

LASER SAFETY MANUAL

POLICIES AND PROCEDURES

FOR

LASER SAFETY

AT

TEXAS TECH UNIVERSITY

LUBBOCK, TEXAS

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TEXAS TECH UNIVERSITY LASER SAFETY MANUAL

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SECTION I – MANAGEMENT OF LASER LICENSE

Introduction

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

A. Laser Safety Program

1. **Objective:** This program is designed to protect the faculty, staff, employees, and students of Texas Tech University (TTU); to protect members of the general public; and to comply with **25 TAC §289.301** [Texas Regulations for Control of Laser Radiation Hazards (TRCLRH)].
2. **Method:** Texas Tech University (TTU) has established this **Laser Safety Manual (LSM)** to provide safety guidance to its faculty, staff, and students when working with lasers. The **Radiation Laser Safety Committee (RLSC)** and **Laser Safety Officer (LSO)** are also, available for additional assistance.
3. **Date of Implementation:** September 1, 2002, upon approval by the **RLSC**.
4. **Review:** This program will be reviewed on an annual basis no later than the anniversary month of its inception.
5. **Program Elements:**
 - a. **Purchase, Transfer, Shipping, and Delivery Notification:** Laser purchase, transfer, shipping, and delivery procedures are specified in II J.1.
 - b. **Access Controls for Laser Areas:** Access to the laser areas is controlled by II J.4 of the **LSM**. In addition, certain elements of administrative and engineering controls regarding storage, use, and maintenance/service procedures contain steps which specifically address access controls.
 - c. **Posting of Areas and Rooms:** II J.3 of the **LSM** provides for posting of the appropriate signage respective of the class(s) of the laser.

- d. **Training:** II J.5 of the LSM addresses the required training for laboratory personnel.
- e. **Management of Required Records:** Records management procedures are addressed in II J.11 of the **LSM**.
- f. **Personal Protective Equipment:** II J.6 provides procedures for providing for the necessary protection respective of the class(s) of the laser.
- g. **Reports of Incidents and Accidents:** All TTU personnel are responsible for reporting incidents and accidents to the **LSO, immediately**. The specific procedures are found in Section V of the **LSM**.

B. Radiation Laser Safety Committee:

1. **Purpose and Structure:** The **RLSC** is composed of a group of administrators, faculty, and staff appointed by the Executive Vice President and Provost to establish policies and regulations governing the use of ionizing and non-ionizing radiation. The **RLSC** is primarily responsible for the administration, implementation, and enforcement of the laser radiation safety program at TTU.
2. **Duties (RLSC Authority) - The RLSC will:**
 - a. establish policies and procedures, as well as provide administrative advice regarding laser radiation safety;
 - b. approve or disapprove all applications, amendments, and renewals relating to the use of laser equipment;
 - c. receive and review reports from the **LSO** on monitoring, surveillance, and exposure;
 - d. monitor procurement, use, and transfer procedures;
 - e. take appropriate corrective action on laser incidents, including administrative guidance and license suspension or revocation;
 - f. provide a representative to the University Safety Committee; and
 - g. serve as an avenue of appeal in cases of dispute and exception to actions by the **LSO**.
3. **Membership – The RLSC shall be composed of:**
 - a. three faculty members who regularly use radioactive materials;
 - b. two faculty members who regularly use lasers;
 - c. at least one faculty member who regularly uses radiation producing equipment;
 - d. at least two faculty/staff members who are non-users of radioactive materials, lasers, or radiation producing equipment;
 - e; **RSO** (Ex-Officio);
 - f. **LSO** (Ex-Officio);
 - g. Associate Vice President for Operations, (Ex-Officio)

The members of the committee will be appointed by the Executive Vice President and Provost. Members of the committee, other than

those specified by virtue of their position, will be nominated by the committee chairperson and the Associate Vice President for Operations. 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. Re-appointments are permissible.

4. **Operating Procedures** - The **RLSC** shall observe the following:
 - a. the **RLSC** shall schedule a regular meeting for each month of the 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
 - 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 three consecutive meetings or one-half of the called meetings in a twelve month period, without just cause, the Chairperson will contact that member to determine if that person should be replaced. If so, the Chairperson will ask the Associate Vice President for Operations to arrange for a replacement under the appointment procedures of the committee.

5. **Responsibilities** - The **RLSC** shall:
 - a. establish policies regarding laser radiation and laser safety;
 - b. provide administrative advice to the **LSO** on matters regarding laser radiation and laser safety;
 - c. regulate type of training needed by laser users to meet applicable statutory and administrative requirements;
 - d. receive, review, and act on all applications and any amendments for the use of laser equipment in any areas used by TTU personnel;
 - e. receive and review periodic reports from the **LSO** on records, surveys, and inspections and require compliance with applicable record keeping standards;
 - f. periodically review the overall use of laser equipment at TTU from the standpoint of operational hazards and potential secondary hazards;
 - g. receive and review all reports from the **LSO** concerning laser radiation and laser incidents at TTU;
 - h. conduct necessary investigations, hearings, and/or appropriate corrective action to be taken if a sublicensee or authorized laser personnel fail to operate the licensed laser equipment according to the criteria specified in this policies and procedures manual at TTU;
 - i. meet regularly during the academic year;
 - j. perform an annual audit of the Laser Safety Program;

- k. upon committee action, issue sublicenses which will be duly signed and approved by the Chairperson of the **RLSC**.

C. **Laser Safety Officer**

1. **Duties:**

The **LSO** is a member of the Radiation Safety Office who is trained in the areas of laser operation and laser safety and registered with the Bureau of Radiation Control. The **LSO** is the University official primarily responsible for compliance with applicable safety policies and regulations. The **LSO** also provides various technical services necessary for achieving such compliance.

2. **Responsibilities - The LSO shall:**

- a. suspend immediately or restrict operation of a laser system when, in the view of **LSO**, the sublicensee or authorized laser personnel working with laser system or other personnel in the vicinity of the laser are in danger;
- b. instruct laser users and others affected in proper procedures and policies concerning laser equipment use, including teaching laser safety training classes. The **LSO** shall also provide consulting services to TTU personnel for aspects concerning laser safety;
- c. assure that appropriate primary control measures are in effect and to recommend alternate control measures as back up if primary measures become infeasible or inappropriate;
- d. generate reports, receive and review records from sublicensees, and maintain all material concerning laser equipment, personnel working in laser areas, and any other information required by the Texas Regulations for the Control of Laser Radiation Hazards (TRCLRH). This shall include, but not be limited to: laser eye protection inspections, incident/accident reports, **LSO** laser lab inspections, registration, inventory forms, and medical surveillance records;
- e. periodically inspect laser sublicensees to ensure proper record keeping, verify inventories, inspect appropriate laser control measures, and ensure compliance with other laser safety aspects as detailed in this manual. The **LSO** shall also inspect all new and existing laser facilities and laser equipment prior to their installation or modification to ensure proper compliance. The results of these inspections shall be periodically presented to the **RLSC**;
- f. investigate all actual and suspected incidents resulting from operation of a laser system by personnel at TTU. The **LSO** shall prepare reports to applicable agencies and the **RLSC** shall approve such reports and initiate appropriate action concerning the incident;
- g. provide each sublicensee with a copy (and updates) of the TTU Policies and Procedures Manual for Laser Safety.

D. Inspections

The **LSO** performs routine monitoring and inspections of all laser sublicensees and the results are then presented to the **RLSC** for their evaluation. Through this process, the Laser Safety Program at TTU can keep abreast of past, present, and future concerns with laser safety.

The entire laser safety program 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 Environmental Health and Safety, the Laser Safety Officer, the Radiation Safety Manager, and the Radiation 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 sublicensee's sops.
- b. The **LSO** will immediately report any major violation to the sublicensee and **RLSC**.
- c. The **LSO** will report minor violations to the sublicensee and **RLSC**.

2. Formal Inspections

- a. Laser inspections will be performed semiannually by the **LSO**.
- b. Inspection results will be presented to the **RLSC**.
- c. Violations found will be brought to the attention of the sublicensee.
- d. Inspections results and reports will be sent to the sublicensee.

3. Violation Levels

Violations by a sublicensee are classified as either major or minor. All violations will be presented to the **RLSC** 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 :
 - (i) Unauthorized personnel in laser area when laser is in use (authorized personnel are listed on the laser sublicense);
 - (ii) Operation of laser equipment in a manner which could cause injury to personnel outside the laser area;
 - (iii) Operation of laser equipment in a manner other than that specified in the approved standard operating procedures;
 - (iv) Personnel in a laser area not utilizing **proper personal protective** equipment when the laser is in use;
 - (v) Operation of laser equipment without prior authorization from the **RLSC** and **LSO**; or
 - (vi) Any combination of (i) to (v).

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

- b. Minor Violations** - include but are not limited to:
 - (i)** Improper posting of a laser area;
 - (ii)** Improper labeling of laser equipment;
 - (iii)** Usage log books not filled out as required;
 - (iv)** Monthly surveys and interlock checks not performed;
 - (v)** Standard operating procedures and laser equipment manuals not in vicinity of laser equipment;
 - (vi)** Expiration of a laser sublicense;
 - (vii)** Information on laser sublicense out of date; or**Any minor violation will be reported to the Sublicensee for correction and results discussed in the RLSC meeting.**

4. Inspection Procedures

- a.** The **LSO** shall inspect all laser usage facilities for compliance with all applicable regulations - state, federal, and local.
- b.** The **LSO** shall make a record of each inspection and keep those on file in the Radiation Safety office.
- c.** The **LSO** will forward a formal report of inspection (Form LS-1) to each sublicensee within two weeks of final evaluation of his/her inspection results, noting corrective action needed.
- d.** Each sublicensee 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 **RLSC**.
- e.** The **LSO** will request a written response to some of the "Corrective Actions" from the sublicensee within 30 days.
- f.** The **LSO** will report all major violations as well as any instance of non-compliance for a sublicensee to the **RLSC**.
- g.** The **LSO** shall make follow-up inspections of all sublicensees having deficiencies deemed serious by the **RLSC** within 15 days of report.
- h.** All inspection statistics should be evaluated by the **RLSC**.
- i.** Sublicensees having repeated violations (same violation during two consecutive inspections) will be reported to the **RLSC** and the **RLSC** for appropriate action.
- j.** A Sublicensee who commits the same violation during three consecutive inspections will be reported to the **RLSC**. The **RLSC** will issue a written notice and require the sublicensee to meet with the committee during the next scheduled **RLSC** meeting to explain their violation.
- k.** The **RLSC** may terminate a sublicense if major violations are continued.

