laser equipment to be used and the standard operating procedures for the specific equipment to be used. S/he, moreover, must ensure that a new user reads the operating and safety instructions furnished by the manufacturer before operating the equipment.

4.2 Medical Surveillance

Most lasers are capable of causing eye injury to anyone who looks directly into the beam or specular reflections. In addition, diffuse reflection of a high-power laser beams can burn exposed skin, ignite flammable materials, and activate toxic chemicals that release hazardous fumes, gases, debris, and radiation. The equipment and optical apparatus required to produce the lasing action and control and direct the laser beam also introduce additional hazards associated with water, high voltage, high pressure, cryogenics, noise, radiation, and toxic gases. Consequently, medical surveillance is required as follows:

- Individuals operating Class 1, 2, and 3a lasers are exempt from eye exams as are laser users who terminate their work in the laser laboratory unless an employee has had a known laser injury to the eye.
- Laser operators or individuals who will work in areas where there may be exposure to laser radiation from a Class 3b or Class 4 laser are required to have had a baseline eye examination prior to using the laser.
- An eye exam is required in the event of exposure or suspected exposure incident.

4.3 Exposure Incidents

If an exposure incident occurs, the Laser Safety Officer (LSO) must be notified by the Principal Investigator or by the person operating the laser. If the incident causes an injury or could potentially have caused an injury, the person or persons who have received an exposure should inform their supervisors and request an eye examination. The LSO will conduct an investigation, and an incident report will be written.

4.4 Laser Hazards

Before appropriate controls can be selected and implemented, laser radiation hazards must be identified and evaluated. It is the responsibility of the Principal Investigator who operates or supervises the operation of the laser to correctly identify the class of the laser and apply the concomitant controls. Refer to either ANSI Z136.1- 1993 or contact the LSO for additional information.

Types of laser-related hazards include:

- **Eye**: Acute exposure of the eye to lasers of certain wavelengths and power can cause corneal or retinal burns (or both). Chronic exposure to excessive levels may cause corneal or lenticular opacities (cataracts) or retinal injury.
- **Skin**: Acute exposure to high levels of optical radiation may cause skin burns, while carcinogenesis may occur for ultraviolet and near ultraviolet wavelengths.
- **Chemical**: Some lasers require hazardous or toxic substances to operate (i.e., chemical dye, Excimer lasers).
- **Electric shock**: Most lasers require high voltages that can be lethal.
- **Fire hazards**: The solvents used in dye lasers are flammable. High voltage pulse or flash lamps may cause ignition. Flammable materials may be ignited by direct beams or specular reflections from high power continuous wave (CW) infrared lasers.
- **Water Hazards**: In general, lasers are water-cooled, so flooding is a possibility. Hose connections should be checked regularly.

7.0 ROLES AND RESPONSIBILITIES

Responsibility for the administration of the safety standards contained herein rests with the Chancellor of the University or his/her designee and is directly overseen by the Associate Vice Chancellor for Research. The RSC is responsible for the implementation of the appropriate safety standards by: 1) reviewing and approving investigator use of lasers, 2) maintaining records of laser acquisition and registration, 3) operating a comprehensive laser safety program, and 4) make policy recommendations to the University administration. The LSO, as the RSC's representative, shall have the authority and responsibility to monitor and enforce the control of laser hazards.

Principal Investigators are responsible for:

- The immediate supervision of lasers in the laboratory.
- Providing, implementing, and enforcing the safety recommendations and requirements prescribed in this program.
- Classifying and labeling all of their lasers.
- Completing a Laser Registration Form and sending it to the Laser Safety Officer.
- Training and documenting all employees who work with and around Class 2a, 2, 3a, 3b, and 4 lasers in the safe use of lasers.
- Registering for the Medical Surveillance program for users of Class 3b and Class 4 lasers.
- Notifying the LSO immediately in the event of an exposure to a Class 3b or Class 4 laser.

Laser Operators are responsible for:

- Following laboratory alignment, operational, safety, and maintenance Standard Operating Procedures.
- Reading additional safety instructions in laser equipment operators' manuals.
- Keeping the Principal Investigator fully informed of any departure from established safety procedures. This includes notification of an exposure incident.
- Reading the University's Laser Safety Manual, and becoming familiar with its contents.
- Registering for the Medical Surveillance program for users of Class 3b and Class 4 lasers.

