

Laser Safety Manual

Texas State University

May 1, 2007

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PREFACE

RADIATION SAFETY is the responsibility of all faculty, staff, and students who are directly or indirectly involved in the use of laser devices.

The Texas State University at San Marcos is licensed by the State of Texas to use lasers in research, development, and instruction. While this means a minimum of controls by the state, it entails the responsibility that we establish and pursue an effective Laser Safety Program. It is the purpose of this manual to set out the guidelines of that program.

The use of lasers in a university, where a large number of people may be unaware of their exposure to laser hazards, makes strict adherence to procedures established by federal and state authorities of paramount importance. Special efforts to ensure the safety of faculty, staff, students and the general public are essential. The Environmental Health, Safety & Risk Management Office has the responsibility for establishing and pursuing an effective Laser Safety Program for this University.

It is the responsibility of all faculty, staff, and students involved in laser work to familiarize themselves with the program outlined in this manual, and to comply with its requirements. Laser safety depends on a continuous awareness of potential hazards.

Texas State University – San Marcos Laser Safety Committee:

Dr. Hector Flores, Dean of Science

Dr. Wilhelmus Geerts, Associate Professor - Physics Department

Dr. David Easter, Professor – Chemistry and Biochemistry

Terry Dowdy, Director – Environmental Health, Safety & Risk Management

Gus Cantu, Supervisor – Laboratory Services - Technology

	<u>Ext.</u>	<u>After 5pm</u>
TEXAS STATE UNIVERSITY LASER SAFETY OFFICER		
Bill Hollingsworth	5-1834.....	5-2805
Environmental Health, Safety & Risk Management Thornton House		

TEXAS STATE UNIVERSITY ENVIRONMENTAL HEALTH, SAFETY & RISK MANAGEMENT OFFICE

EHSRMO	5-3616.....	5-2805
Thornton House		

TEXAS STATE UNIVERSITY POLICE DEPARTMENT

Nueces	5-2805.....	5-2805
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ALL EMERGENCIES

(TEXAS STATE UNIVERSITY Police Dispatcher) . **911**

UTILITY OUTAGES (Utilities Operations)	5-2350.....	5-2108
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TEXAS DEPARTMENT of STATE HEALTH SERVICES RADIATION CONTROL

Routine Business	512-834-6688
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In the event of a fire, explosion or other serious incident involving lasers, call the TEXAS STATE UNIVERSITY Police Department as soon as possible (911 on a university phone) and be prepared to provide the dispatcher with the following information-but do not delay an EMERGENCY call to accumulate this information:

Location of the fire/incident (BUILDING & ROOM/LAB NUMBER)

Hazardous materials involved (LASER/ NAME/TYPE, ETC.)

If medical assistance is needed (TYPE & NUMBER OF INJURED)

SECTION I – MANAGEMENT OF BROAD LICENSE

Introduction

The purpose of this manual is to provide users and non-users of lasers the more significant facts and figures about laser safety. Overviews of state regulations, and direct policies and procedures concerning different areas of laser use at Texas State University are covered. The regulations, policies and procedures set forth in this guide are written to protect Texas State University faculty, staff, students, and visitors against unnecessary and potentially harmful exposures.

A. Definitions of Key Terms and Acronyms

1. Agency means the Texas Department of State Health Services Radiation Control.
2. DSHS means Texas Department of State Health Services
3. LSO means the Laser Safety Officer
4. Registration means Texas Certificate of Registration for lasers No. Z01624
5. LSC means the Laser Safety Committee of Texas State University.
6. TAC means the Texas Administrative Code.
7. EHSRMO means Environmental Health, Safety & Risk Management Office

B. Laser Safety Program

1. Objective: This program is designed to prevent occupational and public exposure to laser energy to protect the staff, employees, and students of Texas State University; to protect members of the general public; and to comply with 25 TAC §289.301 [Texas Regulations for Control of Laser Radiation].
2. The program is based upon the laser classification as designated in American National Standard Z136.1-2000 section 3.3 "Laser and Laser System Hazard Classification Definitions."
3. Method: Texas State University has established this Laser Safety Manual (LSM) to provide guidance to faculty, staff, and students when working with Class 3b and Class 4 lasers.
4. Date of Implementation: January 1, 2005, upon approval by the LSC.
5. Review: This program will be reviewed no less than once per year.

C. Laser Safety Management

Should any operation involving lasers present a threat to the staff or students of the University, or to any member of the general public, the EHSRMO has the authority to terminate any such operation until the hazard is removed or mitigated.

