



ENVIRONMENTAL HEALTH AND SAFETY STANDARD OPERATING PROCEDURES

SOP No. 24.01.01.W1.39AR WTAMU Laser Safety Procedure

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Environmental Health and Safety at WTAMU is composed of three distinct but integrated environmental safety departments that report to the Vice President of Research and Compliance. Academic and Research Environmental Health and Safety (AR-EHS) is responsible for research and academic related compliance, which includes laboratory and academic research and the associated compliance committees. Fire and Life Safety (FLS-EHS) is responsible for fire related compliance and conducts fire and life safety inspections of campus buildings and assists with the testing all fire detection and suppression systems. General Safety (GHS-EHS) promotes safe work and health practices, to all faculty, staff, students, and visitors. Examples of General Health and Safety components include: office safety, proper lifting techniques, trip and fall prevention.

Supplements [TAMUS Regulation 24.01.01](#)

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Introduction

The West Texas A & M University Laser Safety Procedure sets forth controls and safety guidance for research and educational activities involving lasers. This program is established to institute prudent safety practices and to meet the requirements of 25 Texas Administrative Code §289.301. If any conflict occurs between this Program Manual and the Code, the latter shall prevail.

Additional guidance documents are available from the American National Standards Institute (ANSI)

Safe Use of Lasers (Z-136.1)

Safe Use of Optical Fiber Communication Systems Utilizing Laser Diode and LED sources (Z-136.2)

Safe Use of Lasers in Health Care Facilities (Z-136.3)

These and other publications and services can be ordered through Laser Institute of America, www.laserinstitute.org.

1. Organization

The Laser Safety Program shall be administered by the WTAMU Laser Safety Officer (LSO) within the Environmental Health and Safety Department (EHS).

2. Laser Safety Officer (WTAMU LSO) (See also section 4.2)

The WTAMU Laser Safety Officer is an EHS staff member who has the knowledge and responsibility to apply appropriate laser radiation protection rules, standards, and practices. The WTAMU Laser Safety Officer (LSO) is named and specifically authorized to perform duties specified on the Certificate of Laser Registration issued by the State of Texas, Department of Health, Bureau of Radiation Control.

3. Classification and Registration

Classification of lasers shall be in accordance with US Food and Drug Administration (FDA) or American National Standards Institute specification ANSI Z136.1. Each Class IIIb or IV laser at WTAMU shall be registered, and shall have a permit issued by the WTAMU LSO. Arrays of semiconductor lasers shall be permitted if the cumulative power exceeds Class IIIa limits. Lasers which are classified as IIIa or lower, but which contain a IIIb or IV laser, shall be controlled at

the higher classification if the class IIIb or IV laser is accessed. Any class IIIb and IV laser will be referred to as "laser" unless otherwise noted. Each permittee shall be responsible for establishing and supporting laser safety for the permitted laser.

3.1. Registration Information

Each laser which is possessed, purchased, donated, manufactured, created, assembled or otherwise received by any person or entity at WTAMU shall have a permit. [Application for the permit shall be tendered to the WTAMU LSO by the receiving party as soon as is practicable, but **in no case more than 10 days following receipt of the laser.**]

A Laser Permit Application (Laser Form 1) is provided as Appendix C to this document.

This section describes what information must be provided with the Laser Permit Application. Information shall include:

1. The name and position of the applying permittee including, department and contact information.
2. The PI, if different from the permittee. (The See section 4.2).
3. The signature of the Department Head or equivalent. The department head must recognize and acknowledge use of lasers in that department.
4. The physical location of the laser. This is the room number or lab. A drawing may be required in some instances.
5. The type of laser (Dye, Argon, Diode, Eximer, etc.)
6. The manufacturer of the laser. (From the control panel. If the laser is manufactured by WTAMU personnel, so state).
7. The model and serial number of the laser. (This should come from the control panel...)
8. The inventory number (AMU, RF etc.)
9. The excitation mechanism (Optical, electrical, chemical, etc.).
10. The time-dependent operating properties of the laser (CW, Pulse, Repetitively Pulsed, mode-locked, etc.).
11. If continuous wave (CW), the power in watts.
12. If pulsed:
 - a. The maximum capable energy level of the laser in joules.
 - b. The maximum pulse frequency per second.

c. The minimum pulse duration.

13. The operating wavelength(s) of the laser.

14. Other information should include a brief description of the purpose of the laser (Doppler measurements, fluorescence etc.), frequency of use, expected primary users etc. Anything that may have a bearing on safety related issues.

