

LASER SAFETY PROGRAM

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1. INTRODUCTION AND SCOPE

In accordance with its health and safety policy and the general provisions of the Ontario Occupational Health and Safety Act, the University of Ontario Institute of Technology must take every reasonable precaution for the health and safety of its employees and students.

Where lasers are used in the research and teaching programs of the University they are capable of posing significant hazards and, depending on the specific laser system, controls must be put in place to control these hazards.

The purpose of this laser safety program is to establish and maintain controls for the safe use of lasers within the University. The standard which applies to this program is that outlined in the ANSI Standard Z136.1 - 2007, *American National Standard for Safe Use of Lasers*.

This laser safety program applies to all Class 3B and 4 lasers and laser systems used within the University. The basic elements of the laser safety program are:

1. Definition of responsibilities with respect to the laser safety program
2. Registration of all Class 3B and 4 lasers and laser systems
3. Hazard assessment of all Class 3B and 4 lasers and laser systems
4. Training of all laser workers
5. Engineering controls
6. Administrative and procedural controls
7. Personal protective equipment
8. Provision for medical surveillance for laser workers
9. Inspections of Class 3B and 4 lasers and laser systems
10. Reporting of accidents and incidents
11. Provision for auditing the implementation and effectiveness of the program.

2. CLASSIFICATION OF LASERS

The basis for the classification scheme for lasers is the ability of the primary or reflected primary beam to cause biological damage to the eye or skin. There are four classes in order of increasing hazard. Classes 1, 2 and 3 are subdivided into two subclasses each.

Normally lasers are classified by the manufacturer, but when the system is modified in any way or the operating procedures differ from those specified by the manufacturer, the system may require reclassification to a higher level. In situation, and for unclassified lasers or laser systems manufactured in-house, the Radiation Safety Officer should be contacted regarding the classification.

Class 1

A Class 1 laser system is considered to be incapable of producing damaging radiation levels during operation.

Class 1 lasers are exempt from any control measures or other forms of surveillance.

Class 1M

A Class 1M laser system is considered to be incapable of producing hazardous exposure conditions during normal operations unless the beam is viewed with an optical instrument such as an eye-loupe (diverging beam) or a telescope (collimated beam).

Class 1M lasers are exempt from any control measures other than to prevent potentially hazardous optically aided viewing, and are exempt from other forms of surveillance.

Class 2

Class 2 lasers emit in the visible portion of the spectrum (400 to 700 nm). Class 2 lasers have the potential for eye injury but the normal bright light aversion response of the eye (blinking or eye movement) normally prevents exposure times greater than 0.25 seconds and provides sufficient protection.

Class 2M

A Class 2M laser emits in the visible portion of the spectrum (400 to 799 nm) and eye protection is normally affected by the aversion response for unaided viewing.

Class 2M is potentially hazardous if viewed with certain optical aids.

Class 3 (Medium Power)

A Class 3 laser may be hazardous under direct and specular reflection viewing conditions, but is not a diffuse reflection or fire hazard.

Class 3R

A Class 3R laser is potentially hazardous under some direct and specular reflection viewing conditions if the eye is appropriately focused and stable, but the probability of an actual injury is small. This laser will not pose either a fire hazard or a diffuse reflection hazard. (Note: Lasers classified as 3A under previous standards are now classified as 3R).

Class 3B

A Class 3B laser may be hazardous under direct and specular reflection viewing conditions, but is normally not a diffuse reflection or fire hazard.

Class 4

A Class 4 laser is a hazard to the eye or skin from the direct beam and may pose a diffuse reflection or fire hazard. A Class 4 laser may also produce laser generated air contaminants and hazardous plasma radiation.

3. RESPONSIBILITIES**3.1 Laser Safety Officer**

The Laser Safety Officer (LSO) is a person designated by the University (the employer) with the authority and responsibility to effect the knowledgeable evaluation and control of laser hazards and to monitor and enforce the control of these hazards.

It is a requirement of the ANSI standard that there shall be a designated LSO for all circumstances of operation, maintenance and service of a Class 3B or Class 4 laser or laser system.

Specific duties of the LSO include:

- Establish and maintain adequate policies and procedures for the control of laser hazards;
- Classify or verify classifications of lasers and laser systems;
- Perform a hazard evaluation of laser work areas;
- Assure that adequate controls are implemented;
- Approve Class 3B and Class 4 standard operating procedures;
- Recommend or approve personal protective equipment;
- Review the wording on area signs and equipment labels;
- Review Class 3B and 4 laser installations and equipment prior to use;
- Ensure adequate training is provided to laser personnel;
- Determine personnel categories for medical surveillance;
- Ensure necessary records are maintained;
- Perform regular inspections (at least annually) of Class 3B and 4 lasers and laser systems and submit reports to the Radiation Safety Committee and the Joint Health and Safety Committee
- Develop an accident response plan;
- Approve the operation of Class 3B and 4 lasers and laser systems.

3.2 Radiation Safety Committee

The Radiation Safety Committee is responsible for reviewing, approving, overseeing and enforcing the Laser Safety Program. The Committee provides oversight, support, direction and guidance to the Laser Safety Officer.

3.3 Laser Supervisor

The laser supervisor is the person with overall responsibility for the laser or laser system. The laser supervisor has control of the workplace and authority over all persons working with the laser or within the laser work area. The laser supervisor has the following responsibilities:

- Ensure that all persons working with the laser or in the laser control area have received proper instruction and training;
- Control the operation of the laser and not permit operation of the laser unless there are proper controls in place;
- Ensure that the laser is operated in a safe manner in accordance with safe laser practices and the approved standard operating procedures;
- Submit to the Laser Safety Officer the names of all persons scheduled to work with the laser or in the laser controlled area;
- In the event of an incident or accident implement the appropriate emergency procedures and notify the Laser Safety Officer;
- Ensure access control to the laser and ensure that all persons within the laser hazard zone are provided with and wear appropriate protective eyewear.
- Prior to the start of every Fall semester, review, ensure and document that the requirements of the University Laser Safety Program are followed.
- Liaise with the University Health and Safety Officer regarding the nature and circumstances of all deficiencies in the University Laser Safety Program and any incidents or accidents.

3.4 Laser Worker

A laser worker is any person, employee or student who operates, works with or in proximity to a Class 3B or 4 laser. Laser workers have the following responsibilities:

- Not energize or work with or near a laser unless authorized to do so by the laser supervisor;
- Operate the laser system in accordance with the approved operational procedures;

- Participate in appropriate laser safety training and be familiar with and follow the safety rules and procedures prescribed by the LSO and the laser supervisor;
- Immediately report any accident or incident involving the laser to the laser supervisor;
- Participate in any medical surveillance program prescribed by the LSO.

3.5 Dean of the Faculty

The Dean of the Faculty has the following responsibilities:

- Ensure that all members of the Faculty are aware of and comply with the provisions of the University Laser Safety Program;
- To ensure that all Class 3B and 4 Lasers within the Faculty are registered with the Laser Safety Officer.

3.6 University Safety Officer

Working with the Laser Safety Officer, the University Safety Officer is responsible for:

- Receiving and acting upon reports of accidents/incidents involving lasers;
- Performing periodic audits of the laser safety program

4. LASER REGISTRATION AND OPERATING PERMITS

4.1 Laser Registration

All Class 3B and 4 lasers are to be registered with the Laser Safety Officer before they are put into operation.

The purpose of this registration is:

- to ensure that a hazard analysis is performed for the laser and that appropriate engineering and administrative controls are put in place;
- to permit identification of persons using or potentially exposed to lasers so that they can receive appropriate training; and
- to enable the lasers and laser systems to be inspected on a regular basis for compliance with the Laser Safety Program.

The Dean of the Faculty is responsible for ensuring that all persons within the Faculty who acquire or purchase Class 3B or 4 lasers register the lasers with the Laser Safety Officer.

Registration of lasers is to be done using the form in Appendix A.

When in doubt as to the class of the laser, the registration form should be completed and sent to the Laser Safety Officer, who will classify the laser.

4.2 Laser Operating Permits

No class 3B or 4 laser may be operated without an operating permit issued and approved by the Radiation Safety Committee.

Upon registration of a Class 3B or 4 laser, the Laser Safety Officer will review the proposed operation and use of the laser with the Laser Supervisor, perform a hazard assessment, and determine the appropriate controls to be put in place. The Laser Safety Committee will issue a Laser Operating Permit to the Laser Supervisor incorporating the conditions under which the laser may be operated.

The permit is granted on the grounds that the permit holder is aware of and responsible for the operation of the laser in accordance with the conditions specified on the permit. The permit holder is responsible for overseeing all activities taking place under the permit and for providing appropriate training and supervision to individuals operating under the permit.

Permitted locations are subject to periodic inspections by the Radiation Safety Officer. Any infractions to the permit conditions will be discussed with the Laser Supervisor and, if necessary, referred to the Radiation Safety Committee.

A copy of the Laser Operating Permit must be posted in a prominent location in the areas designated on the permit.

5. HAZARD ASSESSMENT

The Laser Safety Officer will perform a hazard assessment of every Class 3B and 4 laser and laser system before they are put into operation. This assessment shall be performed in accordance with the provisions of ANSI Standard Z136.1 – 2007 and shall take into account the following:

- the classification of the laser
- the environment in which the laser is being used
- the personnel who may use or be exposed to laser radiation
- any non-beam hazards associated with the laser or laser system

Reviews of reported incidents with lasers has demonstrated that accidental eye and skin exposures to laser radiation and accidents related to non-beam hazards are most often associated with the following conditions:

1. unanticipated exposure during alignment
2. misaligned optics and upwardly directed beams
3. available eye protection not used
4. equipment malfunction
5. improper methods of handling high voltage
6. intentional exposure of unprotected personnel
7. operators unfamiliar with laser equipment
8. lack of protection for non-beam hazards
9. improper restoration of equipment following service
10. eyewear won not appropriate for the laser in use
11. unanticipated eye/skin exposure during laser usage
12. inhalation of laser generated air contaminants and/or viewing laser generated plasmas
13. fires resulting from the ignition of materials
14. eye or skin injury of photochemical origin
15. failure to follow standard operating procedures.

The purpose of control measures is to reduce the possibility of human exposure to hazardous laser radiation and to non-beam hazards. The general hierarchy of controls, in order of preference, is as follows:

- engineering controls incorporated into the laser by the manufacturer or designed into the installation by the user
- administrative and procedural controls
- personal protective equipment

The number and extent of the controls will depend to a large extent on the hazard class of the laser with the more extensive controls being applied to Class 3B and 4 lasers.

Following from the hazard assessment, the LSO shall specify:

- The Nominal Hazard Zone (NHZ) for the laser or laser system;
- The engineering and administrative controls to be put in place,
- The personal protective equipment (including protective eyewear) to be used;
- The training requirements for laser workers and others potentially exposed to laser radiation; and
- Medical surveillance requirements.

6. TRAINING

All laser supervisors and laser workers must participate in the University's laser safety training prior to operating or working in proximity to Class 3B or 4 lasers and laser systems. Training will be coordinated through the University Safety Officer and Laser Safety Officer.

The training will include the following:

- Legislation, standards and the University laser safety program
- Responsibilities
- Laser basics
- Laser hazards
- Laser system classification
- Control measures
- Eye protection
- Medical surveillance
- Non-beam hazards
- Laser accidents

The training will also include specific hazards and standard operating procedures of the specific lasers with which the trainee will be working.

7. ENGINEERING CONTROLS

Commercial laser products will be certified by the manufacturer and will incorporate a number of engineering controls. The user should not attempt to disable any of these controls. Additional controls as specified in this section shall be considered to reduce the hazards associated with the specific use of the laser systems.

The following general controls should first be considered in all laser applications:

- The minimum power of laser radiation required for the application be used.
- The laser equipment or beam path be totally enclosed where feasible.
- The beam height be maintained at a level other than the normal position of the eye of a person in the standing or seated positions.

Following are the measures that are normally required for Class 3B and 4 laser system.

7.1 Protective Housings

A protective housing is a physical barrier preventing laser radiation in excess of the MPE from exiting the laser. The protective housing may have interlocks to prevent operation when the protective housing is removed. This protective housing is normally supplied with the laser itself, but the use of the laser may result in the beam exiting the laser, in which case a user-created additional enclosure should be considered.

7.2 Laser use without a Protective Housing

In some applications of research, the operation of the laser without a protective housing may be necessary. In such cases, the LSO shall conduct a hazard analysis to determine any additional controls that are required to ensure safe operation of the laser system. These controls may include, but are not restricted to:

- Access restriction
- Eye protection
- Barriers, shrouds, beam stops, etc
- Administrative and procedural controls
- Education and training

7.3 Interlocks on Removable Protective Housings

Protective housings which totally enclose Class 3B or 4 lasers must be provided with an interlock which is activated when the protective housing is removed during operation and maintenance. The interlock prevents exposure to the laser radiation above the MPE.

This interlock must not be overridden during operation unless the provisions of section 7.2 – Laser use without a Protective Housing are satisfied.

7.4 Service Access Panels

These panels are part of the protective housing which are intended to be removed by service personnel only and permit direct access to laser radiation associated with a Class 3B or 4 laser. These panels shall be either:

- Interlocked (fail-safe interlock not required); or
- Require a tool for removal and have an appropriate warning label.

7.5 Key Control

A Class 3B laser should and a Class 4 laser shall be fitted with a master switch which shall be operated by a key or a coded access. The master switch shall effect beam termination and/or system shutoff. The authority for access to the master switch shall lie with the laser supervisor.

7.6 Viewing Windows and Display Screens

All viewing windows and diffuse (reflective or transmitted) display screens included as a integral part of the laser system shall incorporate a suitable means (such as interlocks, filters, attenuators) to maintain the laser radiation at the viewing position at or below the applicable MPE.

7.7 Collecting Optics

All optical instruments such as lenses, telescopes, microscopes, eye-loupes, etc, intended for viewing a laser shall incorporate a suitable means (such as interlocks, filters, attenuators) to maintain the laser radiation transmitted through the collecting optics to levels at or below the appropriate MPE.

7.8 Enclosed Beam Path

In applications of all classes of lasers or laser systems when the entire beam path is enclosed and the enclosure limits the laser radiation exposure to at or below the applicable MPE, the laser system meets the requirements of a Class 1 laser and no other controls are required.

7.9 Limited or Totally Open Beam Path

In some applications of Class 3B and 4 lasers where all or a part of the beam path is accessible, the LSO shall conduct a hazard analysis to establish the Nominal Hazard Zone (NHZ). The NHZ will define the area where the laser radiation is accessible at levels above the MPE and the LSO will define appropriate control measures.

7.10 Remote Interlock Connector

A Class 3B laser should and a Class 4 laser shall be provided with a remote interlock connector. The interlock connector facilitates connection to an emergency disconnect switch or “panic button” which deactivates the laser as part of a controlled area interlock system.

7.11 Beam Stop or Attenuator

A Class 3B or 4 laser system should and a Class 4 system shall be provided with a permanently attached beam stop or attenuator capable of preventing access to laser radiation in excess of the MPE when the beam is not required, as in warm up procedures.

7.12 Activation Warning Systems

An activation warning system is required on all Class 4 lasers or laser systems. Such a system is recommended for Class 3B lasers.

This can be a visible warning such as a red light which is connected to the laser power supply and flashes when the laser is energized. For single pulse lasers the warning could be an audible alarm which sounds when the power supply is charged.

7.13 Equipment Labels

All laser systems except Class 1 must have appropriate warning labels.

All laser systems with removable protective housings which have no safety interlock, must have a label indicating the class of laser inside the protective housing.

7.14 Laser Area Warning Signs

An area which contains a Class 3B or 4 laser must be posted with an appropriate warning sign. The purpose of the sign is to:

- Warn of the presence of a laser hazard in the area
- Indicate the severity of the hazard (e.g. Class of laser)
- Indicate actions to be taken to reduce the hazard.

The signs shall conform to the requirements of the ANSI Z136.1 – 2007 Standard.

7.15 Indoor Laser Controlled Area

Where the beam path of a Class 3B or 4 laser is open and accessible a laser controlled area must be established and adequate control measures instituted. The extent of the control measures depends on the laser class.

Control Measures Required for Both Class 3B and 4 Lasers

- Operation of the laser only by trained and authorized personnel
- Posting of the area with appropriate warning signs
- Operation of the laser such that the beam path is well defined

Additional Control Measures Recommended for Class 3B and Required for Class 4 Lasers

- Operation of the laser under the direct supervision of an individual knowledgeable in laser safety
- Limited access to the laser by spectators and such access requiring approval
- Termination of any potentially hazardous beam with a beamstop of appropriate material
- Where feasible have only diffusely reflecting materials in or near the beam path
- Provision of appropriate eye protection to all personnel within the laser controlled area
- Securing of the laser such that the exposed beam path is above or below eye level of a person in any standing or seated position
- Have all windows, doorways, open portals, etc. from the laser controlled area either covered or restricted in such a manner as to reduce the transmitted laser radiation to levels at or below the applicable MPE
- Require storage or disabling (e.g. removal of a key) of the laser when not in use to prevent unauthorized use.

Additional Controls Required for Class 4 Lasers

- All personnel entering the controlled area must be appropriately trained, provided with appropriate protective equipment and follow all applicable administrative and procedural controls
- All Class 4 entryway safety controls shall be designed to allow both rapid egress by laser personnel at all times and admittance to the laser controlled area under emergency conditions
- For emergency conditions there shall be a clearly marked “Emergency Stop” or other appropriately marked device appropriate for the intended purpose available for deactivating the laser or reducing the output to levels at or below the MPE.
- The Class 4 laser controlled area **must incorporate one of the following options for entryway controls:**

(1) Non-defeatable (non-override) Area or Entryway Safety Controls

Safety latches, entryway or area interlocks (electrical switches, pressure sensitive floor mats, infrared or sonic detectors) shall be used to deactivate the laser or reduce the output to safe levels in the event of unexpected entry into the laser controlled area.

(2) Defeatable Area or Entryway Safety Controls

If non-defeatable entry controls limit the intended use of the laser then defeatable entry controls may be used if it is clearly evident that there is no laser radiation hazard at the point of entry into the controlled area. In this case override of the safety controls is permitted to allow entry of authorized personnel that have been adequately trained and provided with adequate personal protective equipment.

(3) Procedural Area or Entryway Safety Controls

Where door interlocks are not feasible or are inappropriate the following procedural controls shall apply:

- (a) All authorized personnel shall be adequately trained and adequate personal protective equipment provided upon entry.
- (b) A door blocking barrier, screen, curtain, etc. shall be used to block, screen or attenuate the laser radiation at the entryway. The level of radiation at the exterior of these devices shall not exceed the applicable MPE, nor shall personnel experience any exposure above the MPE immediately upon entry.
- (c) At the entryway there shall be an activation warning system indicating that the laser is energized and operating at Class 4 levels.

7.16 Temporary Laser Controlled Area

Where the removal of panels or protective housings, override of protective housing interlocks or entry into the NHZ becomes necessary (such as for service or research activities), and the accessible laser radiation exceeds the applicable MPE, a temporary laser controlled area shall be set up.

Such an area shall be posted to warn of the potential hazard and shall provide all safety requirements for all personnel both within and outside of the area.

The engineering control measures are summarized in the following table.

**SUMMARY OF ENGINEERING CONTROL MEASURES FOR
CLASS 3B AND CLASS 4 LASERS**

CONTROL MEASURE	CLASS 3B	CLASS 4
Laser to be enclosed in a protective housing (7.1)	Required	Required
Protective housing to be provided with interlocks which are activated when the housing is opened or removed during operation and maintenance (7.3)	Required	Required
Interlocks on service access panels that permit direct access to laser radiation (7.4)	Required	Required
Provision of a master system shutoff switch with a key control (7.5)	Recommended	Required
Viewing portals to be designed to maintain laser radiation below the MPE at the viewing position (7.6)	Required if MPE exceeded	Required if MPE exceeded
Collecting optics intended for viewing use shall incorporate means to maintain the radiation the radiation transmitted through the optics below the MPE (7.7)	Required if MPE exceeded	Required if MPE exceeded
Where beam path is unenclosed a hazard analysis is to be performed to establish the Nominal Hazard Zone (7.9)	Required	Required
Remote interlock connector to be provided (7.10)	Recommended	Required
Permanently attached beam stop or attenuator to be provided (7.11)	Recommended	Required
Activation warning system – audible and visible when system is operating (7.12)	Recommended	Required
Laser equipment must bear appropriate warning labels (7.13)	Required	Required
Laser Area Warning Signs to be Posted (7.14)	Required	Required

Laser controlled area to be established where beam is accessible (7.15)	Required	Required
Temporary laser controlled area to be established (7.16)	Required	Required

8. ADMINISTRATIVE AND PROCEDURAL CONTROLS

Administrative and procedural controls are methods or instructions which specify rules and/or work practices which implement or supplement engineering controls. Administrative controls normally apply only to Class 3B and 4 laser systems, but some, such as training, apply to other classes.

8.1 Standard Operating Procedures (SOPs)

Written standard operating procedures must be developed and maintained with the laser equipment and must be available as a reference for all laser workers.

SOPs are required for:

- Experimental set-up and system alignment
- Routine operation
- Laser maintenance

A step-by-step operating procedure shall be affixed to the wall close to the laser or on the laser itself.

8.2 Output Emission Limitations

The laser should be operated at the lowest power commensurate with the required application.

8.3 Laser Worker Training

Education and training are required for all operators, maintenance and service personnel for Class 3B and 4 laser systems. Training is required where a Class 1 laser system contains an imbedded Class 3B or 4 laser Training is provided for users of all other classes. The level of such training shall be commensurate with the level of potential hazard.

8.4 Authorized Personnel

Class 3B or 4 lasers and systems with imbedded Class 3B or 4 lasers shall only be operated, maintained and serviced by authorized personnel.

8.5 Alignment Procedures

Laser incident reports have repeatedly shown that an ocular hazard may exist during beam alignment procedures. Alignment of Class 2, 3R, 3B and 4 laser optical systems shall be performed in such a manner that the primary beam, or a specular or diffuse reflection of a beam, does not expose the eye to a level above the applicable MPE.

Written SOPs outlining alignment methods for Class 3B and 4 and imbedded class 3B and 4 lasers shall be develop and approved by the laser supervisor.

8.6 Protective Equipment

Enclosure of the laser equipment and the beam path is the preferred method of control, since the enclosure will isolate or minimize the hazard.

When the engineering control measures do not provide adequate means to prevent access to direct or reflected beams at levels above the MPE, it may be necessary to use personal protective equipment such as goggles or spectacles, barriers, windows, clothing and gloves.

Protective equipment should not be used as the only control measure with higher-power Class 4 lasers as the equipment may not adequately eliminate or reduce the hazard and may be damaged by the incident laser radiation.

Section 9 of this document provides guidance in the selection of protective eyewear.

8.7 Spectators

When the laser is operating, spectators should not be permitted within a laser controlled area which contains a Class 3B laser and shall not be permitted within a Class 4 area unless:

- Appropriate approval is obtained from the laser supervisor.
- The degree of hazard and avoidance procedure has been explained, and
- Appropriate protective measures are taken.

The administrative controls are summarized in the following table.

**SUMMARY OF ADMINISTRATIVE CONTROL MEASURES FOR
CLASS 3B AND CLASS 4 LASERS**

CONTROL MEASURE	CLASS 3B	CLASS 4
Standard Operating Procedures (8.1)	Recommended	Required
Output emission limitations (8.2)	Recommended	Recommended
Laser worker training (8.3)	Required	Required
Authorized personnel (8.4)	Required	Required
Alignment procedures (8.5)	Required	Required
Protective Equipment where MPE is exceeded (8.6)	Required	Required
Spectator control (8.7)	Recommended	Required

9. PERSONAL PROTECTIVE EQUIPMENT

9.1 Eye Protection

The laser supervisor shall ensure that appropriate eye protection is available and work by all personnel within the Nominal Hazard Zone for Class 3B and 4 lasers where exposure above the MPE may occur.

The eyewear shall be clearly labeled with the optical density and the wavelength for which protection is provided.

The LSO shall specify and/or approve the selection of protective eyewear.

9.2 UV Laser Protection

For Class 3B and 4 lasers operating in the ultraviolet region (180 to 400 nm), skin protection shall be used if exposures are anticipated at or near the applicable MPE for the skin.

Types of skin protection would include laboratory coats, tightly woven fabrics, opaque gloves, and “sun screen” creams.

9.3 Other Protective Equipment

The use of other protective equipment (e.g. respirators, hearing protection, local exhaust ventilation, face shields) may be required depending on the presence of other physical or chemical hazards present.

10. MEDICAL SURVEILLANCE

Medical examinations shall be performed as soon as practical (usually within 48 hours) after any suspected injury or adverse effect from a laser exposure. Such examinations shall be arranged and coordinated through the Human Resources Department.

The University may require pre-exposure eye examinations for persons working with Class 3B and 4 lasers.

11. INSPECTIONS

The Laser Safety Officer will inspect all new Class 3B and 4 lasers and laser systems before they are put into operation. The LSO shall also inspect all Class 3B and 4 lasers on a regular basis (at least annually) for compliance with the laser safety program.

12. REPORTING OF ACCIDENTS AND INCIDENTS

All accidents or incidents involving lasers which result in or have the potential to result in personal injury must be reported promptly to the University Safety Officer and to the Laser Safety Officer.

13. PROGRAM AUDIT

The University Safety Officer, in conjunction with the Laser Safety Officer, shall audit various components of the laser safety program on a periodic basis but at least annually. The results of the audit shall be reported to the University Joint Health and Safety Committee.

The purpose of the audit is to determine the extent of compliance with and the completeness and effectiveness of the laser safety program.

The audit may consist of but is not limited to the following:

- Inspections of some Class 3B and 4 laser facilities for compliance with the provisions of the laser safety program,

- Review of training records to confirm that laser supervisors and workers have received appropriate training,
- Review of records of inspections conducted by the Laser Safety Officer, and
- Review of accident/incident records.

APPENDIX A**LASER REGISTRATION FORM**

Date: _____

Laser Class:3B 4 Unknown **Manner of Operation:**Continuous wave (CW) Power: _____ mWPulsed: Pulse Duration: _____ sQ-switched Energy/Pulse: _____ J

Pulse frequency: _____ Hz

Wavelength of emitted beam: _____ nm**Lasing Medium:** _____**Beam totally enclosed?** Yes No **Ancillary Hazards:**

High Voltage: _____ V (specify)

Gases: _____ (specify)

Cryogenics: _____ (specify)

Dyes: _____ (specify)

Laser Supervisor (individual responsible for the laser)

Name/Title: _____

Office: _____ Telephone: _____

Location of Laser:

Building/Room Number: _____