The Laser Safety Officer or his/her representative will:

- Maintain an inventory of all Class 3b and Class 4 lasers. Classify or verify classification if necessary.
- Be responsible for hazard evaluation of laser work areas, including the establishment of Nominal Hazard Zones.
- Approve Standard Operating Procedures, alignment procedures and other control measures.
- Provide consultative services on evaluation and control of laser hazards and worker training programs.
- Inspect all Class 3b and Class 4 lasers for compliance at least annually with ASU Laser Safety Program. Ensure any required corrective action is taken.
- Suspend, restrict or terminate the operation of a laser or laser system without adequate hazard controls, and advise Radiation Safety Committee of such action.
- Approve wording on area signs and equipment labels.
- Maintain records required by various regulatory bodies. Ensure records are maintained of medical examinations and training has been provided.
- Investigate incidents involving potentially harmful laser exposures.

The Radiation Safety Committee will:

- Develop and promulgate Governing Principles and procedures regarding laser safety within the university;
- Review and grant permission for, or disapprove, the use of laser equipment of Class 3 or
- higher for experimental, routine, or non-routine uses within the university from the
- standpoint of health and safety of experimenters, students, and staff, and the general public;
- Recommend candidates to the Associate Vice Chancellor for Research for the position of University Laser Safety Officer;
- Outline the duties of the Laser Safety Officer;
- Insure compliance with laser safety standards, including federal and state regulations, and
- non-regulatory standards as outlined in the American National Standards Institute (ANSI) Z136 series of laser safety standards;
- Review annual reports from the LSO regarding personnel training records, laser hazard control measures, laser safety inspections, and other matters concerning use and operational hazards of lasers;
- Investigate alleged infractions of safety rules or improper use of laser equipment brought to their attention by the radiation safety officer or other responsible personnel; and

- recommend remedial action to correct such infractions.

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8.0 PROCEDURES

8.1 Eye Protection

Principal Investigators and/or staff who operate or supervise the operation of a laser are responsible for determining the need for laser eye protection for a particular laser. If required, eye protection will be provided by the supervisor for staff and visitors to the area. The booklet "Guide for Selection of Laser Eye Protection" produced by the Laser Institute of America may provide assistance in eyewear selection. Check with the Principal Investigator or the LSO for a copy.

8.2 Power Levels

The minimum laser radiant energy or laser power level required for the application should always be used.

8.3 Beam Control

To minimize direct eye exposure, observe these precautions:

- Do not intentionally look directly into the laser beam or at a specular reflection, regardless of its power.
- Terminate the beam path at the end of its useful path.
- Locate the beam path at a point other than eye level when standing or when sitting at a desk.
- Orient the laser so that the beam is not directed toward entry doors or aisles.
- Minimize specular reflections.
- Securely mount the laser system on a stable platform to maintain the beam in a fixed position during operation and limit beam traverse during adjustments.
- Confine primary beams and dangerous reflections to the optical table.
- Clearly identify beam paths and ensure that they do not cross populated areas or traffic paths.
- When the beam path is not totally enclosed, locate the laser system so that the beam will be outside the normal eye-level range, which is between 1.2 to 2 meters from the floor. A beam path that exits from a controlled area must be enclosed where the beam irradiance exceeds the MPE.

8.4 Warning Signs for Low-Power Lasers

Post "CAUTION-LOW POWER LASER" signs at each entrance to the operating area. If the laser has not been labeled by the manufacturer, attach a label to the laser with its classification and relevant warning information. (*Refer to the ANSI Z136.1-1993 for further guidance on control measures for various classifications of lasers.)*