Any request for exemption or waiver of these information requirements shall be addressed by the WTAMU LSO on a case-by-case basis upon petition from the person who possesses the laser. Multiple semiconductor lasers may be registered as an array if so designed. Class IIIb or IV semiconductor lasers must be individually permitted, and a means for tracking these lasers must be provided by the permittee.

3.2. Removal from Registration

Each laser that is rendered permanently inoperative by disassembly or destruction, or which is removed from WTAMU's control by gift, surplus designation, or transfer to a non-WTAMU entity shall: **provide information regarding the condition or destination to the WTAMU LSO not later than 10 days from its inoperative state or removal.** The permittee shall provide disposition information to the WTAMU LSO prior to leaving the university.

3.3. Manufacture/Construction (Reference) 25 TAC §289.301(b)(2)

Each laser which is manufactured to an entity outside WTAMU shall meet US Food and Drug Administration requirements per 21 CFR Part 1040, Federal Laser Product Performance Standard. A laser which is manufactured or assembled for internal WTAMU use, **or which is designed for specific temporary use by another entity with express intent to return the laser directly to that entity**, is exempt from this requirement.

4. Laboratory Personnel

4.1. Permittee

The permittee is the person whose name appears on the permit for the laser. Typically, this is the Primary Investigator (P. I.) and, must be permanent faculty or staff (not a postdoctoral fellow or a graduate student). The permittee is responsible for:

1. Laser Safety in the laboratory
2. Ensuring the availability of correct protective eyewear. (See section 6.5)
3. Providing a Laser Safety Standard Operating Procedure (SOP). (See Section 6.1)
4. Providing, implementing, and enforcing the Laser Safety Program specific to the laboratory's laser
5. Ensuring proper training in laser operation and safety

6. Classifying and labeling all lasers in the laboratory
7. Completing laser permitting with the WTAMU LSO
8. Notifying the WTAMU LSO immediately if an exposure incident occurs
9. Notifying the WTAMU LSO if a laser is decommissioned, sold, or transferred.

The permittee may designate any of these responsibilities to the principle investigator (PI).

4.2. Laser Safety Officer (Permittee/Laboratory)

Each permittee shall designate a Laboratory Laser Safety Officer (LSO) and shall identify the authorized PI to the WTAMU LSO. This person may be the permittee or a delegate, but shall be a budgeted employee (staff or faculty, not a graduate student or post-doctoral worker) of the university. (Normally the permittee retains the function and title of the LSO.) The PI shall maintain the Laser Safety Program for the individual lasers in the laboratory, and may call on the WTAMU LSO for assistance as needed. The PI, acting under the permittees authority has the responsibility to institute corrective actions including shutdown of laser operations when necessary due to unsafe conditions.

4.3. Laser Operator or User

The laser operator or user is a person who sets up, aligns, operates or, uses the laser for experimental or research purposes, or has other assigned laser duties. The laser operator/user is responsible for:

1. Following laboratory administrative, alignment, safety, and standard operating procedures while operating the laser.
2. Keeping the PI fully informed of any departure from established safety procedures.

5. Maximum Permissible Exposure (MPE) and Nominal Hazard Zone (NHZ) *(Reference) 25 TAC §289.301(d)(31) and,(34), 25 TAC §289.301(u)*

An MPE is the level of laser exposure to which the eye or (less limiting) the skin, may be exposed without adverse affects. NHZ is the space within which the level of direct, reflected or scattered radiation during operation exceeds the applicable MPE.

When any class IIIb or IV laser is used at levels at or above IIIb in an open beam mode (unenclosed) the MPE will be assumed to be exceeded in that room or area and appropriate precautions shall be taken. In other words, The NHZ (nominal hazard zone) will comprise the enclosure (room or area to which the beam is restricted to by virtue of walls, curtains or other barriers) in which the laser is operating if operated at or above IIIb levels. This is done to account for intentional or unintentional scattered or reflected beam. If the PI believes the NHZ does not apply to the whole area he may justify a more limited NHZ in the SOP by using information supplied by the laser manufacturer, by measurement, or by using the appropriate laser range equations or other equivalent assessments.

6. Required Laser Safety Program Features

6.1. Laser Safety Standard Operating Procedure (*Reference*) 25 TAC §289.301(r)

Each laser shall have a Laser Safety Standard Operating Procedure (SOP) written for its operation. An SOP is the same as a laboratory/laser/research specific protocol that specifies safe use and procedures for the laser system. The **SOP must be present at the operating console or control panel of the laser**. The SOP shall include at a minimum operating instructions, safety eyewear parameters and instructions for proper use, interlock instructions, and a checklist for operation. The SOP shall include clear warnings to avoid possible exposure to laser and collateral radiation in excess of the MPE and 25. TAC §289.301(r)(2). The SOP shall be available for inspection by the WTAMU LSO at any time. **A template for Laser Safety Standard Operating Procedures is attached as Enclosure 1.**

6.2. Safety Interlocks and Warning Systems (Reference) 25 TAC §289.301(r)(3)(B) and (D)

A safety interlock is a device that automatically prevents human access above MPE limits.

Safety interlocks shall be provided for any portion of the protective housing that by design can be removed or displaced without the use of tools during normal operation or maintenance, and thereby allows access to radiation above MPE limits.

Adjustment during operation, service, testing, or maintenance of a laser containing interlocks shall not cause the interlocks to become inoperative except where a laser controlled area, as specified in subparagraph (E) of the referenced regulation, is established.

For pulsed lasers, interlocks shall be designed to prevent firing of the laser; for example, by dumping the stored energy into a dummy load and for CW lasers, the interlocks shall turn off the power supply or interrupt the beam (i.e., by means of shutters).

Each class IIIb or IV laser system shall provide visual or audible indication during the emission of accessible laser radiation. The indication shall occur prior to emission of radiation with sufficient time to allow appropriate action to avoid exposure. Any visual indication (e.g., lights) shall be visible through protective eyewear for the wavelength of the laser so that eyewear need not be removed to see it.

6.3. Safety Interlocks-Alternatives (Reference) 25 TAC§ 289.301(r)(3)(E)(iii)(II)

The regulations recognize that in situations where an engineering control (automatic safety interlock) may be inappropriate, the WTAMU LSO shall specify alternate controls to obtain equivalent laser safety protection. **Requests to use alternate controls may be submitted in writing to the WTAMU LSO and, if accepted, will be documented in the SOP.**

Where safety latches or interlocks are not feasible or are inappropriate, for example during surgical procedures a **controlled area** shall be established and the following shall apply:

1. All authorized personnel shall be trained in laser safety and appropriate personal protective equipment shall be provided and worn upon entry.
2. A door, blocking barrier, screen, or curtains shall be used to block, screen, or attenuate the laser radiation at the entryway. The level at the exterior of these devices shall not exceed the applicable MPE, nor shall personnel experience any exposure above the MPE immediately upon entry.
3. If a laser is energized and operating at class IV levels then at the entryway there shall be a visible or audible signal and other appropriate signage indicating laser operations. This indicator may be interfaced with the laser itself, the power supply, or manually operated in accordance with the SOP requiring its use.
 - a. For indoor controlled areas, during tests requiring continuous operation, the individual in charge of the controlled area may momentarily override the safety interlock. The sole purpose is to allow access to other authorized persons if it is clearly evident that there is no optical hazard at the entry area and protective eyewear is worn by the entering person.
 - b. For outdoor controlled areas (such as atmospheric tests) the permittee or PI must notify the WTAMU LSO or EHS three working days prior to operation of class IV levels of laser energy. The WTAMU LSO will contact the Federal Aviation Administration or other appropriate agencies as necessary.
 - c. When removal of panels or protective covers and/or overriding interlocks becomes necessary, such as for servicing, testing or maintenance and laser radiation exceeds the MPE, a temporary controlled area must be established and posted.

6.4. Training (Reference) 25 TAC §289.301(q)(1)

Every person who operates or works with a laser shall complete training in laser safety provided by WTAMU or WTAMU LSO-approved equivalent. This training is referred to as the General Laser Safety Training available on TrainTraQ. Persons completing General Laser Safety Training shall also complete specific laser safety training given by the permittee or PI. No person may work in a NHZ prior to completing both laser safety training classes.

West Texas A & M University Environmental Health and Safety will follow the Texas A & M University System Policy [33.05.02 Required Employee Training](#). Staff and faculty whose required training is delinquent more than 90 days will have their access to the Internet terminated until all trainings are completed. Only Blackboard and Single Sign-on will be accessible. Internet access will be restored once training has been completed. Student workers whose required training is delinquent more than 90 days will need to be terminated by their manager through Student Employment.

6.5. Protective Eyewear (Reference) 25 TAC §289.301(t)(1)

Each permittee shall provide protective eyewear that meets the requirements of 25 TAC §289.301(t)(1). The eyewear shall be located where persons who operate the laser have unrestricted access to the eyewear. The eyewear shall be worn during any operation where a class IIIb or IV beam is not enclosed. This normally includes alignments. Training on identification, proper fit, location, and use of eyewear shall be included in the specific laser safety training.

Protective eyewear shall meet the following requirements:

1. Provide a comfortable and appropriate fit all around the area of the eye
2. Be in good physical condition to ensure the lenses retain all protective properties during its use
3. Be of optical density adequate for the laser energy involved
4. Have the optical density or densities and associated wavelengths permanently labeled on the filters or eyewear
5. Be examined at intervals not less than 12 months, to ensure the reliability of the protective filters and integrity of the holders. Unreliable eyewear shall be discarded and replaced.
6. The optical density of the protective eyewear shall be appropriate for the specific frequency and pulse length of the laser beam in use, and shall provide reduction of the incident energy to less than the MPE of the laser. It is important to include the pulse length and frequency of pulse repetition of pulsed lasers in selecting appropriate protective eyewear

6.6. Miscellaneous Safety and Training Issues

1. Persons working in a laboratory with multiple lasers shall be made aware of the various wavelengths and other operating parameters by the laser operator/users
2. Persons working with tunable lasers, or any laser which is frequency doubled or frequency tripled, shall be aware of the effect of frequency manipulation and shall choose protective eyewear which will provide protection for the effective wavelength of the laser.

6.7. Surveys (Reference) 25 TAC §289.301(w)

Each PI shall survey the laboratory containing the laser(s) for which the permittee is responsible. The survey shall be performed using Laser Form 2 (Appendix D) or equivalent that covers the items of Laser Form 2 at a minimum. The survey shall be performed at least quarterly, and shall be performed prior to operating a laser for the first time after assembly, maintenance, or modification of the beam path, operating wavelength, or power level. Survey records shall be retained for inspection by the WTAMU LSO.

6.8. Fiber Optic Transmission (Reference) 25 TAC §289.301(s)(2)

Optical cables used for transmission of laser radiation shall be considered part of the laser protective housing. Disconnection of a fiber optic connector which results in access to radiation in excess of the MPE, shall take place in a controlled area. All connectors shall bear appropriate labels. Optical cables shall be encased in an opaque sleeve to prevent leakage of laser radiation in case of breakage. Note: If the fiber is designed to emit light through the walls of the fiber the PI must inform the WTAMU LSO and include justification for lack of opaque cover in the SOP.

6.9. Skin protection (Reference) 25 TAC §289.301(t)(2)

When there is potential for skin exposure to levels exceeding the skin MPE for the laser, persons in the controlled area shall wear appropriate clothing, gloves, and/or shields.

6.10. Magnification of Laser Beam (Reference) 25 TAC §289.301 (r)(2)(C)(ii)

If at any time a laser beam is optically magnified or concentrated, special precautions shall be taken by the permittee to prevent specular or diffuse reflection or other exposure greater than the MPE for the laser. The special precautions shall be documented in the SOP for the laser.

7. Records Retention (Reference) 25 TAC §289.301(ee)

Records of Surveys, Training, NHZ and MPE calculations, and other laboratory-specific information shall be maintained in the laboratory, and shall be available for inspection/review by the WTAMU LSO at any time.

No official state records may be destroyed without permission from the Texas State Library as outlined in [Texas Government Code, Section 441.187](#) and [13 Texas Administrative Code, Title 13, Part 1, Chapter 6, Subchapter A, Rule 6.7](#). The Texas State Library certifies Agency retention schedules as a means of granting permission to destroy official state records.

West Texas A & M University Records Retention Schedule is certified by the Texas State Library and Archives Commission. West Texas A & M University Environmental Health and Safety will follow [Texas A & M University Records Retention Schedule](#) as stated in the Standard Operating Procedure [61.99.01.W0.01 Records Management](#). All official state records (paper, microform, electronic, or any other media) must be retained for the minimum period designated.

8. Non-Radiation Hazards *Appendix B*

Each PI shall evaluate or have an evaluation made of non-radiation hazards. This evaluation shall include electrocution, chemical, cutting edge, compressed gases, noise, confined space, fire, explosion, ventilation, and physical safety hazards. The evaluation shall be made part of the SOPs and be available for review.

9. Incident Reporting (Reference) 25 TAC §289.301(z) -(bb)

Each permittee shall immediately seek appropriate medical attention for the injured individual and notify the WTAMU LSO by telephone of any exposure injury involving a laser possessed by the university. The WTAMU LSO shall be notified within 48 hours of any non-injury incident (near miss) which involves potential exposure to laser radiation exceeding the MPE. A written summary of an injury or non-injury incident shall be forwarded to the WTAMU LSO not later than five working days following the incident. Records of any incident shall be maintained by the PI (permittee).

Related Statutes, Policies, or Requirements

Contact Office

WTAMU Environmental Health and Safety
(806) 651-2270

West Texas A&M University Laser Safety Program

Beam Control Precautions

- Do not look directly into the beam or at a specular reflection, regardless of its power.
- Terminate the beam at the end of its useful path.
- Locate the beam path at a point other than eye level when standing or sitting at a desk.
- Orient the laser so that the beam is not directed toward entry points to the controlled area or toward aisles.
- Minimize the possibility of specular and diffuse reflections.
- Securely mount the laser on a stable platform.
- Limit beam traverse during adjustments.
- Clearly identify beam paths. Ensure the path does not cross into areas, study areas, desk areas, or traffic paths.
- A beam path that exits from a controlled area must be enclosed wherever the beam irradiance exceeds the MPE.
- Minimize reflective objects in the laboratory.
- Be aware that cooling systems or any liquid condensate can provide a specular reflective surface.
- Utilize appropriate eye protection during beam alignment and beam instrument manipulation.

West Texas A&M University Laser Safety Program

Non-beam Control Precautions

This section references ANSI Z136.1 "For the Safe Use of Lasers" Section (7). Non-beam controls refer to hazard controls associated with:

- electricity
- noise,
- chemicals
- cryogenics
- other hazards.

Until this appendix is completed in more detail the primary interim reference is *The Laser Safety Institute of America Guide to Non-beam Hazards Associated with Laser Use*, 1999. A copy of this reference is available from the WTAMU LSO and can be ordered through the Laser Safety Officer.

Special note: the only fatalities associated with the use of lasers are by electrocution, even though most of the emphasis of the regulations and policy is eye damage.

Warning!

During periods of installation, maintenance, repair, calibration and any other procedures which result in the accessibility to high-voltage components, the concern for electric shock is paramount!

See Section 8.0 of this Laser Safety Program

West Texas A&M University Laser Safety Program

Laser Form 1

Laser Permit Application

All class IIIb and IV lasers used at West Texas A&M University are required to have a permit from the Environmental Health and Safety Department (EHS) [See Section 3.1 Registration Information]. Safe laser use and procedural compliance is the responsibility of the faculty or staff member who is assigned as the Laboratory Laser Safety Officer (LSO).

To register your laser, please provide the following information on each laser and send it to:

WTAMU **Laser Safety Officer**, EHS, WT Box 60217 Canyon, TX 79016

PERSONAL INFORMATION

Permittee _____ Title/Position _____
 Dept. _____ Office Phone _____ Mail Stop _____

Email _____

PI (Indicate if different from permittee) _____

LASER INFORMATION

Location _____ Type (Dye, Gas, etc.) _____
 _____ Manufacturer: _____ Model: _____

Serial # _____ AMU or Inventory # _____

Excitation Mechanism: _____

Time-dependent operating properties: (CW, pulse, mode-locked) _____

(If CW, power in watts) _____

(If pulsed maximum capable energy (joules) _____

Minimum pulse duration (sec) _____

Maximum Pulse Frequency (per sec) _____

Operating Wavelengths (nm) _____

Other/notes

Safety Procedures: By checking these boxes below, you agree that you will abide by the required safety procedures at your facility. Each box must be checked or the application will be considered incomplete.

- Use of proper protective eyewear
- Proper signage, labeling, posting, and barriers
- Operating and safety procedures and operator's manual readily available

I have read and understand the WTAMU Laser Safety Program Manual regarding laser safety and my responsibilities and authority as stated in section 4.1 (permittee).

Permittee Signature _____ Date _____

PI designated PI signature (if different from Permittee) _____

Department Head (Equivalent) Signature _____

Date _____

West Texas A&M University Laser Safety Program

Laser Form 2

Laboratory Laser Survey

Yes-No-N/A

1. Labels and Signs

Is the correct warning label affixed to the laser? _____

Are signs posted clearly near the laser _____

Are all accesses to the room properly posted? _____

Is a label, sign, or warning posted near the aperture? _____

Is a label or warning posted near an interlock? _____

2. Engineering Controls

Does each laser have a key switch or entry password? _____

Is appropriate safety eyewear provided and present? _____

Do safety covers have interlocks? _____

Are latches or interlocks provided to restrict access
to the controlled area? _____

Are all warning devices functioning within design
specifications? _____

Are any items in or near beam paths which could cause
specular reflections? _____

Is a physical barrier present at the controlled area entry? _____

3. Procedural Controls

Is each laser registered properly? _____

Is access to the NHZ restricted? _____

Does each person have required training? _____

Is the SOP for the laser present at the control? _____

Are curtains up and used (If required)? _____

Is documentation available? _____