END OF SECTION I

SECTION II – SUBLICENSE PROGRAM

Introduction

This section details the procedures and requirements for obtaining a sublicense for laser equipment. Also included will be procedures for renewals and amendments.

A. Definitions:

1. **Laser License** – the specific laser license issued to TTU by the Bureau of Radiation Control of the Texas Department of Health. This license authorizes all laser use programs to be conducted at the discretion of the **RLSC**.
2. **Sublicense** – an authorization issued by the **RLSC** to use laser equipment.
3. **Sublicensees** - authorized laser personnel, full-time faculty members, whose training and experience are such that they have been sublicensed by the **RLSC** to use lasers in their research and educational activities. The **RLSC** will determine the extent of required training respective of the laser classification involved.
4. **Authorized Laser Personnel** – faculty, students and other professionals, usually research or laboratory assistants or workers which may be engaged in education, laboratory research, and research support activities. These personnel may work with lasers but only after completing the required safety training programs and the Sublicensee amending his/her Sublicense to include them on it.
5. **Non – Authorized Personnel** – faculty, students, and other professionals and non -TTU personnel which have not had TTU Laser Safety Training nor listed on the researcher’s Sublicense.
6. **Operation** – the normal mode of the laser or laser system over the full range of its intended functions. It does not include *maintenance*.
7. **Maintenance** - tasks specified in the maintenance instructions provided by the manufacturer which are to be performed by the user to ensure the intended performance of the product. It does not include *operation*.
8. **Service** – procedures or adjustments described in the manufacturer’s service instruction which are to be performed by a “licensed” manufacturer serviceman which is performed infrequently. It does not include *maintenance* or *operation*.

B. Sublicense Application Procedures

1. Qualifications for Sublicense

- 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 TTU faculty member.
- c.** The applicant must submit a completed application form for a laser usage sublicense, and a resume of use and experience within the area of interest shown by the application. This resume may include papers referencing the use of an instrument, and/or any formal training courses or continued education.
- d.** The applicant must specify on the application all types and numbers of lasers to be licensed as well as the procedures involved.
- e.** The **RLSC** will authorize issuance of the sublicense if it determines that all requirements have been met.
- f.** The **RLSC** will require all applicants to attend the TTU Laser Safety Training and/or obtain experience by working under an active sublicensee for a specified period.
- g.** The **RLSC** will require additional, “specific” training for individuals utilizing any class IIIB and IV laser users.

2. Requirements for Individuals Working Under a Sublicense:

- a.** All workers must document, prior to approval, completion of computer based Laser Safety Training.
- b.** All workers will document, prior to approval, completion of required training for class IIIB and IV lasers.

3. Procedures for Obtaining Sublicense

- a.** The **LSO** will first review all applications.
- b.** If an licensing amendment is properly completed by an authorized laser Sublicensee and a qualifying inspection or a recent inspection of the laboratory by the TTU **LSO** 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**.
- c.** A diagram of the proposed work area in the laboratory must accompany the application, indicating laser work areas, and non-laser work areas, and equipment location(s).
- d.** Final approval is required of all applications by the TTU **RLSC**.
- e.** To be considered for final approval **all** applications, amendments and renewals must be submitted at least two working days before a regularly scheduled **RLSC** meeting.
- f.** All applications must be completed and signed by the applicant. Incomplete applications will be returned to the applicant for re-submission.

4. Sublicense Renewal and Amendment

- a. Term - Texas Tech University sublicenses remain in effect for two years from date of issue.
- b. Renewal - Although the Radiation Safety Office will remind sublicensees of a pending expiration, it is the **sole responsibility of the sublicensee** to submit a timely renewal application to avoid expiration of a sublicense. If a sublicense expires, authorized use of laser equipment ends and may be continued again, only after a new application is processed and approved by the **RLSC**.
- c. Conditions – Any one of the following changes in the conditions of the sublicense requires an amendment to the sublicense.
 - (1) a change in personnel (additions and deletions);
 - (2) a change in the authorized locations of laser use (addition or deletion of rooms);
 - (3) a change in the laser inventory (new laser equipment, transfer or disposal of laser equipment, storage or reactivation of laser equipment);
 - (4) a change in the standard operation procedures;
 - (5) any change on the laser equipment.

All modifications need to be reported to the **LSO**.

Application forms for license renewal or amendment are available from the Radiation Safety Office or may be found in this manual.

C. Absence Of Sublicensee From Campus

If a sublicensee expects to be absent from the campus for more than 30 days, the **LSO** shall be notified and the sublicensee shall:

1. Deactivate all laser equipment on the sublicense during the absence (appropriate forms must be filled out to deactivate and subsequently reactivate laser equipment); or notify the **LSO** as to the responsible individual (another sublicensee) who will take over supervision of the use of the laser equipment to be used. This sublicensee must be competent in the use and regulations concerning the lasers to be used.
2. Should arrangements as specified above in C.1 not be made, the **RLSC Chairman** and **LSO**, shall revoke and terminate the sublicense. The **LSO** will terminate all laser use in the affected laboratories.

It is the sole responsibility of a sublicensee to notify the LSO during a period of his/her absence and to take appropriate action as outlined above.

D. Termination of Sublicense - The following procedure shall be used to terminate a laser equipment sublicense.

1. A letter of intent to terminate the sublicense will be submitted to the **LSO**. This letter will include:

- a. The date of termination.
- b. The listing of the sublicensee's authorized laser inventory and laboratories, including storage areas. A diagram of all these areas should accompany this letter of intent.
- c. A statement that all lasers active and/or stored will be transferred either to the **LSO** for storage or disposal, or to another sublicensee authorized to possess the lasers under consideration.
- d. Upon receipt of the letter of intent, the **LSO** will conduct a visual inspection of the laboratory and laser equipment. All signs and labels indicating laser use will be removed.
- e. The **LSO** will label all laser equipment with a "Security Seal" to prevent use until the laser equipment is transferred or disposed. Laser equipment transferred to another TTU sublicensee will continue to bear the "Security Seal" until the recipient sublicensee has his sublicense adjusted accordingly and the laser equipment to be disposed will continue to bear the "Security Seal" until the laser is rendered incapable of emitting laser radiation.
- f. **AT THIS POINT, FURTHER USE OF LASER EQUIPMENT BY THE SUBLICENSEE AND INDIVIDUAL WORKERS OF THAT SUBLICENSE IS STRICTLY PROHIBITED.**
- g. Based on a review of the letter of intent, the results of the close-out survey, and the disposition of the laser equipment, the **LSO** will make recommendations to the **RLSC** regarding the request to terminate the sublicense.
- h. Until the **RLSC** and the **LSO** formally terminates the sublicense, the department chairperson will be responsible for all laser equipment until these termination procedures are complete until such time that the equipment is transferred to another sublicense.
- i. Once a sublicense has been terminated **due to negligence**, the sublicensee cannot apply for another laser sublicense for a period of one year from the date of his/her laser sublicense termination.

E. Deactivation/Reactivation of Sublicense

Should a sublicensee foresee a period of time in which they do not plan to use laser equipment the affected laboratory may be deactivated, by meeting the following criteria:

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

- e. Upon receipt of the letter of intent, the **LSO** will perform an inspection of the laboratory and laser equipment.
 - f. Based on a review of the letter of intent, the results of the inspection, the **LSO** will make his recommendations to the **RLSC** who, in turn, will authorize deactivation of the laboratory.
 - g. Upon deactivation, all signs and labels, indicating where laser use was authorized for use shall be removed.
 - h. **AT THIS POINT, FURTHER USE OF LASER EQUIPMENT BY THE SUBLICENSEE AND INDIVIDUAL WORKERS OF THAT SUBLICENSE IS STRICTLY PROHIBITED.**
 - i. The **LSO** will label all laser equipment with a "Security Seal" to prevent any further use. These security seals will only be removed at the expressed approval of the **LSO**.
 - j. 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). At the end of a deactivation period the sublicensee may request, in writing, to renew the deactivated status of the laboratory(s) for another term.
 - k. During the period in which a laser use area is deactivated, the sublicense will remain in an active status. If there are still active laboratories on the sublicense, all current rules, regulations and policies governing that sublicense (relative to the active laboratories) remain in effect. Since deactivated laboratories are no longer considered laser use areas, the requirements for inspections no longer applies. However, the sublicensee is still responsible for the retention of ALL records and files which were generated for that laboratory.
2. A sublicensee may REACTIVATE a sublicense at any time AFTER the initial fifteen day period if the following criteria are met:
- a. A TTU Form LS-2, Laser Amendment Application, must be filled out and delivered to the **LSO**.
 - b. Any and all changes in work areas, storage areas, etc. must be reflected on the amendment application and accompanied with a diagram.
 - c. The **LSO** will review the request and inspect the laboratory area(s) and make his recommendations to the Chairperson of the **RLSC**.
 - d. After the Chairperson has approved the reactivation of the laser laboratory, it will, again, be subject to the posting, required records, safety procedures, and survey/safety check requirements as stipulated by local, state, federal, and TTU regulations and policies.
 - e. At this time, the laser equipment may again be used and stored in that particular laboratory(s). However, the laser equipment will be subject to a survey conducted by the **LSO** to ensure the laser(s) meet all state and local requirements.