8.5 Standard Operating Procedures for Class 3b and 4 Lasers

- All Principal Investigators are required to write Standard Operating Procedures (SOP) for all laser operations involving Class 3b and Class 4 lasers. The SOP must detail alignment, operation, safety, and maintenance procedures and should be posted or attached to the inside surface of the lab door. Other unusual operating circumstances may require additional procedures. Contact the Laser Safety Officer for assistance.
- A log must be maintained showing **periods of use, service, maintenance, incidents, and** monthly interlock checks. (See Appendix A.)
- A laser classification label must be conspicuously affixed to the laser housing.
- Each entrance must be posted with a danger sign in accordance with ANSI Z136.1-1993.
- Entrances to laboratories with Class 3b or 4 lasers shall have a lighted warning sign that is fail-safe interlocked with the laser, to activate when the laser is energized. The sign must be tested monthly. **A written record must be kept of each test.**
- All protective enclosures that surround laser devices and high-voltage electrical sources must be equipped with interlocks to prevent operation of the equipment when enclosures are not in place. Interlocks must be tested monthly to ensure that they are operational. Interlocks must be designed so that after they are actuated, the capacitor banks, shutters, or power supplies cannot be re-energized except by manually resetting the system.
- The responsible individual in a laser area controlled by a warning light is permitted to momentarily override (bypass) interlocks to allow access of authorized persons if all of the following conditions are met:
    - There is no laser radiation hazard at the point of entry.
    - The necessary protective devices are worn by the personnel entering the area.
    - An interlock bypass circuit is designed into the interlock control system.
    - This bypass circuit must only be operated from inside the interlocked area. It must delay no more than 15 seconds before shutting down the system.
- If interlocks are not feasible, the Principal Investigator may consider the use of alarms, voice warnings, danger lights, door locks, key cards, or extensive security. The Laser Safety Officer and the Radiation Safety Committee must be consulted in choosing alternatives to interlocks.
- Laser laboratories and controlled areas must be designed so that personnel can enter and leave under emergency conditions.
- Lasers must have a master switch with a key or coded access that prevents use once the key has been removed or a code has been entered. The key must not be left in the control panel when he laser is not in use.
- An alarm, a warning light, or a verbal "countdown" command must be used during activation and start up.
- Lasers must have a permanently attached beam stop or attenuator and emission delays.
- Laser-controlled areas shall be established which have limited access and shielding sufficient to contain or direct scattered radiation. Access to the area during laser operation requires the permission of the responsible operator.
- Class 3b and 4 infrared laser beams with a wavelength greater than or equal to 710 nm must be terminated with fire resistant material.
- Securely fasten all mirrors, prisms, beam stops, etc. in the beam path. Ensure that the laser is also securely fastened.

- Circuit breakers must be identified for each laser.
- The entire beam path of Class 3 and Class 4 lasers, including the target area, should be surrounded by an enclosure equipped with interlocks that prevent operation of the laser system unless the enclosure is properly secured. When total enclosure of the laser beam path is not practical, both the non-enclosed laser beam and any strong reflections must be terminated at the end of their useful paths using such devices as backstops, shields or beam traps.
- Materials that diffusely reflect laser radiation must be used in place of specularly reflective surfaces wherever possible.
- To minimize personnel exposure, specularly reflecting surfaces that are needed for beampath control should be enclosed or shielded.
- Ultraviolet (UV) and infrared (IR) lasers that emit invisible beams require additional
- Controls including the following:
    - Visual or audible beam-warning devices must be installed in areas where personnel may be exposed to radiation in excess of the MPE. These warning devices must be clearly identified and visible from all areas of potential exposure.
    - Shielding must be installed that will attenuate UV radiation to levels below the MPE for the wavelength being used.
    - Hazardous concentrations of by-products formed by the reaction of intense UV radiation with materials in the area must be controlled.
    - IR beam enclosures and backstops must be fabricated of IR-absorbent material and must also be fire-resistant.
- Controlled laser areas must be surveyed by the user both initially and when beam path changes are made to locate and identify direct and reflected beams that exceed the MPE. Shielding may be required to limit unwanted radiation.
- Personnel must never look directly into any laser beam.
- High powered laser optical **systems must never be aligned by direct beam viewing** if the radiant exposure or irradiance exceeds the MPE.
- Use low-power lasers, diffuse reflectors, image-retaining screens, exposed Polaroid film, and other devices that will minimize eye exposure.
- Using optical systems such as cameras, telescopes, microscopes, etc., to view laser beams may increase the eye hazard. Therefore, all collecting optics must incorporate suitable means (such as interlocks, filters, or attenuators) to prevent eye exposures above the MPE.
- Laser protective eye wear shall be worn whenever MPE levels may be exceeded. However, **it is good practice to always wear eye protection when lasers are in use**. In general, eye wear provides protection over a narrow range of the laser spectrum. Eye wear designed for protection at one wavelength may afford little or no protection at another wavelength. Consult eye wear manufacturers and the LSO for proper selection of protective eye wear.
- Laser protective eye wear must be approved by the American National Standards Institute (ANSI) and clearly labeled with optical densities and wavelengths for which protection is afforded. Eye wear must be inspected periodically by the user for pitting and cracking of the attenuating material, and for mechanical integrity and light leaks in the frame.
- Protection for the skin may be afforded through the use of clothing to cover normally exposed skin areas.