D. Laser Safety Committee

1. Purpose and Structure: The LSC is composed of a group of administration, faculty, and staff appointed by the University President via the Dean of the College of Sciences to establish policies and regulations governing the use of non-ionizing radiation and lasers. The president has designated the Office of the Vice President for Academic Affairs as his duly authorized representative on matters relating to Laser Safety.
2. Duties (LSC Charge) - The LSC will:
 - a. establish policies and procedures, as well as provide administrative advice regarding radiation and laser safety;
 - b. approve or disapprove all applications, amendments, and renewals relating to the use of lasers in a timely manner;
 - c. receive and review reports from the LSO on monitoring and surveillance;
 - d. monitor procurement, use, and disposal procedures;
 - e. take appropriate corrective action on laser incidents, including administrative guidance and license suspension or revocation;
 - f. serve as an avenue of appeal in cases of dispute and exception to actions by the LSO.
3. Laser Safety Committee Membership – The committee shall be composed of:
 - a. Chair as appointed by the President
 - b. Representatives from each department that utilizes lasers;
 - c. Director of EHSRMO;
 - d. LSO (Ex-Officio); and
 - e. Additional members who are experienced in dealing with non-ionizing radiation, or lasers.
4. Laser Safety Committee Appointment - The members of the committee will be appointed by the President of the University. The Dean of the College of Sciences will nominate members of the committee, other than those specified by virtue of their position. The LSO will serve as the Executive Secretary to the committee. Each member will serve a term of three years except when lesser terms may be required to maintain balanced membership and continuity of committee operations. Reappointments are permissible.
5. Laser Safety Committee Operating Procedures:
 - a. The LSC shall schedule a regular meeting at the beginning of each academic year. Additional meetings may be called as necessary. The LSO will prepare and distribute a written agenda to committee members at least one day before each scheduled meeting.
 - b. A quorum, at least one-half of the voting members, is required to conduct official business. The LSO, Chairperson, and Director of EHSRMO must be present to constitute a quorum.

- c. Sub or ad hoc committees may be appointed by the Chairperson as needed.
 - d. If a committee member is unable to continue serving on the committee for any reason, the member shall notify the Chairperson so that a replacement may be appointed promptly.
 - e. If a committee member fails to attend meetings on a regular basis, without just cause, the Chairperson will contact that member to determine if that person should be replaced. If so, the Chairperson will ask the Dean of the College of Sciences to arrange for a replacement under the appointment procedures of the committee.
6. Laser Safety Committee Responsibilities - The LSC shall:
- a. Establish policies regarding laser safety.
 - b. Provide administrative advice to the LSO on matters regarding laser safety.
 - c. Periodically review the overall use of laser sources at Texas State University from the standpoint of operational hazards.
 - d. Receive and review all reports from the LSO concerning laser incidents at Texas State University.
 - e. Conduct necessary investigations, hearings, and / or appropriate corrective action on any laser over-exposure occurrence at Texas State University.
 - f. Perform an annual audit of the Laser Safety Program.
 - g. Upon committee action, issue sub-licenses, which will be duly signed and approved by the Chairperson of the LSC.

E. Laser Safety Officer

1. Responsibilities – the Laser Safety Officer (LSO) will be a trained professional who is responsible for compliance with these policies and the regulations. The LSO will also provide a variety of technical services necessary to maintaining safety and compliance with regulatory requirements.
2. LSO Duties - The duties of the LSO include:
 - a. Oversight of all operating, safety, emergency, and procedures and activities, and annual reviews.
 - b. Ensuring that users of lasers are trained in laser safety, as applicable for the class and type of lasers the individual uses.
 - c. Investigation and reporting of the circumstances for each known or suspected case of laser over-exposure to an individual and each theft or loss of lasers, to include the cause(s), and recommended corrective action to prevent recurrence;
 - d. Maintenance of an inventory for all Class 3b and 4 lasers and laser systems on university property.
 - e. Maintenance of a continuous program evaluation through routine lab inspections and hazard elimination;
 - f. Maintenance of laser safety program records in the EHSRMO.

- g. Regular reports to the LSC.
- h. Maintenance of a thorough knowledge of management policies and administrative procedures of Texas State University.
- i. Prevention, by immediate suspension or termination of activity if necessary, of any unsafe or illegal use of lasers.
- j. Maintenance of files on each sub-licensee in the EHSRMO, and provision for each sub-licensee of a copy (and updates) of the "Laser Safety Manual – Texas State University Policies and Procedures for Laser Safety"; and
- k. Performance of other tasks as requested by the LSC.