F. Deactivation/Reactivation of Equipment

1. Should a sublicensee foresee a period of time in which they do not plan to use specific laser equipment, the laser may be deactivated, by meeting the following criteria:

TTU form LS-2 Laser Amendment Application will be submitted to the **LSO** to deactivate and a letter of intent that will include:

- a. A statement that the laser deactivated will be stored and secured against any use.
 - b. A statement that all associated laser hazards are secure and contained to ensure compliance with regulations.
 - c. Upon receipt of the amendment application and letter of intent, the **LSO** will confirm deactivation of the laser equipment and its storage area.
 - d. Based on a review of the amendment application, the results of the confirmation, the **LSO** will make his recommendations to the Chairperson of the **RLSC** who, in turn, will authorize deactivation of the laser.
 - e. Upon deactivation, all signs and labels, indicating where the laser was authorized for use shall be removed.
 - f. **AT THIS POINT, FURTHER USE OF THE LASER EQUIPMENT BY THE SUBLICENSEE AND INDIVIDUAL WORKERS OF THAT LASER EQUIPMENT IS STRICTLY PROHIBITED.**
 - g. The **LSO** will label the laser equipment with a "Security Seal" to prevent any further use. These security seals will only be removed at the expressed approval of the **LSO**.
 - h. The term of deactivation of an authorized laser equipment will be a minimum of sixty days.
 - i. During this period in which the laser is deactivated, the sublicensee will remain in an active status. If there are still active lasers on the sublicensee, all current rules, regulations and policies governing that sublicensee (relative to the active lasers) remain in effect. Since the deactivated laser is no longer considered active, the requirements for inspections no longer applies. However, the sublicensee is still responsible for the retention of ALL records and files which were generated for that laser.
2. A sublicensee may REACTIVATE a laser at any time AFTER the initial sixty day period if the following criteria are met:
 - a. TTU Form LS-2, Laser Amendment Application, must be made to the **LSO**.
 - b. Any changes in work areas, storage areas, etc. must be reflected on the amendment application.
 - c. The **LSO** will review the request and inspect the laboratory and make recommendations to the Chairperson of the **RLSC**.
 - 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 TTU regulations and polices.

- e. At this time, the laser equipment may be used and stored in that particular laboratory. However, the laser will be subject to a inspection conducted by the **LSO** to ensure the unit(s) meet all state and local requirements.

G. Responsibilities of Sublicensee

The sublicensee has the following obligations

1. **To assure the safe operation of the licensed laser(s) by authorized laser personnel and account for any misuse, accidents, or injuries to persons or property.**
2. To submit an application for a laser sublicense or necessary amendments to update the information in the latest sublicense before any work with lasers. There shall be no use of lasers without first obtaining a sublicense or appropriate amendment from the **RLSC** and approval for laser operation from the **LSO**.
3. To ensure registration of **all** laser(s) under their authority, with the **LSO**. (each laser(s) purchased, donated, received, or otherwise constructed)
4. To maintain records in accordance with national, state, and local regulations. This shall include, but is not be limited to: laser eye protection inspections, incident/accident reports, **LSO** laser lab inspections, registration, inventory forms, and other records concerning the laser(s) under his/her control.
5. To ensure that laser users have general laser safety training, specific hazard laser training, and SOP training for class IIIB and IV lasers. The sublicensee will provide the SOP training.
6. To receive approval for operation of a laser system before the installation of a laser and after modifications have been made. All new or modified (ie. installation setups that are different from approved application) lasers must first be approved by the **LSO** before any operating of the particular laser unit commences.
7. To report any actual or suspected incidents resulting from a laser operated under his/her authority to the **LSO**. If necessary, the sublicensee shall immediately obtain appropriate medical attention for any worker involved in a laser accident.
8. To provide to the **LSO** and maintain standard operating procedures (SOP) for all laser equipment under their authority.

9. To prohibit operation of the laser when adequate control of laser hazards are not met or when personnel are not properly trained.
10. To report to the **LSO** any inoperative lasers due to disassembly or destruction.
11. To provide all lab personnel with the appropriate personal protection equipment (PPE) required.
12. To provided all lab personnel with the appropriate training and emergency procedures specific to the laser being used.
13. To correctly post work areas and all laser-producing equipment.
14. To report possible incidents and actual exposures to the **LSO**.
15. To report all lasers being transferred, sold, or decommissioned.

H. Responsibilities of Users and Operators

1. To comply with all applicable safety rules and laser program requirements and those specified by the **RLSC/LSO** and to be familiar with all standard operating procedures and emergency procedures for the laser equipment under his/her control.
2. To use and operate only those laser(s) which are listed on the sublicense.
3. To maintain documentation of training with dates and signature.
4. To report any departures from established SOPS to the sublicensee and **LSO**.
5. To report all possible incidents and actual exposures to the **LSO**.

I. Program Requirements

1. **Purchase /Transfer/Shipping/Delivery**
 - a. **Ordering lasers or laser equipment**
 - (1) Requestor will contact the **LSO** via email.
 - (2) Requestor will provide the following information:
 - (a) Sublicensee
 - (b) Description of item
 - (c) Manufacturer/Vendor
 - (d) Model and Serial Number
 - (e) Quantity
 - (f) Purpose

- (g) Location of intended use
 - (3) **LSO** will:
 - (a) Verify status of sublicense
 - (b) Document information received
 - (c) Contact Purchasing and grant approval
- b. **Transfer of laser equipment**
 - (1) Requestor will contact the **LSO** and Property/Surplus Manager
 - (2) Requestor will provide the following information
 - (a) Laser specifications
 - (b) To whom the equipment will be transferred
 - (c) Time Frame for the transfer
 - (3) **LSO** will:
 - (a) Verify status and document information
 - (b) Contact Property/Surplus Manager and grant approval
- c. **Shipping and Delivery**
 - (1) Requestor will contact the **LSO**
 - (2) **LSO** will:
 - (a) Verify status of sublicense and paperwork
 - (b) Document information received
 - (c) Contact Central Warehouse and grant approval

2. **Facilities (25 TAC §289.301(v)(3))**

- a. Laser work areas(s) will have restricted access from non-authorized personnel.
- b. Laboratories will have heat-chemical resistant materials in the beam paths(when applicable).
- c. Laser work areas, and lab entrances will be posted with the correct warning signs. (signs available from Laser Safety)
- d. All signage (sublicense, emergency numbers, etc.) shall be posted in prominent view.
- e. Laboratories will have all windows covered with appropriate materials.
- f. 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.

3. **Signage (25 TAC §289.301(v)(3))**

- a. Laser equipment will be labeled with manufacturer and class designation.
- b. Laser equipment will have labels with warning, output, duration, medium, and wavelength.
- c. Laser protective housing and enclosures will be labeled during normal and servicing operations.
- d. Labels will be specific to the hazards of the laser determined by the **LSO**.

- e. Signage must be posted during maintenance and servicing operations and as stated in the Standard Operating Procedures, SOP's.

4. Control Area and Access

- a. Laser work areas(s) will have restricted access from non-authorized personnel.
- b. Class IIIB and Class IV laser laboratories will have safety interlocks or alternate control methods approved by the LSO.

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

5. Training:

Basic Level 1-Fundamentals of laser principles

Administrative Level 2- State regulations, TTU policies, and a brief review.

Hazard Level 3 – Any additional training required by RLSC and LSO

- a. Researchers
 - (1) without training or experience
 - (2) without documentation of training within the last five years

Required to take Laser Training Levels 1 and 2
- b. Researchers and Post-Doctorates
 - (1) with extensive training or experience
 - (2) with **LSO** approval

Required to take Laser Training Level 2
- c. Students and Other Personnel
 - (1) without training or experience
 - (2) without documentation of training within the last five years

Required to take Laser Training Level 1

6. Personal Protective Equipment:

All laboratory personnel will be trained on the proper use of the following by Environmental Health & Safety personnel.

- a. Laser eyewear
 - (1) It will be in good condition and comfortable.
 - (2) It will be labeled with wavelength and optical density.
 - (3) It will be inspected every year.
- b. Protective clothing
 - (1) It will be tightly woven material.
 - (2) It will be long sleeved.
- c. Chemical resistant gloves for handling of dyes and solvents.

- d. Various forms of shielding appropriate for the hazard.
- e. Hearing protection if work environment exceeds regulatory limits.

7. Instrumentation

- a. Laser equipment will have protective housing.
- b. Laser safety interlocks for all class IIIB and IV.
- c. Laser equipment will have either a key switch or a computer code.
- d. Laser laboratories will have optical attenuators
- e. Laser equipment will have operational lights, alarms, and devices to notify others that the laser is in "on."

8. Standard Operating Procedures

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.

a. General Information

- (1) Information of the laser owner
- (2) Inventory control (TTU ID Number)

b. System Information

- (1) Description
- (2) Location
- (3) Class

c. Hazards Summary

- (1) Beam information
- (2) Non-Beam information

d. Required Control Measures

- (1) Access Controls
- (2) System Controls
- (3) Personnel Controls

e. Alignment Procedures

- (1) By Whom
- (2) Conditions
- (3) Can be general for research purposes with the **RLSC** approval.
- (4) Buddy Policy **required** for Class IIIB and IV laser laboratories.

f. Emergency Instructions

- g. All laser operators must sign the TTU form, LS-8 SOP Training Acknowledgement, to document that they have been trained on the SOP of the laser.**

9. Modifications

- a. A laser or laser system that requires modification that significantly changes the SOP and performance **Shall Not** be operated until approved by the **LSO**.
- b. Modifications not reported to the **LSO** are in violation of the SOP approved by the **RLSC** and terms of the sublicense.

10. 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.

11. Record Keeping

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

- a. Standard Operating Procedures (SOP)
- b. Signatures of SOP and PPE Training
- c. Usage Log
- d. Sublicensee Information
 - (1) Sublicensee-All Sublicensees should have a current copy.
 - (2) Amendments/Renewals-All copies of personnel/laser changes.
 - (3) Past Inspection Reports-All inspection reports sent from the **LSO**.
 - (4) **LSO** Memos-All memos from the **LSO** are available to personnel.
 - (5) Laser Inventory-All current laser inventories for inspections.

12. General services

All laser activity must be **suspended** until these services have been performed.

- a. All laboratories must be surveyed (visual inspection) for any possible hazards within 24 hours of the scheduled cleaning or other services. The lab shall remain in order until after the services, and it is the responsibility of the sublicensee to ensure this. Records of the visual surveys must be kept.
- b. Exposure of general service personnel to preventable hazards will result in the suspension of general services and a probationary period, at which time the status of the sublicense will be determined by the **RLSC**.

13. Custodial Services

All laser activity must be **suspended** until these services have been performed.

- a. To obtain special custodial service (i.e., scrubbing, stripping, and finishing floors), call Custodial Services (744-1866).
- b. Prior to scheduling the cleaning, the following preparations must be made:
 - (1) The floor must be cleared of all obstacles such as boxes, books, containers, and chemical-labeled items. This must be done by authorized personnel. Visual surveys of the lab must be performed within 24 hours.

- (2) Custodial Services will schedule the work and call to confirm the date with the requestor.
 - (3) The custodians will leave a checklist in the laboratory. The checklist must be completed and signed by the lab personnel.
 - (4) Laser laboratories requesting cleaning service will be furnished with a Request for Custodial Service door card. The **door card must be signed by the sublicensee or LSO**, and left on the outside of the door on the day the work is to be accomplished.
 - (5) The sublicensee or a worker on that sublicense **IS required** to be in the lab during the cleaning of all **Class IIIB and IV** laser laboratories.
- c. To obtain routine custodial service, call Custodial Services (744-1866) to receive a door card. Routine custodial service includes only sweeping floors, empty trash containers, and replace paper in paper dispensers.
- (1) The Sublicensee will complete, sign and date a door card.
 - (2) Place the card on the outside of the laboratory door before 6:00 PM on the day of the routine cleaning. These cards are only good for one day. These cards assure the custodians that there are no laser hazard.
 - (3) The sublicensee or a worker **IS NOT** required to be in the lab during the routine cleaning. Routine cleaning will probably be scheduled between 6:30 PM and 8:00 PM.

14. **Building, Maintenance, and Construction (BM&C) Service**

All laser activity must be **suspended** until these services have been performed.

- a. The **LSO** or sublicensee can give clearance for BM&C to perform work in an authorized laser use/storage area. The laboratory must be surveyed within 24 hours of the scheduled work.
- b. The sublicensee or a worker **IS required** to be in the lab during the BM&C services of all **Class IIIB and IV** laser laboratories.

15. **Other Services**

All laser activity is **suspended** until these services have been performed.

- a. Departmental technicians may enter and perform routine duties provided they have the required laser training requirements, and are granted permission by both the sublicensee and the **LSO**.
- b. Company technicians and servicemen servicing or checking items on any laser equipment must have the permission of the **LSO**. The Sublicensee will be required to have the lab surveyed within 24 hours prior to their visit. All laser hazards should be rechecked which would be unfamiliar to the technicians and servicemen. Records of these surveys must be kept.
- c. The sublicensee or a worker **IS** required to be in the lab during the services.

J. 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 programs and the express approval of the **RLSC**. The names of authorized personnel will be listed on the sublicense. Individuals not listed on the sublicense are not authorized personnel.

2. Non – Authorized Faculty, students, and other professionals and non - TTU personnel which have not had TTU Laser Safety Training nor the express approval of the **RLSC** or whose names do not appear on a given laser sublicense.

END OF SECTION II

SECTION III – LASERS

A. Basic Laser Characteristics

1. Laser

Laser is an acronym for **L**ight **A**mplification by the **S**timulated **E**mission of **R**adiation. The major components of a laser are: the excitation mechanism, active medium, and an optical cavity. In general, there are four major laser types: solid state, semi-conductor, gas and liquid (dye). The laser light emits non-ionizing electromagnetic radiation that is ultraviolet, visible, or infrared light.

- a. **Pulsed Lasers** - a laser that delivers energy in the form of a single pulse or train of pulses which is delivered in less than .25 seconds. Pulsed Lasers are expressed as the total energy per pulse (joules).
- b. **Continuous Wave Lasers** - a laser whose output is operated in a continuous mode for at least a period of .25 seconds. Continuous Wave Lasers are expressed as the average power (watts).

2. Intensity Terms

These are important laser terms that describe degrees of intensity which a particular laser is capable of and are also, used in regulatory standards.

- a. **Radiance**- The laser energy per unit area of the beam.
- b. **Irradiance**-The laser power per unit area of the beam

3. Classification

ANSI and LIA Classification

The American National Standards Institute (ANSI 2000) has developed four categories of hazard potential. The classification scheme is based on the ability of optical emissions from a laser system to produce injury to personnel. The higher the classification number, the greater the hazard potential. The Laser Institute of American (LIA) Laser Safety Guide describes each class as follows:

Class I denotes lasers or laser systems that do not, under normal operating conditions, pose a hazard.

Class II denotes low-power visible light lasers or laser systems that, because of the normal human aversion response (i.e. blinking, eye movement, etc.), do not normally present a hazard, but may present some potential for hazard if viewed directly for extended periods of time (similar to many conventional light sources).

Class IIIA denotes some lasers or laser systems that normally would not injure the eye if viewed for only momentary periods (within the aversion response period) with the unaided eye, but may present a greater hazard if viewed using collection optics. Class IIIA lasers must carry a caution

label. Another group of Class IIIA lasers have DANGER labels and are capable of exceeding permissible exposure levels for the eye in 0.25 seconds and still pose a low risk of injury.

Class IIIB denotes lasers or laser systems that will produce eye damage if viewed directly. This includes intrabeam viewing of specular reflections. Normally, Class IIIB lasers will not produce a hazardous diffuse reflection.

Class IV denotes lasers or laser systems that produce retinal damage from direct or specular reflections, but may also produce hazardous diffuse reflections. Such lasers may produce significant eye and skin radiation hazards as well as fire hazards.

4. Hazards

a. Beam Hazards

(1) Beam

Direct beam viewing is dependent on the laser classification. The hazard increases beginning with Class II as minimal to Class IV as very dangerous.

(2) Beam Reflections

These type of reflections can sometimes occur when modifications are made to Class I through Class III; however it is highly dependent on the laser environment. For this reason, the **LSO** should always be consulted. Class IIIB and IV hazards include specular and diffuse reflections which are dependent on the materials, objects, and lenses in the laser area as well as the wavelengths of the beam. The determinations of these are

- (a) Specular Reflection – The reflection is mirror-like due to smooth surfaces being less than the incident wavelength.
- (b) Diffuse Reflection – This type of reflection is much more scattered due to the irregularities of the surface.

b. Non-Beam Hazards

These hazards vary widely and are specific to the materials and the experiments involved with the laser system.

- (1) **Physical-** Factors that contribute to injury are: fire, explosions and electrocutions from arc and filament lamps, capacitors, wiring, power supply's, circuits, solvents, and gases.
- (2) **Chemical-** Various chemical agents include dyes, solvents, gases, and laser-generated airborne contaminants (dusts, mists, fumes, and smokes).
- (3) **Radiation-** The types of radiation's vary from infrared, ultraviolet, x-ray, and visible which the laser produces. The radiation is dependent on the wavelength of the laser in the electromagnetic spectrum.

5. Biological Effects

The biological effects are dependent on the laser beam properties and vary with duration, wavelength, photon energy, target tissue, and tissue condition.

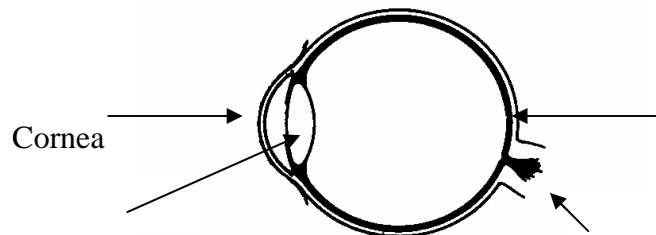
Therefore, all effects have to be weighed on a case by case basis.

However, safety and prevention are the best protection against personal injury.

a. Eye

Injuries to the eye are primarily due to two main types of biological effects which may or may not occur separately. Biological effects to the eye are dependent on exposure conditions, wavelength, and irradiation levels. The main tissue types of the eye which suffer these biological effects are the cornea, lens and retina.

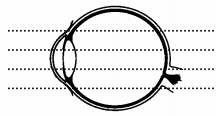
Diagram of Eye Structure



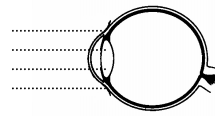
- (1) **Photochemical** - High energy laser light photons may interact with molecules in the eye tissue causing chemical bonds to be broken. The injury depends on the tissue of the eye affected.
- (2) **Thermal**- Heat dissipation is a major factor in causing to the eye. Heat flow could travel horizontally along the same tissue or vertically through different depths of underlying tissues.
- (3) **Summary**-Types of eye damage from laser radiation are:

Cornea	Corneal Burn
Lens	Cataracts
Retina	Decreased Vision/ Vision Loss
Optic Nerve	Blindness

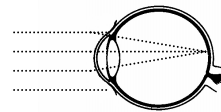
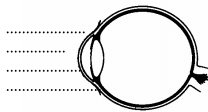
Electromagnetic Radiation To the Eye



Microwaves and Gamma



Near



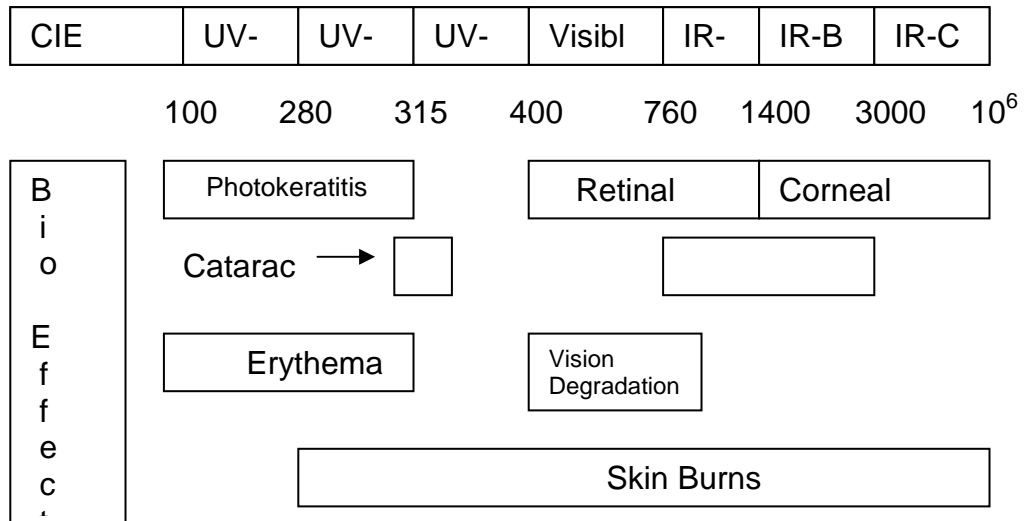
Far Ultraviolet & Far Infrared

b. Skin

Skin tissue is at risk from laser exposure. The effects to the skin are considered secondary. However, the higher the power of the laser, the greater the risk to the skin.

- (1) **Thermal-** It is an actual burn to the skin; the severity of the burn is dependent upon the penetration of the skin tissue.
- (2) **Ultraviolet-** Due to the intense ultraviolet beam exposure, the skin will be affected. Typically, this affect is equivalent to a sunburn.
- (3) **Photosensitivity-** This effect may occur when laser personnel are currently on medications that would cause sensitivity to light.
If medications warn against avoiding sunlight then laser use should also be avoided.
- (4) **Summary-** Types of skin damage from laser radiation are: sunburn, skin burns, skin cancer, and skin aging.

Eye vs Skin Exposures



B. Specific Laser Requirements

1. Class IIIB and IV Lasers

All Class IIIB and IV 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 **RLSC** and the **LSO**.

a. 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).

b. 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.

$$NHZ = \frac{1}{\phi} \left\{ \frac{4P}{\pi (MPE)} - a^2 \right\}^{1/2}$$

ϕ = Divergence in radians
P = Power in watts
 π = 3.1415
a = aperture in cm

c. Accessible Emission Limits (AEL)

The maximum accessible emission level permitted within a particular laser class. AEL is in units of μW 's.

$$AEL = MPE \times (\text{area of limiting aperture})$$

d. 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.

$$OD = \log \left\{ \frac{E_i}{MPE} \right\} \quad E_i = \text{incident beam irradiance in } W \text{ cm}^{-2}$$

e. Interlock

A switch that, when activated, will interrupt normal operation of a laser by closing a shutter or de-energizing the system.

2. Infrared Lasers

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

3. 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.

4. 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.

END OF SECTION III

SECTION IV - EMERGENCY PROCEDURES

Introduction - This section outlines basic emergency procedures. An emergency situation or accident can arise from the use, the misuse, or abuse of laser equipment. This section is intended to enhance a sublicensee's and worker's ability to react properly to laser accidents.

Due to the broad scope of possible accidents at TTU, a comprehensive listing of all steps to be followed for each type of accident is impracticable. Instead, a researcher 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.

It is the responsibility of each sublicensee to develop and ensure that personnel working under their supervision have reviewed a practical emergency plan. This plan is to include all required telephone numbers and is to be posted in each laser work area. (reference TTU - Operating Procedure 78.01 Vol.III)

General Information- **A laser incident at TTU is defined as any accident, single exposure, or suspected exposure as set forth in 25 TAC §289.301. NOTE - Users will report all laser incidents.**

Organization and Authority

1. The **LSO** is responsible to investigate any laser incident at TTU.
2. The **LSO** will promptly report all investigation findings to the **RLSC** and to the Texas Bureau of Radiation [reference **25 TAC §289.301(xx)**] for direction and action.
3. If preliminary findings of an incident presented to the **RLSC** indicate there is probable cause of neglect or violation of state, federal, or local regulations or policies, the sublicensee involved will attend the next **RLSC** meeting to 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.
5. The **LSO** has the responsibility to see that each laser sublicensee/worker:
 - a. Recognizes a laser emergency.
 - b. Has the training to prevent or confine a laser accident.
 - c. Has the training to recognize possible risks of exposure

6. Each sublicensee is responsible to assist the **LSO** in controlling and/or investigating a laser accident. Furthermore, the sublicensee is responsible to assist the laser exposure victim(s) in getting timely medical attention.

Fires, Explosions, or Major Emergencies

The laser sublicensee should:

1. Notify all persons in the area to leave at once and turn off all electrical laser equipment..
2. Notify the Lubbock Fire Department, UPD, TTU Fire Marshall, the **LSO** and other supervisory personnel. Give them the address and the location of the fire.
3. Caution firemen about the current situation in the area. Be ready to advise them on the location of laser(s) and other equipment or chemicals, and provide any other information that may be needed to avoid hazardous exposure of personnel
4. Be available to evaluate or help evaluate the extent of damage to materials and equipment.
5. All sublicensees and workers will be required to file an incident report with the **LSO**.
6. If the fire is minor (individual decision) and there are no chemical hazards involved, a sublicensee or worker may attempt to put out the fire with approved fire fighting equipment.

Incidents: Possible Exposure or Injury

The laser sublicensee should:

1. Immediately remove affected person(s) from the area and **notify the LSO**.
2. Secure the area.
3. Accompany the affected persons(s) to the nearest emergency center immediately for clinical observation. Inform the attending medical personnel that injuries occurred as the result of a laser accident. Be prepared to answer any questions concerning the accident or type of laser involved.
4. Assist the **LSO** in obtaining all details of the incident.
5. Persons involved in the incident will not be permitted to work with the laser equipment until exposure results have been received and the **LSO** has determined that exposure limits are not exceeded.
6. The **LSO** will provide reports to the **RLSC** and regulatory agencies.

Loss or Theft

1. Any loss or theft of laser(s) equipment, shall be immediately reported to the **LSO** and TTU police.
2. The **LSO** will provide required notification to the Bureau of Radiation Control.

NOTE – Laser equipment 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. The **LSO** will determine the extent of damage and analyze the recovery plan.

EMERGENCY PHONE NUMBERS

TTU RADIATION SAFETY OFFICE	742-3876
LSO (HOME).....	298-4621
CHAIRMAN, RADIATION LASER SAFETY COMMITTEE (HOME)	828-5787
LUBBOCK FIRE DEPARTMENT	765-5757
TTU FIRE MARSHAL (HOME)	799-1701
TTU POLICE DEPARTMENT	742-3931
CAMPUS EMERGENCY	DIAL 9911
TEXAS BUREAU OF RADIATION CONTROL (BRC).....	(512) 835-7000

IF TTU RADIATION EMERGENCY PERSONNEL CANNOT BE CONTACTED CALL:

<u>BRC 24 HOUR EMERGENCY PHONE NUMBER</u>	(512) 458-7460
BRC-REGION II RADIATION CONTROL (CANYON)	(806) 655-7151

END OF SECTION IV

SECTION V - FORMS AND RECORDS

A. Forms

- 1. Laser Application(LS-1)**
- 2. Laser Amendment(LS-2)**
- 3. Laser Amendment Attachment(LS-2A)**
- 4. Laser Standard Operating Procedure Outline(LS-7)**
- 5. Laser SOP Training Acknowledgement(LS-8)**
- 6. Laser Usage Log((LS-11)**
- 7. Application for Change of Status(LS-16)**
- 8. Short-Term Application(LS-17)**

B. Reports

- 1. Incident Report: Possible Exposure or Injury**
- 2. Accident Report**

TEXAS TECH UNIVERSITY
LASER EQUIPMENT SUBLICENSE APPLICATION

(UNDER TEXAS BUREAU OF RADIATION LASER LICENSE Z00130 ISSUED TO TEXAS TECH UNIVERSITY)

PLEASE PRINT OR TYPE. USE ADDITIONAL PAPER IF NECESSARY

APPLICANT'S FULL NAME

APPLICANT'S INITIALS

OFFICE DEPARTMENT & BUILDING

OFFICE NUMBER

PHONE NUMBER
ADDRESS

APPLICANT'S E-MAIL

PLEASE COMPLETE SECTIONS I – III FOR ALL LASER EQUIPMENT UNDER YOUR CONTROL.

NOTE THAT SECTIONS E – L MUST BE COMPLETED FOR EACH LASER
USE ADDITIONAL FORMS IF NECESSARY

SECTION I

A. HAVE YOU EVER POSSESSED A LASER EQUIPMENT LICENSE UNDER YOUR NAME?
YES ___ NO _____

IF YES GIVE NUMBER AND ISSUING AGENCY: _____

WAS THE LICENSE OR SUBLICENSE EVER SUSPENDED? YES _____ NO _____

IF YES EXPLAIN: _____

B. HAVE YOU EVER HAD PRACTICAL EXPERIENCE WITH LASERS? YES _____ NO _____

C. HAVE YOU HAD FORMAL TRAINING IN THE SAFE USE OF LASERS FOR WHICH THIS APPLICATION APPLIES? YES _____ NO _____

IF YES EXPLAIN: _____

D. IF YOUR ANSWER TO PART B OR C WAS YES, DOCUMENT YOUR USE BY INCLUDING A COPY OF A PUBLISHED JOURNAL ARTICLE OR PROVIDE A CONFIRMATION LETTER FROM A LASER/RADIATION SAFETY OFFICER _____

E. COMPLETE FOR EACH LASER FOR WHICH YOU WILL BE LICENSED

Manufacturer	Model Number	Serial Number	Building	Room Number	Status (Active/Stored)
1.					
2.					
3.					
4.					
5.					

In, Sections F – L , the lasers will be referred to in the same order as they are listed in Section E

F. LIST INFORMATION FOR EACH LASER

Class (I,II,III,IV)	Laser Setup * Refer to Illustrations (A,B,C)	Emission Duration Range (seconds)	Emission Power Range (Watts or Joules)	Emission Wavelength Range
1.				
2.				
3.				
4.				
5.				

Laser Setups *

- A - Open Path (laser beam is accessible without defeating an interlock)
- B - Fully Enclosed (laser beam accessible via an “opened” interlock)
- C - Fiber Delivery (laser beam is delivered without an accessible beam path)
- D - Other (Explain)

G. STATE THE FOLLOWING FOR EACH LASER:

	Person in Charge	Comments about Laser (s)
1.	_____	_____
2.	_____	_____
3.	_____	_____
4.	_____	_____
5.	_____	_____

H. LIST THE FOLLOWING PROPERTIES FOR EACH LASER

Laser	Type (dye, gas, solid state..)	Active Material (Ar,HeNe,GaAs,Nd Yag..)	Excitation Mechanism (optical,electrical,chemical..)	Time-Dependent Properties (cw, pulsed, rep. pulsed..)
1.				
2.				
3.				
4.				
5.				

I. DESCRIBE LASER APPLICATION (Research Development, Welding, Scribing, Cutting, etc..)

1. _____

2. _____

3. _____

4. _____

5. _____

J. ATTACH A COPY OF NORMAL OPERATING PROCEDURES FOR **EACH LASER**.
[25 TAC §289.301(v)(2)(B)] "Normal operating procedures" means operating procedures for conditions suitable for analytical purposes with shielding and barriers in place. These do not include maintenance but do include routine alignment procedure. Routine and emergency laser radiation considerations are part of these procedures."

EXCEPTION: LSO MAY GRANT APPROVAL TO ACCEPT ONE COPY FOR SEVERAL LASERS WITHIN THE SAME CLASS AND SAME OPERATION SETTING, HOWEVER THE LSO MUST REVIEW EACH CASE, INDIVIDUALLY.

K. LIST ALL PERSONNEL WHO WILL USE THE LASER EQUIPMENT AND WHOSE NAMES SHOULD APPEAR ON THE SUBLICENSE

	NAME COMPLETED	DATE TTU LASER TRAINING COURSE
1.	_____	_____
2.	_____	_____
3.	_____	_____
4.	_____	_____
5.	_____	_____
6.	_____	_____

L. ATTACH A SEPARATE, PAGE-LENGTH DETAILED MAP OF THE PROPOSED WORK AREA FOR **EACH LASER**. INCLUDE LASER RADIATION AND NON-LASER RADIATION AREAS, EQUIPMENT LOCATION (I.E. SINKS, HOODS), AND DOORS. (THIS ALSO PERTAINS TO "MOBILE" LASERS. LSO WILL REVIEW AND DETERMINE EACH CASE INDIVIDUALLY)

M. CLASS I – IIIA LASER APPLICANTS PROCEED TO SECTION III.

N. CLASS IIIB AND IV LASER APPLICANTS PROCEED TO SECTION II.

SECTION II

TO BE COMPLETED BY CLASS IIIB AND IV LASER APPLICANTS ONLY

A. DO YOU HAVE THE “STATE-REQUIRED” [25 TAC §289.301(t)(1)] PROTECTIVE EYEWEAR DESIGNED SPECIFICALLY FOR THE WAVELENGTH OF THE EMITTED LASER RADIATION?

YES _____ NO _____

IF YES, PROVIDE THE MANUFACTURER AND THE WAVELENGTH RANGE

B. DO YOU ALREADY HAVE DOOR INTERLOCKS THAT PREVENT UNAUTHORIZED ACCESS TO THE DESIGNATED AREA (S) OF LASER USE, WHILE THE LASER (S) ARE OPERATING?

YES _____ NO _____

IF YES, PROVIDE THE MANUFACTURER IF NOT THE SAME AS THE LASER MANUFACTURER

IF YES, HAS THE TTU LSO APPROVED THE EXISTING INTERLOCK? _____

IF NO, DO YOU HAVE FUNDING FOR THE INSTALLATION OF **STATE-REQUIRED** [25 TAC §289.301(r)(2)(B)] DOOR INTERLOCKS FOR THE LASER AREA (S)?

YES _____ NO _____

SECTION III

Acknowledgement Statement

I (THE APPLICANT) WILL COMPLY WITH THE STATE OF TEXAS LASER LICENSE REQUIREMENTS, REGULATIONS, AND ALL SPECIFIC CONDITIONS REQUIRED BY THE RADIATION LASER SAFETY COMMITTEE.

THE APPLICANT CERTIFIES THAT ALL PERSONNEL LISTED ON THIS SUBLICNESEE APPLICATION WILL COMPLY WILL THE STATE OF TEXAS LASER LICENSES REQUIREMENTS, REGULATIONS, AND ALL SPECIFIC CONDITIONS REQUIRED BY THE RADIATION SAFETY COMMITTEE, AND THAT ALL OF THE INFORMATION CONTAINED HEREIN AND ATTACHED HERETO IS COMPLETE AND CORRECT TO THE BEST OF MY KNOWLEDGE AND BELIEF.

DATE

SIGNATURE OF THE APPLICANT

SIGNATURE OF THE DEPARTMENT CHAIR

TEXAS TECH UNIVERSITY
LASER APPLICATION FOR AMENDMENT OR RENEWAL OF A SUBLICENSURE

LS-2

10/00

SUBLICENSUREE'S NAME	DEPARTMENT	PHONE NUMBER
SUBLICENSUREE I.D. LETTERS	BUILDING & ROOM #'S	SUBLICENSUREE EXPIRATION DATE
A. CIRCLE ONE:	AMENDMENT	RENEWAL
	AMENDMENT	AND RENEWAL

B. INDICATE ALL LASERS FOR WHICH YOU ARE CURRENTLY LICENSED. NC-NO CHANGE
A-ADDITIONS
D-DELETIONS

ACTIVE OR STORED	MANUFACTURER	MODEL #	SERIAL #	CLASS (I,II,IIIA,IIIB,IV)	CIRCLE ONE
1.	_____	_____	_____	_____	NC / D / A
2.	_____	_____	_____	_____	NC / D / A
3.	_____	_____	_____	_____	NC / D / A
4.	_____	_____	_____	_____	NC / D / A
5.	_____	_____	_____	_____	NC / D / A
6.	_____	_____	_____	_____	NC / D / A

C. IF THIS AMENDMENT ADDS A NEW CLASS OF LASER, HAVE YOU HAD FORMAL TRAINING IN THE SAFE USE OF THIS LASER? (**CIRCLE ONE**) YES NO NA

D. IF YES, DOCUMENT YOUR USE FOR EACH NEW CLASS BY INCLUDING A COPY OF A PUBLISHED JOURNAL ARTICLE (ONE PER CATEGORY) OR PROVIDE A CONFIRMATION LETTER FROM A RADIATION/LASER SAFETY OFFICER.

J. LIST ANY NEW ROOMS OR AREAS (FOR WORK OR STORAGE) THAT WILL APPEAR ON THE AMENDED LICENSE. (**INDICATE "NA" IF NOT APPLICABLE**) _____

F. LIST ALL PERSONNEL WHOSE NAMES SHOULD BE **ADDED (A)** TO OR **DELETED (D)** FROM THE SUBLICENSURE. ALSO INDICATE DATE THAT TTU TRAINING COURSE WAS COMPLETED.

FULL NAME	CIRCLE ONE	TRAINING DATE	<u>ANSWER ONLY WHEN DELETING PERSONNEL</u> Question #1	
1.	A / D		Y / N	Y / N
2.	A / D		Y / N	Y / N
3.	A / D		Y / N	Y / N
4.	A / D		Y / N	Y / N
5.	A / D		Y / N	Y / N
6.	A / D		Y / N	Y / N

Question #1: Did person deleted act in a conscientious and safe manner while in your lab?
 Question #2: Is retraining appropriate for this person?

THE APPLICANT CERTIFIES THAT ALL PERSONNEL LISTED ON THIS SUBLICENSURE APPLICATION WILL COMPLY WITH THE STATE OF TEXAS RAM LICENSE REQUIREMENTS, REGULATIONS, AND ALL SPECIFIC CONDITIONS REQUIRED BY THE RADIATION AND LASER SAFETY COMMITTEE, AND THAT ALL OF THE INFORMATION CONTAINED HEREIN

AND ATTACHED HERETO IS COMPLETE AND CORRECT TO THE BEST OF THEIR KNOWLEDGE AND BELIEF.

SIGNATURE OF THE SUBLICENSEE

DATE

SIGNATURE OF THE DEPARTMENT CHAIR

**TEXAS TECH UNIVERSITY
ATTACHMENT
FOR AMENDMENT OR RENEWAL OF A LASER SUBLICENSE**

LS-2A
10/00

E. LIST ALL PERSONNEL WHOSE NAMES SHOULD BE **ADDED** TO OR **DELETED** FROM THE SUBLICENSE.

ALSO INDICATE DATE THAT TTU TRAINING COURSE WAS COMPLETED.

NAME	CIRCLE ONE	TRAINING DATE	<u>ANSWER ONLY WHEN DELETING PERSONNEL</u>	
			Question #1	Question #2
7.	A / D		Y / N	Y / N
8.	A / D		Y / N	Y / N
9.	A / D		Y / N	Y / N
10.	A / D		Y / N	Y / N
11.	A / D		Y / N	Y / N
12.	A / D		Y / N	Y / N
13.	A / D		Y / N	Y / N
14.	A / D		Y / N	Y / N
15.	A / D		Y / N	Y / N
16.	A / D		Y / N	Y / N
17.	A / D		Y / N	Y / N
18.	A / D		Y / N	Y / N
19.	A / D		Y / N	Y / N
20.	A / D		Y / N	Y / N
21.	A / D		Y / N	Y / N
22.	A / D		Y / N	Y / N
23.	A / D		Y / N	Y / N
24.	A / D		Y / N	Y / N
25.	A / D		Y / N	Y / N
26.	A / D		Y / N	Y / N
27.	A / D		Y / N	Y / N
28.	A / D		Y / N	Y / N
29.	A / D		Y / N	Y / N
30.	A / D		Y / N	Y / N

Question #1: Did person deleted act in a conscientious and safe manner while in your lab?

Question #2: Is retraining appropriate for this person?

THE APPLICANT CERTIFIES THAT ALL PERSONNEL LISTED ON THIS SUBLICENSE APPLICATION WILL COMPLY WITH THE STATE OF TEXAS LASER LICENSE REQUIREMENTS, REGULATIONS, AND ALL SPECIFIC CONDITIONS REQUIRED BY THE RADIATION AND LASER SAFETY COMMITTEE, AND

THAT ALL OF THE INFORMATION CONTAINED HEREIN AND ATTACHED HERETO IS COMPLETE AND CORRECT TO THE BEST OF THEIR KNOWLEDGE AND BELIEF.

SIGNATURE OF THE SUBLICENSEE

DATE

SIGNATURE OF THE DEPARTMENT CHAIR

Standard Operation Procedure Outline

Each Sublicensee will be responsible for creating SOP's for each laser which should include the following information.

System Information

- ◆ Description
- ◆ Location
- ◆ Classification

Hazard Summary

- ◆ Beam Information
- ◆ Non-beam Information

Control Measures

- ◆ Access Controls
- ◆ System Controls
- ◆ Personnel Controls

Procedural Information

- ◆ Adjustment and Alignment
- ◆ Maintenance and Servicing
- ◆ General Research
- ◆ Buddy Policy (if required)

Training Requirements

- ◆ Sublicensee
- ◆ SOP and PPE
- ◆ Environmental Health & Safety (if required)

Chain of Command

- ◆ Sublicensee
- ◆ Supervisory
- ◆ Research personnel

Emergency Instructions

- ◆ First Aid
- ◆ Evacuation
- ◆ Contacts: 9-911, sublicensee, **LSO**

Incident Report Form

(for No Lost Time/No Medical Cost ONLY)

Last Name:	First Name:	Sex: G F G M	Date of Birth: (MM/DD/YY)
Department:		Supervisor's Name:	
Briefly describe what happened:			
Date of Incident: (MM/DD/YY)	Time of Incident: G a.m. G p.m.	Part of Body Involved:	
Location of Incident:			
Cause of Incident:	Was a safety rule violated? G Yes G No	Date Reported (MM/DD/YY)	
Safety Coordinator's Actions:			
Department Phone Number:		Point of Contact:	
<p>Please send this form to Environmental Health & Safety at Mailstop 1090, Room 122, Administrative Support Center.</p>			

TWCC CLAIM #
DIRECTOR-S #

EMPLOYER-S FIRST REPORT OF INJURY OR ILLNESS

1. Name (Last, First, M. I.)		2. Sex F <input checked="" type="checkbox"/> M <input checked="" type="checkbox"/>		15. Date of Injury (m-d-y)		16. Time of Injury a.m. <input checked="" type="checkbox"/> p.m. <input checked="" type="checkbox"/>		17. Date Lost Time Began (m-d-y) - -		
3. Social Security Number - -		4. Home Phone ()		5. Date of birth (m-d-y) - -		18. Nature of Injury*		19. Part of Body Injured or Exposed*		
6. Does the Employee Speak English? If no, Specify Language YES <input checked="" type="checkbox"/> NO <input checked="" type="checkbox"/>				20. How and Why Accident/Injury Occurred*						
7. Block no longer used		8. Block no longer used.		21. Was employee doing his regular job? YES <input checked="" type="checkbox"/> NO <input checked="" type="checkbox"/>		22. Worksite Location of Injury (stairs, dock, etc.)*				
9. Mailing Address Street or P.O. Box City State ZIP Code County				23. Address Where Injury or Exposure Occurred Name of business if incident occurred on a business site Street or P.O. Box City State Zip Code						
10. Marital Status Married <input checked="" type="checkbox"/> Widowed <input checked="" type="checkbox"/> Separated <input checked="" type="checkbox"/> Single <input checked="" type="checkbox"/> Divorced <input checked="" type="checkbox"/>				24. Cause of Injury (fall, tool, machine, etc.)*						
11. Number of Dependent Children		12. Spouse-s Name		25. List Witnesses						
13. Doctor-s Name				26. Return to work date/or expected (m-d-y) - -		27. Did employee Die? YES <input checked="" type="checkbox"/> NO <input checked="" type="checkbox"/>		28. Supervisor-s Name		29. Date reported (m-d-y)
14. Doctor-s Mailing Address (Street or P.O. Box) City State Zip Code				30. Date of Hire (m-d-y) - -		31. Was employee hired or recruited in Texas? YES <input checked="" type="checkbox"/> NO <input checked="" type="checkbox"/>		32. Length of Service in Current Position Months _____ Years		33. Length of Service in Occupation Months _____ Years
34. State Payroll Classification Code				35. Occupation of Injured Worker						
36. Rate of Pay at this Job \$ _____ Hourly \$ _____ Weekly \$ _____ Monthly		37. Full Work Week is: _____ Hours _____ Days		38. Last Paycheck was: \$		39. Is employee an Owner, Partner, or Corporate Officer? YES <input checked="" type="checkbox"/> NO <input checked="" type="checkbox"/>				
40. Name and Title of Person Completing Form			41. Name of Agency Texas Tech University			Home Department & Phone Number				
42. Agency Mailing Address and Telephone Number Street or P. O. Box Box 41090 Telephone Number (806) 742-3876 City Lubbock State TX Zip Code 79409-1090				43. Agency Location (If different from mailing address) Number and Street 2903 4th Street City Lubbock State TX Zip Code 79409-0						
44. Federal Tax ID Number 756002622 9998		45. Primary SIC 8221		46. Specific SIC N/A		47. Comptroller Agency Code 733				
48. Worker-s Compensation Insurance Company Worker-s Compensation Division, Office of the Attorney General				49. Policy Number TXSTATEPOL0001						
50. Did you request accident prevention services in the past 12 months? YES <input checked="" type="checkbox"/> NO <input checked="" type="checkbox"/>				52. Number of Hours of Sick Leave Credited to Employee on Date of Injury						
51. Signature and Title (READ INSTRUCTIONS ON INSTRUCTION SHEET BEFORE SIGNING) X _____ Claims Coordinator Date _____										

Employer's First Report of Injury or Illness (TWCC-1S)

Required:

Form TWCC-1S must be completed and submitted to EH&S for any on-the-job injury that:

- ! has more than one day of lost time;
- ! is an occupational disease, with or without lost time or medical expenditures;
- ! resulted in the death of the employee; or
- ! results in expenditures for medical treatment or service.

Instructions:

Please complete all applicable fields. Most fields are self-explanatory, however, the following items may require more attention:

- Item 4: If no home phone is available, please give a phone number where the employee can be reached.
- Item 13: Enter the name of the doctor seen as a result of your injury. Do not list your Primary Care Physician and do not simply list the location where you were seen, such as AUMC Emergency Room@.
- Item 17: This should be the first full day of lost time from work. (Please note that the Date of Injury is not considered a day of lost time.)
- Item 18: List the nature of the injury. Examples include: burn, cut, or sprain.
- Item 19: List specific body part, e.g., chin, right leg, upper arm, etc. If more than one body part is affected, list each part.
- Item 20: Describe in detail. Use an additional sheet of paper if necessary.
- Item 24: This should state the specific substance or exposure that directly inflicted the injury such as a tool, chemical or machine.
- Item 28: This is the employee's immediate supervisor.
- Item 29: This is the date the employee reported the injury to the employer.
- Item 34: This 4-digit job classification code corresponds to the primary occupation in which the employee was engaged at the time of the injury or exposure.
- Item 51: **Do not sign!** This must be the signature of the Claims Coordinator in EH&S.
- Item 52: Enter the number of sick leave hours credited to the employee as of the date of injury.

APPENDICES

Appendix A - Reference Information

- 1. Glossary of Terms**
- 2. Index of Abbreviations and Acronyms**

Appendix B - Regulations

- 1. 25 Texas Administrative Code §289.301**
- 2. Texas Tech Laser License**

APPENDIX A – REFERENCE INFORMATION

A. 1 Glossary of Terms

Introduction – This section lists information pertinent to laser safety and is considered to be a part of this manual. The definitions in this glossary will not cover every term associated with lasers but does cover a majority of the terms. If a term should be encountered in your work with lasers and is not in this glossary, consult your supervisor or call the TTU Department of Environmental Health and Safety.

Laser Terms

Absorption - means the transformation of radiant energy to a different form by interaction with matter.

Access Control - Entry must be restricted to only authorized laser personnel during the operation of laser equipment.

Accessible Emission Level (AEL) - means the maximum accessible emission level permitted within a particular class as set forth in TRCR Part 70 .

Agency - means the Texas State Radiation Control Agency, Texas Department of Health .

Average Power - means the total energy imparted during exposure divided by the exposure time .

Aversion Response - means the movement of the eyelid or the head to avoid an exposure to a noxious stimulant or bright light. It can occur within 0.25 seconds, including blink reflex time .

Aperture - means any opening in the protective housing or other enclosure of a laser product through which laser radiation is emitted, thereby allowing human access to such laser radiation .

Attenuation - means the decrease in the radiant flux as it passes through an absorbing or scattering medium .

Beam - means a collection of rays which may be parallel, divergent or convergent .

Beam Diameter - means the distance between diametrically opposed points in the cross-section of a beam where the power per unit is 1/e times that of the peak power per unit area .

Beam Divergence (O) - means the full angle of the beam spread between diametrically opposed 1/e irradiance points; usually measured in milliradians (one milliradian is approximately 3.4 minutes of arc) .

Beam Expander - means any combination of optical elements which can increase the diameter of the laser beam. Laser beam expansion is always accompanied by a proportional decrease in laser beam divergence .

Beam Splitter - means an optical device which uses controlled reflection to produce two beams from a single incident beam .

Class I - Any laser that does not permit access during the operation to levels of laser radiation in excess of the accessible emission limits contained in subsection (cc) (1) of this section.

Class II - Any laser that permits human access during operation to levels of visible laser radiation in excess of the accessible emission limits contained in subsection (cc) (1) of this section, but does not permit human access during operation to levels of laser radiation in excess of the accessible emission limits contained in subsection (cc) (2) of this section.

Class IIIa - Any laser that permits human access during operation to levels of visible laser radiation in excess of the accessible emission limits contained in subsection (cc) (2) of this section, but does not permit human access during operation to levels of laser radiation in excess of the accessible emission limits contained in subsection (cc) (3) of this section.

Class IIIb - Any laser that permits human access during operation to levels of laser radiation in excess of the accessible emission limits of subsection (cc) (3) of this section, but does not permit human access during operation to levels of laser radiation in excess of the accessible emission limits contained in subsection (cc) (4) of this section.

Class IV - Any laser that permits human access during operation to levels of laser radiation in excess of the accessible emission limits contained in subsection (cc) (4) of this section.

C0-2 Laser - wave-length 10.6 micrometers (for infrared, invisible) .

Collimated Beam - a "parallel" beam of light with very low divergence or convergence .

Continuous Wave (cw) - means the output of a laser which is operated in a continuous rather than pulse mode for a period greater than 0.25 seconds .

Controlled Area - means an area where the occupancy and activity of those within are subject to control and supervision for the purpose of protection from radiation hazards .

Diffraction - means the deviation of a part of a radiation beam, determined by the wave nature of the radiation, and occurring when the radiation beam passes the edge of an opaque obstacle.

Diffuse Reflection - means the change of the spatial distribution of a beam of radiation when it is reflected in many directions by a surface or by a medium .

Emergent Beam Diameter (a) - means the diameter of the laser beam at the exit aperture of the laser product. Measured in centimeters (cm).

Energy (Q) - means the capacity for doing work. Energy content is commonly used to characterize the output from pulsed laser products and is generally expressed in joules (J).

Energy Density - means the emittance (M) or irradiance (E) of electromagnetic radiation, energy per unit area, e.g., joules/meter² or joules/centimeter² .

Exposure - means the product of an irradiance (E) and its duration .

Gas Laser - means a type of laser where the laser action takes place in a gaseous medium .

Helium-Neon (HeNe) Laser - red aiming beam. Wave length 632.8 nanometers .

Hertz (Hz) - means the unit which expresses the frequency of a periodic oscillation in cycles per second .

Human Access - means access at a particular point to laser or collateral radiation by any part of the human body or by an object. A laser product or installation shall be considered to permit human access if radiation in excess of an accessible emission limit is incident at a point that can be reached by a straight object 3.0 + 0.1 millimeters in diameter and 10.0 + 0.1 centimeters in useful length .

Incident - means an unusual event or occurrence .

Individual - means a human being .

Infrared Radiation - - means the electromagnetic radiation with wavelengths that lie in the 0.7 micrometer to 1 millimeter range.

Installation - means any location where one or more products are used or operated .

Intensity - means the amount of energy or energy per unit time passing through a unit area perpendicular to the line of propagation at the point in question .

Intrabeam Viewing - means the viewing condition whereby the eye is exposed to all or part of a laser radiation beam .

Irradiance (E) - means the quotient of the radiant power incident on an element of a surface by the area of what element, expressed in watts per square centimeter (W/cm²).

Joule (J) - means a unit of energy, one J = 1 Watt/second .

Laser - Light Amplification by Stimulated Emission of Radiation. A device which generates or amplifies electromagnetic oscillations in the spectral region between the far infrared (submillimeter) and ultraviolet . The laser consists of an amplifying (active or Casing) medium and a regenerative of feedback device (resonant cavity). The amplifying medium can be gas, solid, or liquid. The feedback medium is generally bounded by two end mirrors. The laser light produced is of high intensity, high monochromaticity, small beam divergency (collimated), and is phase coherent .

Laser Controlled Area - means any area which contains one or more lasers and in which the activity of personnel is subject to control and supervision for the purpose of protection from laser radiation hazards .

Laser Protective Device - means any device, the intended function of which is the control of laser radiation with the intent of reducing or eliminating the exposure of personnel to such radiation .

Laser Radiation - means all electromagnetic radiation which is produced as a result of controlled stimulation emission .

Laser Safety Officer (LSO) - means any individual, qualified by training and experience in occupational and public health aspects of lasers, who is designated to evaluate the radiation hazard of and to establish, administer, and be responsible for, laser radiation protection .

Laser System - means a laser in combination with an appropriate laser energy source with or without additional incorporated components .

Lasing Medium - means a material emitting coherent radiation by virtue of stimulated electronic or molecular transitions to lower energy levels .

Limiting Aperture - means the maximum circular area over which radiance or radiant exposure can be averaged .

Maintenance - means the performance of those adjustments or procedures specified in user information provided by the manufacturer, with the laser or laser system, which are to be performed by the user to insure the intended performance of the product. It does not include "operation" or "service" as defined in this section .

Maximum Emission Duration - means the maximum duration of repeated, or continuous operation of which the laser product is capable, whichever is greater.

Maximum Output - means that maximum magnitude of energy or power, at any time after manufacture, of total accessible laser radiation emitted by a laser product over the full range of operational capability .

Maximum Permissible Exposure (MPE) - means that integrated radiance or irradiance which is specified for accessible emission limits of class I or collateral radiation of TRCR Table 70-3. Exposure duration for MPE shall be that of actual or potential personnel exposure, and not a product of classification emission duration.

Medical Laser Products - means any laser product designed or intended for purposes of in vivo diagnostic or therapeutic laser irradiance of any part of the human body .

Neodymium.Yttrium Aluminum Garnet (Nd.YAG) Laser - wavelength (λ) 1 06 nanometers .

Nominal Hazard Zone (NHZ) - means the space within which the level of the direct, reflected, or scattered radiation during normal operation exceeds the applicable MPE . Exposure levels beyond the boundary of the NHZ are below the appropriate MPE level .

Nominal Ocular Hazard Distance (NOHD) - means the distance along the axis of the unobstructed beam from the laser to the human eye beyond which the irradiance or radiant exposure during normal operation is not expected to exceed the appropriate MPE .

Operable Laser - means a laser which can produce laser radiation .

Operation - means the performance of the laser or laser system over the full range of its intended functions (normal operation). It does not include "maintenance" or "service" as defined in this section .

Optical Density (D) - means the logarithm to the base ten of the reciprocal of the transmittance.

Output Power and Output Energy - means the laser output power used primarily to rate CW lasers since the energy delivered per unit time remains constant (output measured in watts). In contrast, pulsed lasers deliver energy in pulses and their effects can be best categorized by energy output per pulse.

Power (P) - means the time rate at which energy is emitted, transferred, or received; usually expressed in watts.

Protective Housing - means those portions of a laser product which are designed to prevent human access to laser and collateral radiation in excess of the prescribed accessible emission limit under conditions specified in TRCR Part 70.

Pulse Duration - means the time increment measured between the half-peaks-power points of the leading and trailing edges of the pulse.

Pulse Repetition Frequency (PRF) - means the number of laser pulses per unit time (usually expressed in seconds).

Pulsed Laser - means a laser which delivers its energy in the form of a single pulse or a train of pulses, where the duration of a pulse is less than or equal to 0.25 seconds .

Q-switch - means a device for producing very short (approximately 30 nanoseconds), intense laser pulses by enhancing the storage and dumping of electronic energy in and out of the basing medium, respectively.

Q-switched Laser - means a laser which emits short (approximately 30 nanoseconds), high-power pulses by utilizing a Q-switch .

Radiance (L) - means radiant power per unit area of radiation surface per unit solid angle of emission, expressed in watts per square centimeter per steradian ($\text{w/cm}^2/\text{Sr}$).

Radiant Energy (Q) - means energy emitted, transferred or received in the form of radiation, expressed in joules (J).

Radiant Exposure (H) - means the quotient of radiant energy incident on an element of a surface by the area of that element, expressed in joules per square centimeter (J/cm^2).

Radiant Intensity (I) (of a source in a given direction) - means the quotient of the radiant flux leaving the source, propagated in an element of solid angle containing the given direction, by the element of solid angle. Expressed in watts per steradian (w/Sr).

Radiant Power means power emitted, transferred or received in the form of radiation, expressed in watts (W).

Reflectance, Reflectivity (P) - means the ratio of total reflected radiant power to total incident power .

Reflection - means the deviation of radiation following incidence on a surface .

Remote Control Connector - means a two-terminal connector which permits the connection of external controls placed apart from other components of the laser product to prevent human access to all laser and collateral radiation in excess of limits specified .

Safe Eye Exposure Distance (SEED) - means the distance from an operating laser such that the energy that might infringe upon the eye is less than the MPE .

Safety Interlock - means a device associated with the protective housing or enclosure of a laser product to prevent human access to excessive radiation under conditions specified .

Service - means the performance of those procedures or adjustments described in the manufacturer's service instructions which may affect any aspect of the performance of the laser or laser system. It does not include "maintenance" or "operation" as defined in this section .

Shall - the word "shall" is understood to mean mandatory.

Should - the word "should" is understood to mean that which is advisable .

Source - means the term used to describe either a laser or laser-illuminated reflecting surface .

Specular Reflection - means a mirror-like reflection .

Transmission - means the passage of radiation through a medium .

Transmittance (T) - means the ratio of total transmitted radiant power to total incident radiant power.

Ultraviolet Radiation - means the electromagnetic radiation with wavelengths shorter than those for visible radiation (0.2 - 0.4 micrometers). This region is often broken down into three spectral bands by wavelength: VV-A (315 - 400 nanometers). UV-B (280 - 315 nanometers), and UV-C (200 - 280 nanometers).

Unrestricted Area - means any area to which access is not controlled for the purposes of protection of individuals from exposure to radiation .

Vaporization - means the conversion of a solid or liquid into vapor.

Visible Radiation (Light) - means all electromagnetic radiation which can be detected by the human eye . It is commonly used to describe wavelengths which lie in the range between 0.4 micrometers and 0.7 micrometers .

Watt (W) - means a unit of power, or radiant flux .

Wavelength - means only the propagation wavelength in air of electromagnetic radiation .

A. 2 Index of Abbreviation and Acronyms

TAC	Texas
LSM	Laser Safety Manual
RLSC	Radiation Laser Safety Committee
LSO	Laser Safety Officer
SOP	Standard Operating Procedures
OD	Optical Density
PPE	Personal Protective Equipment
ANSI	American National Standards Institute
LIA	Laser Institute of America

APPENDIX B – REGULATIONS

The regulatory documents and licenses may be examined at Administration Support Center Room 122, in the department of Environmental Health & Safety. More specific information can be obtained from the Radiation Safety Office.

B.1 TEXAS DEPARTMENT OF HEALTH

The following section will briefly describe specific parts of the **Texas Regulations for Control of Radiation (TRCR) and the Texas Regulations for Control of Laser Radiation Hazards (TRCLRH)**. TTU is subject to the rules of the **TRCR, TRCLRH**, and other state, federal, and local regulations when using lasers

1. **25 TAC §289.301-** establishes requirements for the registration of who receive, possess, acquire, transfer, or use class IIIB and class IV lasers; requirements for protection against laser radiation hazards; and responsibilities of the registrant and the laser safety officer, laser hazard control methods, training requirements and notification of injuries.
2. **25 TAC §289.201- General Provisions**, contains general information concerning record keeping, testing of sealed sources, violation information, and transport grouping of radionuclides.
3. **25 TAC §289.203- Notices, Instructions, and Reports to Workers; Inspections** - establishes requirements for notices, instructions, and reports by licensees or registrants to individual engaged in work under a license or registration, and options available to such individuals in connection with the State Bureau of Radiation Control (BRC) inspections regarding radiological conditions. Areas of particular interest are requirements for Posting of Notices, Instructions to Workers, Requests by Workers for Inspections, etc.
4. **25 TAC §289.204- Fees for Certificates of Registration, Radioactive Material (s) Licenses, Emergency Planning and Implementation, and Other Regulatory Services**, establishes fees, schedules and provide for the payment of registrations, licenses emergency planning and implementation, and other regulatory services according to the various categories in the specified disciplines.
5. **25 TAC §289.205- Hearing and Enforcement Procedures**, governs the proceedings for the granting, denying, renewing, transferring, amending, suspending, revoking, or annulling of license or certificate of registration; determining compliance; assessing administrative penalties; and determining propriety of other agency orders.

B.2 Texas Tech University Laser License

Texas Tech University currently holds a laser license issued by the Texas Department of Health Bureau of Radiation Control: **Certificate of Laser Registration Z00130**.

This license authorizes Texas Tech University to receive, possess, transfer or acquire laser devices and to use such devices for the purpose (s) and at the place (s) designated. Texas Tech University is subject to all applicable rules, regulations and orders of the Texas Department of Health, and the stated conditions.

REFERENCES

1. Laser Institute of America; 2000.
2. Rockwell Laser Industries; 1994.
3. Sliney, D.; and Wolbarsht, M. Safety with Lasers and Other Optical Sources. New York: Plenum Press; 1980.
4. Michel, R.; Michel, R.; Kerns, K.; and Zimmerman, T.; Managing a Sound Laser Safety Program, Operational Radiation Safety, Vol. 77, No 2. S2-S8. August 1999.
5. 25 Texas Administrative Code §289.301