- Protective equipment is no substitute for common sense and the use of good safety practices.
- When lasers are to be left unattended, de-energize the power supplies or capacitor banks and remove the keys from power switches or master interlocks to prevent unauthorized activation of the equipment.
- The operation of unattended lasers is only allowed when a specific SOP has been written and approved by the Principal Investigator and the Radiation Safety Committee.
- Occasionally, it may be necessary to remove protective enclosures or override equipment interlocks or other safety devices for service adjustments, maintenance, special training exercises, etc. In these instances, a temporary controlled laser area must be set up. Specific methods for handling situations of this type must be described in the SOP.
- Because the area will not have all the standard safety features, the SOP must describe provisions for protecting personnel who could potentially be exposed.
- When the entire beam path is not fully enclosed, restrict access into the area to persons wearing proper protective equipment. Make sure that all optical paths from the restricted access area are adequately covered to prevent escape of laser radiation greater than the MPE for the eye. Refer to the ANSI Z136.1-1993 and Table 10 of this manual for further guidance on control measures for various classifications of lasers.

8.6 Converting to a Class 1 Enclosed Laser

Any laser or laser system can be converted to a Class 1 enclosed laser by including all of the following controls in the laser system design. These controls will effectively enclose the laser, thus preventing personal contact with emitted radiation while permitting unrestricted access into the area.

Approval must be obtained from the Radiation Safety Committee in order to convert a Class 3b or Class 4 laser to a Class 1 enclosed laser. **Users of these converted Class 1 lasers must still attend Laser safety training.**

- House the laser system within a protective enclosure to prevent escape of laser radiation above the MPE.
- The protective housing must prevent personnel access to the laser system during normal operations.
- Personnel entering the enclosure to perform maintenance or adjustment tasks must be made aware of the higher risk laser class.
- Install safety interlocks wherever the protective enclosure can be opened, removed or displaced. When activated, these interlocks must prevent a beam with a radiant energy above the MPE from leaving the laser or laser system. Service adjustments or maintenance work performed on the laser system must not render the interlocks inoperable or cause exposure levels outside the enclosure to exceed the MPE, unless work is performed in a laser area with limited access and appropriate safeguards, supervision, and control.
- The protective enclosure and the laser system must be designed and fabricated so that if a failure occurs, the system will continue to meet the requirements for an enclosed laser operation.

- Modifications to commercial laser systems must be evaluated. Contact the LSO for an evaluation. If the modifications decrease the safety controls, an SOP will be required.
- Attenuated Viewing Windows: Use viewing windows containing a suitable filter material that will attenuate the transmitted laser radiation to levels below the MPE under all conditions of operation.
- Label the enclosure with **"CAUTION-ENCLOSED LASER"** signs and attach a label directly to the laser which gives the laser classification in the absence of the enclosure. Make sure that the label can be seen immediately when the enclosure is opened.

8.7 Controlling Associated Hazards

The Radiation Safety Committee is responsible for oversight of other hazards associated with laser use and requires that laboratories that house Class 3b or Class 4 lasers provide Standard Operating Procedures (Appendix A) to control hazards as follows:

- **Electrical Equipment and Systems.** Always be aware of the high risk of injury and fire in laser operations because of the presence of electrical power sources. The installation, operation, and maintenance of electrical equipment and systems must conform to existing standards. Contact Environmental Health and Safety (EH&S) for assistance.
- **Lighting.** Adequate lighting is necessary in controlled areas. If lights are extinguished during laser operation, provide control switches in convenient locations or install a radio-controlled switch. Luminescent strips should be used to identify table and equipment corners, switch locations, aisles, etc. When ambient light is not sufficient for safe egress from a laser area during an electrical power failure, install emergency lighting.
- **Ionizing and Non-ionizing Radiation.** Laser operations may involve ionizing radiation that originates from the presence of radioactive materials or the use of electrical power in excess of 15kV. If radioactive material is present in the laser system, "CAUTION-RADIOACTIVE MATERIAL" sign must be prominently displayed. If X-rays are generated a CAUTION-X-RAYS" sign must be prominently displayed. Microwave and radio frequency (RF) fields may be generated by laser systems or support equipment. Contact the Radiation Safety Office at 753-1093 to obtain an evaluation of these hazards before starting an operation.
- **Hazardous Materials**. Bring only those hazardous materials into the laser area that are needed for the operation. Do not allow laser beams and strong reflections to affect combustible materials, explosives, highly flammable liquids or gases or substances that decompose into highly toxic products under elevated temperatures. Conduct or sponsor tests that establish the effects of beam interactions with hazardous materials. Test results can be used to determine safe parameters for laser operation. All hazardous materials must be properly used, stored and controlled. **Consult Material Safety Data Sheets, and EH&S for additional information.**
- **Dyes and Solutions.** Dye lasers normally use a lasing medium composed of a complex fluorescent organic dye dissolved in an organic solvent. These dyes vary greatly in toxicity, mutagenicity, and potential carcinogenicity. Most solvents suitable for dye solutions are flammable and toxic by inhalation and/or skin absorption. Prepare and handle dye-solutions inside a chemical fume hood. Wear a lab coat, eye protection and gloves. Pressure-test all dye laser components before using dye solutions. Pay particular attention to tubing connections. Install spill pans under pumps and reservoirs. Be alert to

contaminated parts. Keep dye-mixing areas clean. Obtain Material Safety Data Sheets from EH&S for all dyes and solvents. And use in accordance with those instructions.