F. Environmental Health, Safety & Risk Management Office

Conducts operations and services to support the University laser safety program.

SECTION II – SUBLICENSE PROGRAM

A. Definitions:

1. Broad License – the specific certificate of registration issued to Texas State University by the Bureau of Radiation Control of the Texas Department of State Health Services. The registration authorizes laser use programs to be conducted at the discretion of the LSC.
2. Sub-License – an authorization issued by the LSC to use Class 3b and Class 4 lasers.
3. Sub-Licensees – Authorized users, faculty members or staff, whose training and experience are such that they have been sub-licensed by the LSC to use non-ionizing radiation in their research and educational activities.

B. Sub-License Application Procedures

1. Qualifications for Sub-License
 - a. The applicant must have sufficient training and experience in the use of the laser(s) requested to ensure that proposed work is conducted and/or supervised in a safe manner.
 - b. The applicant must be a Texas State employee.
 - c. The applicant must specify on the application the type of lasers to be used as well as the safety precautions to be used.
 - d. The LSC will authorize issuance of the sub-license if it determines that all requirements have been met.
 - e. The LSC may require an applicant to attend the Texas State Laser Safety Training and/or obtain experience by working under an active sub-license for a specified period.
 - g. See Section III.F for requirements for individuals working under an applicant's sub-license.
2. Procedure for Obtaining a Sub-License
 - a. The prospective sub-licensee will complete the following forms:
RMS-LSF-001, "Laser Use Authorization Request"
RMS-LSF-002, "Restricted Laser Registration"
RMS-LSF-005, "Laser Class 3b & 4 Authorized Users List"
 - b. The LSO will review all applications.
 - c. If an application (for amendment or renewal only) is properly completed by the applicant or authorized user and a qualifying inspection (for new laboratories) or a recent inspection of the laboratory by the TEXAS STATE UNIVERSITY Laser Safety Officer shows that the laboratory is in compliance with state and local regulations, interim approval not to exceed 30 days may be granted by the LSO.
 - d. A diagram of the proposed work area in the laboratory must accompany the application, indicating laser work areas, non-laser work areas, and equipment locations, and if applicable the Nominal Hazard Zone.

- e. Final approval of all applications is required by the Texas State University LSC.
 - f. All applications must be filled out completely and signed by the applicant. All applications not filled out completely and correctly will be returned to the applicant for re-submission.
3. Sub-License Renewal and/or Amendment
- a. Term of Sub-license - Texas State University sub-licenses remain in effect for two years from date of issue.
 - b. Renewal - Although the EHSRMO will generally remind sub-licensees of a pending expiration, it is the sole responsibility of the sub-licensee to submit the renewal application timely to avoid expiration of a sub-license before receipt of renewal application by the Laser Safety Officer.
 - c. Actions or activities requiring an amendment to a sub-license:
 - If there is a change in the terms and conditions of sub-license or if procedures authorized by it change (personnel, lab relocation, etc.)
 - If there is a change in equipment
 - If there is a significant change in submitted Operating Procedures
 - If significant changes occur in the normal operation of sub-license procedures
 - Application forms for license renewal or amendment are available from the Laser Safety Officer
4. Absence of Sub-Licensee from Campus
- If a sub-licensee expects to be absent from the campus for more than 30 days, the LSO shall be notified and the sub-licensee shall:
- a. Deactivate all lasing equipment on the sub-license during the absence OR to notify the LSO as to the responsible individual (another sub-licensee) who will take over supervision of the use of the laser equipment.
 - b. Should arrangements not be made, the LSC Chairman and LSO shall revoke and terminate the sub-license. The LSO will terminate all laser use in the affected laboratories.
 - c. It is the sole responsibility of a sub-licensee to notify the LSO during a period of his/her absence and to take appropriate actions as outlined above.

5. Procedure for Termination of a Sub-License

The following procedure shall be used should a sub-licensee desire to terminate their laser equipment sub-license.

 - a. A letter of intent to terminate the sub-license will be submitted to the LSO. This letter will include:
 - The date of termination
 - The listing of the sub-licensee's authorized laboratories
 - A statement that all lasing equipment used and/or stored will be removed
 - b. Upon receipt of the letter of intent, the LSO will conduct a close-out survey of the affected areas and equipment
 - c. Based on a review of the letter of intent, the results of the close-out survey, and the disposition of lasing equipment, the LSO will make his recommendations to the LSC at its next meeting, which in turn will consider and vote on the request to terminate the sub-license
 - d. Upon termination, all signs and labels (See 3D) indicating that the areas were authorized for use lasing equipment, shall be removed.
 - e. The laboratory notebook, as required by III.L, should be forwarded to the LSO for archiving.
 - f. Should a sub-licensee permanently leave Texas State University and neglect to officially terminate his/her sub-license, the LSO upon notification will contact the absent sub-licensee's Department Chairperson. The Department Chairperson will be responsible for initiating the sub-license termination procedures as outlined above
6. Deactivation of Sub-License or Lasing Equipment

Should a sub-licensee foresee a period of time in which they do not plan to use all or some of the laser equipment the affected laboratory and/or the specific equipment may be deactivated, by meeting the following criteria:

 - a. A letter of intent to deactivate the sublicense/ specific equipment will be submitted to the **LSO**. This letter will include:
 - The date of deactivation
 - Laboratory Deactivation:
 - The listing of the sub-licensee's authorized laser inventory and laboratories, including storage areas. A diagram of all these areas should accompany this letter of intent.
 - A statement that all lasers used and/or stored in the affected laboratory will be secured against any use.
 - Specific Equipment Deactivation:
 - A statement that the laser deactivated will be stored and secured against any use.
 - A statement that all associated laser hazards are secure and contained to ensure compliance with regulations

- b. Upon receipt of the letter of intent, the **LSO** will perform an inspection of the laboratory and laser equipment to confirm deactivation of laboratory and/or laser equipment.
 - c. Based on a review of the letter of intent, the results of the inspection, the **LSO** will make his recommendations to the **LSC** who, in turn, will authorize deactivation of the laboratory/specific equipment.
 - d. Upon deactivation, all signs and labels, indicating where laser use was authorized for use shall be removed
 - e. The Laboratory notebook, as required by III.L, shall be kept by the Principal Investigator if reactivation of the laboratory at a later date is possible. If reactivation will not be performed, then forward the laboratory notebook to the LSO for archiving.
 - e. **AT THIS POINT, FURTHER USE OF LASER EQUIPMENT BY THE SUBLICENSEE AND INDIVIDUAL WORKERS OF THAT SUBLICENSE/LASER EQUIPMENT IS STRICTLY PROHIBITED.**
 - f. The term of deactivation of an authorized laser use area will be a MINIMUM OF FIFTEEN DAYS AND A MAXIMUM OF UP TO TWO YEARS (or until the sublicense is due for renewal).
 - g. During this period in which the laser use area/specific laser equipment is deactivated, the sublicense will remain in an active status. If there are still active lasers on the sublicense, all current rules, regulations and policies governing that sublicense (relative to the active lasers) remain in effect. Since the deactivated laboratory/laser is no longer considered active, the requirement for inspections no longer applies. However, the sub-licensee is still responsible for the retention of ALL records and files which were generated for that laboratory/ laser.
7. Reactivation of Sub-License or Lasing Equipment
A sublicensee may REACTIVATE a sublicense/lasing equipment at any time AFTER the initial fifteen day period if the following criteria are met:
- a. A letter of intent to reactivate the sublicense/lasing equipment will be submitted to the LSO. This letter shall include:
 - The date of reactivation
 - A listing of the laboratory/lasing equipment to be reactivated.
 - Any new Class 3b and/or 4 lasing equipment must be registered using a form RMS-LSF-002, "Restricted Laser Registration".
 - b. Any changes in work areas, storage areas, etc. must be reflected on the letter of intent. Include a diagram of all these areas if necessary.
 - c. The LSO will review the request and inspect the laboratory and make recommendations to the Chairperson of the LSC.

- d. After the Chairperson has approved the reactivation of the laser equipment, it will, again be subject to the posting, required records, safety procedures, and survey/safety check requirements as stipulated by federal, state, and local TxState regulations and policies

C. Sub-Licensee Inspection/Monitoring Program

1. The LSO shall inspect all laser usage facilities for compliance with all applicable regulations - state, federal, and local.
2. The LSO shall make a record of each inspection and keep those on file.
3. The LSO will forward a formal report of inspection to each sub-licensee within two weeks of final evaluation of his/her inspection results, noting corrective action needed.
4. Each sub-licensee will revise or correct his/her individual program as noted in the report under "Corrective Actions". Questions or problems should be addressed to the LSO or the LSC.
5. The LSO will request a written response to the "Corrective Actions" from the sub-licensee within 30 days.
6. The LSO will report all major violations as well as any instance of noncompliance for a sub licensee to the LSC.
7. The LSO shall make follow-up inspections of all sub-licensees having deficiencies deemed serious by the LSC within 15 days of report.
8. All inspection statistics should be evaluated by the LSC.
9. Sub-licensees having repeated violations (same violation during two consecutive inspections) will be reported to the LSC for appropriate action.
10. A Sub-licensee who commits the same violation during three consecutive inspections will be reported to the LSC. The LSC will issue a written notice and require the sub-licensee to meet with the committee during the next scheduled meeting to explain their violation.
11. The LSC may terminate a sub-license if major violations are continued.

SECTION III – LASER SAFETY PROGRAM

Introduction

The purpose of this section is to inform users and non-users of laser equipment about the policies and procedures concerning laser use at Texas State University and state regulations, 25 TAC §289.301. Policies and Procedures set forth in this guide have a primary goal to protect Texas State University faculty, staff, students, and visitors against unnecessary and potentially harmful laser exposure. This manual includes the procedure for permitting lasers at Texas State University, and the requirements to obtain a Sub-license permit for laser usage from the Laser Safety Committee.

A. General

The LSO performs routine monitoring and inspections of all laser sub licensees and the results are then presented to the LSC for their evaluation. Through this process, the Laser Safety Program at Texas State University can keep abreast of past, present, and future concerns with laser safety.

The entire radiation safety program (including lasers) is periodically inspected by a Regional Inspector from the Bureau of Radiation Control for compliance with the Texas Regulations for the Control of Laser Radiation Hazards. The results of these inspections are presented to the Director of EHSRMO and Safety, the Laser Safety Officer, and the Laser Safety Committee.

1. General Monitoring
 - a. The LSO may visit laboratories to ensure laser operations are according to procedures set forth in this manual and sub licensee's approved standard operating procedures.
 - b. The LSO will immediately report any violation to the sub licensee and LSC.
2. Formal Inspections
 - a. Laser inspections will be performed annually by the LSO.
 - b. Inspection results will be presented to the LSC.
 - c. Violations found will be brought to the attention of the sub licensee.
 - d. Inspections results and reports will be sent to the sub licensee.
3. Violation Levels

Violations by a sub-licensee are classified as either major or minor. All violations will be presented to the LSC at the next regularly scheduled meeting. A copy of the most current monitoring and inspection criteria and the type of violation may be obtained from the LSO.

- a. Major Violations - include but are not limited to:
 - (1) Unauthorized personnel in laser work area when laser is in use. Authorized personnel are listed on the Laser Class 3b & 4 Authorized Users List form (RMS-LSF-005.);
 - (2) Operation of laser equipment in a manner, which could cause injury to personnel outside the laser area;
 - (3) Operation of laser equipment in a manner other than that specified in the approved standard operating procedures;
 - (4) Personnel in a laser area (NHZ) not utilizing proper personal protective equipment when the laser is in use;
 - (5) Operation of laser equipment without prior authorization from the LSC and LSO; or
 - (6) Any combination of (1) to (5).

Any major violation may warrant the immediate deactivation of the laser operation, and will remain so until safety concerns are addressed.

- b. Minor Violations - include but are not limited to:
 - (1) Improper posting of a laser area;
 - (2) Improper labeling of laser equipment;
 - (3) Log books not filled out as required;
 - (4) Monthly surveys and interlock checks not performed;
 - (5) Standard operating procedures and laser equipment manuals not in vicinity of laser equipment;
 - (6) Expiration of a laser sub-license; or
 - (7) Information on laser sub-license out of date.

Any minor violation will be reported to the Sub-licensee for correction and results discussed in the LSC meeting.

B. Lasers or Laser Equipment Purchase/Transfer

1. Purchase
 - a. Requestor will contact the LSO.
 - b. Requestor will provide the following information:
 - (1) Sub-licensee
 - (2) Description of item
 - (3) Manufacturer/Vendor
 - (4) Model and Serial Number
 - (5) Quantity
 - (6) Purpose
 - (7) Location of intended use
 - c. LSO will:
 - (1) Verify status of sub-license
 - (2) Document information received

- d. When laser received, the Sub-licensee will complete the following and forward to the LSO within 5 business days:
 - (1) Restricted Laser Registration Form (RMS-LSF-002)
 - (2) Laser Transaction Form (RMS-LSF-006)
2. Transfer of Laser Equipment
 - a. Requestor will contact the LSO and Property/Surplus Manager
 - b. Requestor will complete a Laser Transaction Record Information form (RMS-LSF-006) and forward to the LSO within 5 business days.
 - c. LSO will document information

C. Facilities (25 TAC §289.301(r))

1. Laser work areas(s) will have restricted access from non-authorized personnel.
2. Laboratories will have heat-chemical resistant materials in the beam paths (when applicable).
3. Laser work areas and lab entrances will be posted with the correct warning signs. (Signs available from LSO)
4. All signage (sub-license, emergency numbers, etc.) shall be posted in prominent view.
5. Laboratories will have all windows covered with appropriate materials.
6. Laser dye, solvent, and gas laboratories will have ventilation, fume hoods, and gas cabinets capable of handling and storing the chemicals being utilized in order to comply with regulatory limits.

D. Signage (25 TAC §289.301(v))

1. Laser equipment will be labeled with manufacturer and class designation.
2. Laser equipment will have labels with warning, output, duration, medium, and wavelength.
3. Laser protective housing and enclosures will be labeled during normal and servicing operations.
4. Labels will be specific to the hazards of the laser determined by the LSO.
5. Signage must be posted during maintenance and servicing operations and as stated in the Standard Operating Procedures.

E. Control Area and Access

1. Laser work areas(s) will have restricted access from non-authorized personnel.
2. Class 3b and Class 4 laser laboratories will control access to the laser radiation.

NOTE – All costs for installations and materials will be assumed by the sub-licensee or their department.

F. Training

1. Authorized Users
 - a. Workers (Technicians, students, graduate assistants, post doctoral researchers, etc.) who will be working with a Class 3b or 4 lasing device must complete the Laser Safety Course.
 - b. The course consists of the following:
 - Classroom/self-study of Texas State University Laser Safety training material.
 - A written exam. Minimum score for passing is 80%.
 - Completion of Laser Operator Qualification Card form RMS-LSF-004.
 - c. When form RMS-LSF-004, is complete, the form must be forwarded to the LSO for documentation and retention.
 - d. Sub-Licensee must update form RMS-LSF-005 for all lasers that the individual will be associated with and send a copy of the form to the LSO.
2. Incidental Users
 - a. Workers (technicians, students, graduate assistants, etc.) who as a result of their job/education requirements may be present in a laboratory during the operation of a Class 3b or 4 laser but are **NOT** an authorized user must complete the following:
 - Completion of the Texas State University "Laser Awareness Non-User" presentation.
 - Completion of "Mastering Light: An Introduction to Laser Safety and Hazards" video.
 - b. Completion of the training requirements shall be documented and kept in the laboratory notebook. A copy shall be forwarded to the LSO for retention.

G. Personal Protective Equipment (PPE)

1. Laser eyewear
 - a. Must be in good condition and comfortable.
 - b. Must be labeled with wavelength and optical density.
 - c. Must be inspected every year to ensure the reliability of the protective filters and integrity of the protective filter frames.
2. Protective clothing
 - a. Clothing shall be appropriate for the protection of the operator.
3. Chemical resistant gloves for handling of dyes and solvents.
4. Various forms of shielding appropriate for the hazard.
5. Hearing protection if work environment exceeds regulatory limits.

H. Instrumentation

1. Laser equipment will have protective housing.
2. Laser safety interlocks for all Class 3b and Class 4.
3. Laser equipment will have either a key switch or a computer code.
4. Laser laboratories will have optical attenuators
5. Laser equipment will have operational lights, alarms, and devices to notify others that the laser is in "on."

I. Standard Operating Procedures (SOP)

The items listed are recommended to be included in the SOP's for each laser. The information can be revised in part to reflect major modifications that affect the laser's performance and operation.

1. General Information
 - a. Information of the laser owner
 - b. Inventory control (Texas State University ID Number)
2. System Information
 - a. Description
 - b. Location
 - c. Class
3. Hazards Summary
 - a. Beam information
 - b. Non-Beam information
4. Required Control Measures
 - a. Access Controls
 - b. System Controls
 - c. Personnel Controls
5. Alignment Procedures
 - a. By Whom
 - b. Conditions
 - c. Can be general for research purposes with the LSC approval.
 - d. Buddy Policy is recommended for Class 3b and Class 4 laser laboratories.
6. Emergency Instructions

J. Modifications

1. A laser or laser system that requires modification that significantly changes the SOP and performance **SHALL NOT** be operated until approved by the LSO.
2. Modifications not reported to the LSO are in violation of the SOP approved by the LSC and terms of the sub-license.

K. Usage Logs

The usage logs must be dated and initialed by operator each time the laser equipment is operated. This log should include notes of adjustments, operation conditions, maintenance, servicing, and problems.

L. Record Keeping

The laser sub-licensee should keep the following for documentation and inspection purposes in one notebook. The records shall be available during routine monitoring of the lab by EHSRMO personnel and/or regulatory agencies.

1. Standard Operating Procedures (SOP)
2. Signatures of SOP and Personal Protective Equipment (PPE) Training
3. Sub-licensee Information
 - a. Sub-license - All Sub-licensees should have a current copy.
 - b. Amendments/Renewals-All copies of laser changes.
 - c. Past Inspection Reports-All inspection reports sent from the LSO.
 - d. LSO Memos-All memos from the LSO are available upon request.
 - e. Laser Inventory-All current laser inventories for inspections.
 - f. List of authorized users for the specific lasers in laboratory (RMS-LSF-005 or equivalent).

M. Special Services

1. Special services include but are not limited to the following:
 - a. General Services
 - b. Custodial Services (e.g. scrubbing, stripping, and finishing floors, etc.)
 - c. Building Maintenance
 - d. Construction Services
2. Normally, all laser activity is suspended during the performance of these services.
3. The laboratories shall be surveyed (visual inspection) for any possible hazards within 24 hours of the scheduled service.
 - a. This is the responsibility of the sub-licensee to ensure that this is completed.
 - b. The results of the survey shall be documented in the laboratory notebook.
4. If it is necessary to have the laser in operation during the performance of any of these special services, then an authorized user is required to be present in the laboratory.

N. Routine Custodial Services

1. Routine custodial services include but are not limited to sweeping and/or mopping floors and emptying trash receptacles.
2. Normally, all laser activity is suspended during the performance of these services.
3. If it is necessary to have the laser in operation during the performance of routine custodial services, then an authorized user is required to be present in the laboratory.

O. Other Services

Normally, all laser activity is **suspended** until these services have been performed.

1. Departmental technicians may enter and perform routine duties provided they have the required laser training requirements, and are granted permission by both the sub-licensee and the LSO.
2. Company technicians and servicemen servicing or checking items on any laser equipment must have the permission of the LSO. The Sub-licensee will be required to have the lab surveyed within 24 hours prior to their visit. An authorized user **IS** required to be in the lab during the services.

P. Lab Personnel

1. Authorized
Personnel such as faculty, students and other professionals, usually research or laboratory assistants or workers that may be engaged in education, laboratory research, and research support activities may work with lasers but only after completing the required safety training program and the express approval of the LSC or the LSO. The names of authorized personnel will be designated on the authorized users list that is kept in the laboratory notebook. Individuals not listed on the sub-license are not authorized personnel.
2. Non – Authorized
Personnel such as faculty, students, and other professionals and non-Texas State University personnel which have not had Texas State University Laser Safety Training nor the express approval of the LSO or LSC or whose names do not appear on a given laser authorized users list.
3. Incidental-Users
Personnel such as faculty, students, and other professionals that may be engaged in education, laboratory research, and research support activities that do NOT work with lasers but may require unaccompanied access to the laboratory.

SECTION IV – SPECIFIC LASER REQUIREMENTS

A. Class 3b and Class 4 Laser

All Class 3b and Class 4 lasers require the following five items to be in full compliance of 25 TAC §289.301. Exemptions will be determined by substituting engineering and administrative controls reviewed by the LSC and the LSO.

1. **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. Parameters that determine the MPE are wavelength, duration, exposure conditions (point or extended source, cw or pulsed, pulse width, pulse repetition frequency). MPE are given in units of radiant exposure (J/cm^2) or irradiance (W/cm^2).
2. **Nominal Hazards Zone (NHZ)**
The space within which the level of direct, reflected, or scattered radiation during operation exceeds the applicable MPE. Exposure levels beyond the boundary of the NHZ are below the applicable MPE level.
3. **Accessible Emission Limits (AEL)**
The maximum accessible emission level permitted within a particular laser class. AEL is in units of mW's.
$$AEL = MPE \times (\text{area of limiting aperture})$$
4. **Optical Density (OD)**
The logarithm to the base ten of the reciprocal of the transmittance. The OD will be labeled on the eyewear for each laser. Optical density in terms of MPE is:
$$OD = \log \left[\frac{E}{MPE} \right]$$

Where:
E = incident beam irradiance in (W/cm^2)
MPE = for laser specifications (Table 5 ANSI Z136.1-2000)
5. **Interlock**
A switch that, when activated, will interrupt normal operation of a laser by closing a shutter or de-energizing the system.

B. Infrared Lasers

Fire resistant materials are to be used in and around the laser work area.

C. Fiber Optic Lasers

The use of a tool shall be required for the disconnection of a connector of the laser fiber optic cable for servicing and maintenance purposes, if the connector is not within a secured enclosure. All connectors shall bear the appropriate label.

D. Constructed Lasers

All "constructed lasers" built from separate components must comply with the 21 Code of Federal Regulations (CFR) Part 1040, Federal Laser Product Performance Standard. Contact the LSO for more specific information.

SECTION V - EMERGENCY PROCEDURES

Introduction

This section outlines basic emergency procedures. An emergency situation or accident can arise from the use, storage, or transfer of radioactive material or from the misuse or abuse of equipment that produces non-ionizing (i.e. laser) radiation. This section is intended to enhance each sub-licensee and worker's ability to react properly to radiation accidents.

Due to the broad scope of possible accidents at Texas State University, listing every step that must be followed for each type of accident would be impracticable. Instead, one must use the following basic procedures and apply them to his/her individual situation. The best advice for protection against laser accidents is to prepare for them.

A. General Information

A laser incident at Texas State University should be defined as any unintentional accident or any single exposure or suspected exposure or accident involving laser radiation exposure to the eyes or skin.

NOTE

If persons involved in a laser incident are unsure as to the extent of the incident, those persons shall proceed with the assumption that an incident has occurred, unless otherwise noted. Users will report all laser incidents.

B. Organization and Authority

1. The LSO shall have responsibility for incident investigation.
2. The LSO will promptly report all investigation findings to the LSC and to the Agency [reference TAC §289.301(z)] for direction and action.
3. If preliminary findings of an incident presented to the LSC indicate there is probable cause of neglect or violation of state, federal, or local regulations or policies, the sub-licensee involved will be asked to attend the next LSC meeting to answer questions and present his/her account of the incident.
4. In the event of a major emergency situation the LSO shall have the authority to bring the situation under control. It should be noted that this may not follow the Texas State University Administration Organization Chart. However, this will only be used in extreme emergencies where there is immediate danger to individual(s) or major buildings.
5. It is the responsibility of each sub-licensee to see that personnel working under their supervision have practical and easily understood plans for an emergency, and control of an emergency in their respective laboratory.

6. The LSO has the responsibility to see that each laser user knows how to:
 - a. Recognize a laser emergency.
 - b. Prevent or confine the accident.
 - c. Exclude all personnel from possible risk of exposure.
 - d. Immediately contact his/her supervisor, the LSO, and/or other emergency personnel for assistance.
7. Each user will be responsible for assisting the LSO in controlling and/or investigating the accident. Furthermore, the sub- licensee is responsible for assisting the victim(s) in obtaining medical attention, if necessary, as soon as practicable.

C. Fires, Explosions, or Major Emergencies

1. Notify personnel in the area to leave at once.
2. Call 911 Give them the address and the location of the emergency.
3. If possible shutdown lasing equipment before evacuating the area.
4. Contact LSO.
5. If firefighters arrive before the LSO, caution them that lasers are present in the area.
6. All users will be required to file an incident report with the LSO.
7. **MINOR FIRES** - If the fire is minor (individual decision) and there are no laser or chemical hazards involved, a user may attempt to put out the fire with approved fire fighting equipment.

D. Accidents Involving Possible Laser Exposure

If a laser exposure has occurred, or is suspected to have occurred, proceed as follows:

1. Immediately remove affected person(s) from the area and notify the LSO.
2. Secure the area.
3. Take the affected persons(s) to the nearest emergency center immediately for clinical observation. Be sure to inform the attending medical personnel that it is a laser accident. Be prepared to answer any questions that may arise concerning the accident or type of laser involved.
4. Assist the LSO in obtaining all details of the incident.
5. The LSO will provide reports to the TDH, LSC, and regulatory agencies.

E. Loss Or Theft Of Laser Equipment

1. Any loss or theft of a laser shall be immediately reported to the LSO.
2. The LSO will provide required notification to the Bureau of Radiation Control.
3. The LSO will determine the extent of damage and analyze the recovery plan.

NOTE –Unauthorized repair of any laser device **IS PROHIBITED**. Laser sources involved in an accident, fire, flood, etc. **MAY NOT BE USED** until tested by the LSO and found to be in proper and safe operating condition.

F. Malfunction of Laser Equipment

1. Any laser believed to be defective shall be locked into a safe position and made inoperative immediately. In emergency situations the individual user, authorized user, and/or the LSO can take such action as to deactivate the equipment.
2. The responsible user must restrict access to the area until the LSO arrives.
3. The LSO will evaluate the incident thoroughly, notify the LSC in writing within 10 days and if necessary report the incident to the DSHS within 30 days