- **Water.** In general, lasers are water-cooled, so flooding is a possibility. Check hose connections regularly.

APPENDIX A
ARKANSAS STATE UNIVERSITY
STANDARD OPERATING PROCEDURE FOR LASER SAFETY

This procedure shall be developed by the Principal Investigator and approved by the RSC before laser use commences and shall be approved by the RSC every two years thereafter, unless the procedures undergo substantive change. In the latter case, the Principal Investigator is required to submit the revised SOP to the RSC for its review and approval prior to the onset of any work conducted under the new procedures. Operators must read and sign the most recent SOP annually.

1. GENERAL INFORMATION

Department/Laboratory:

Date:

Principal Investigator:

Phone number:

2. LASER DESCRIPTION

Attach latest Laser Inventory (available from Laser Safety Supervisor). Update as required.

3. LASER SAFETY PROGRAM

See the ASU Laser Safety Governing Policies and Procedures for:

- Responsibilities of the laser operator/user and the Principal Investigator:
- Laser Permit Requirements
- Training Requirements
- Eyewear Requirements, including annual eyewear inspections
- Sign and Labeling Requirements
- Non-radiation Hazards

4. HAZARDS & CONTROLS

Check if applicable:

❑ High Voltage

❑ Entryway (door)

❑ Interlocks or Controls

❑ Laser Enclosure

❑ Interlocks

❑ Laser Housing

❑ Interlocks

❑ Panic Button

❑ Emergency Stop

❑ Beam Stops

❑ Infrared Laser terminates in fire-resistant material and the absorber must be inspected at least quarterly

❑ Master Switch (operated by key or computer code)

❑ Laser Secured to Base

5. PERSONAL PROTECTIVE EQUIPMENT

Eyewear:

Acquisition date:

Type Wavelength (nm):

Wavelength:

Attenuated (nm):

Optical Density (OD):

Example:

Aug 08

CO2 10,600 10,600 At least 3.5 Glendalewhite frames

Identify each set of laser protective eyewear with a unique designation (name or number).

What (item): And is available from (where) which must be worn (when):

6. OPERATING PROCEDURES

A. Initial preparation of lab environment for normal operation (key position, warning light on, interlock activated, identification of personnel, other);

B. Target area preparation:

C. Operational procedures are as follows:

D. Shutdown procedures are as follows:

E. Special procedures (alignment, safety tests, interlock bypass, emergency, etc.):

7. Non-Radiation Hazards Survey

Please circle correct response.

1. Electrical

Are there any exposed wiring terminals or connections?	Yes/No/NA
Is a positive on/off switch available and connected?	Yes/No/NA
Are all connections permanent (Screwed or clamped)?	Yes/No/NA
Are personnel trained in CPR?	Yes/No/NA
Is access to the power supply controlled	Yes/No/NA

2. Chemical

Is personal protective equipment available	Yes/No/NA
Are Material Safety Data Sheets available?	Yes/No/NA
Is absorbent or diluent available?	Yes/No/NA
Are personnel trained in the hazards of the chemical?	Yes/No/NA

3. Cutting Edge

Is the cutting edge identified prominently?	Yes/No/NA
Are personnel trained in safety for this hazard?	Yes/No/NA

4. Compressed Gases

Is the gas cylinder properly secured and connected?	Yes/No/NA

Is an MSDS available for the gas (If required)? Yes/No/NA

Are personnel trained in safety for this hazard? Yes/No/NA

5. **Ventilation**

Is proper ventilation present for the laser space? Yes/No/NA

6. **Noise**

Are noise levels excessive? Yes/No/NA

Is hearing protection available? Yes/No/NA

Are personnel trained in safety for this hazard? Yes/No/NA

7. **Confining Space, Explosion, Physical Safety**

Is the hazard identified? Yes/No/NA

Is training provided in safety for this hazard? Yes/No/NA

Is protective equipment available? Yes/No/NA

8. PRINCIPAL INVESTIGATOR ACKNOWLEDGEMENT OF COMPLIANCE

This SOP is accurate to the best of my knowledge.

Name (Print):

Signature:

Signature Date:

7. OPERATOR REVIEW

I have read this procedure, been trained by the Principal Investigator, and understand its contents.

Name (Print):

Signature:

Signature Date: