

I. Introduction

Texas Christian University ("TCU") has established this Laser Safety Policy to provide controls and safety guidance for research and educational activities involving lasers. This policy and supporting procedures are established to meet the requirements of 25 Texas Administrative Code 289.301 ("TAC Requirements"), other applicable law, and to institute prudent safety practices. If any conflict occurs between this Policy and applicable law, the latter shall prevail.

II. Applicability

This policy applies to all class 3R, 3B and 4 lasers and laser systems operated under the authority of TCU for research purposes. This includes acquisition, manufacture, registration, use, monitoring, transfer, and disposal of lasers.

III. Definitions

The definitions used in this policy, but not otherwise defined, have the same meaning as in the TAC Requirements.

Accessible emission limit ("AEL"). The maximum accessible emission level permitted within a particular class.

Beam. A collection of rays characterized by direction, diameter (or dimensions), and divergence (or convergence).

Class 1 (I) laser, IEC Class 1 and 1M. Any laser that does not permit access during the operation to levels of laser radiation in excess of the AELs contained in American National Standards Institute (ANSI) Z136.1-2000, Safe Use of Lasers.

- a. Class 1 laser systems are incapable of producing damaging radiation levels during normal operation and are exempt from any control measures. Class 1 laser systems may contain embedded higher class lasers and may produce laser hazards if operated with interlocks defeated. Only authorized personnel may operate those class 1 laser systems with interlocks defeated.
- b. Class 1M laser systems are incapable of producing hazardous exposure conditions during normal operation unless the beam is viewed with optical instruments.

Class 2 (II) laser, IEC Class 2 and 2M. Any laser that permits human access during operation to levels of visible laser radiation in excess of the AELs of Class 1 lasers contained in ANSI Z136.1-2000, Safe Use of Lasers, but does not permit human access during operation to levels of laser radiation in excess of the AELs of Class 2 lasers contained in ANSI Z136.1-2000, Safe Use of Lasers.

- a. Class 2 laser systems emit visible light only at a power level of 1 milliwatt or less. The normal aversion response to bright light is adequate protection. Staring into the beam of a class 2 laser is hazardous.

- b. Class 2M laser systems emit visible light only. The normal aversion response to bright light is adequate protection for unaided viewing. However, viewing the beam with optical aids is potentially hazardous.

Class 3a (IIIa) laser, IEC Class 3R. Any laser that permits human access during operation to levels of visible laser radiation in excess of the AELs of Class 2 lasers contained in ANSI Z136.1-2000, Safe Use of Lasers, but does not permit human access during operation to levels of laser radiation in excess of the AELs of Class 3a lasers contained in ANSI Z136.1-2000, Safe Use of Lasers.

Class 3R laser systems are potentially hazardous under some viewing conditions, but the probability of an actual injury is small, and the control measures for safe use are straightforward.

Class 3b (IIIb) laser, IEC Class 3B. Any laser that permits human access during operation to levels of laser radiation in excess of the AELs of Class 3a lasers in ANSI Z136.1-2000, Safe Use of Lasers but does not permit human access during operation to levels of laser radiation in excess of the emission limits of Class 3b lasers contained in ANSI Z136.1-2000, Safe Use of Lasers.

Class 3B laser systems are eye hazards for intrabeam viewing and specular reflections, even for momentary exposures, but diffuse reflections are not usually hazardous. Class 3B laser systems shall be operated only in laser controlled areas by authorized operators. Operators of class 3B laser systems shall receive approved laser safety training. A written Standard Operating Procedure is required for class 3B laser operation.

Class 4 (IV) laser, IEC Class 4. Any laser that permits human access during operation to levels of laser radiation in excess of the AELs of Class 3b lasers contained in the most recent edition of ANSI Z136.1-2000, Safe Use of Lasers.

Class 4 laser systems are eye hazards and skin hazards for intrabeam exposures, specular reflections, and diffuse reflections. They are also fire hazards and may produce laser generated air contaminants. Class 4 laser systems shall be operated only in laser controlled areas by authorized operators. Operators of class 4 laser systems shall receive approved laser safety training. A written Standard Operating Procedures is required for class 4 laser operation.

Joule. A unit of energy. One joule is equal to one watt • second.

Laser. An electronic device that emits stimulated radiation to energy density levels that could reasonably cause bodily harm. A laser may also produce an intense, coherent, directional beam of light by stimulating electronic or molecular transitions to lower energy levels. The term "laser" also includes the assembly of electrical, mechanical, and optical components associated with the laser. A laser can be a component of a product or system.

Laser Safety Committee ("LSC"). The LSC is a technical advisory committee for laser safety issues for TCU. The LSC will support the Laser Safety Officer, by assisting with the defining and evaluating safety compliance with all appropriate federal and state regulations, and TCU policies and procedures, among other things. The Committee reports to the Associate Provost for Research.

Laser Safety Officer (“LSO”). The LSO is a faculty representative appointed by the Chancellor, in consultation with the Associate Provost for Research, who has a knowledge of and the authority and responsibility to apply appropriate laser radiation protection rules, standards, and practices. The LSO reports to the Associate Provost for Research and is supported by the Office of Research and Environmental Management and Safety. The LSO is specifically authorized on a certificate of laser registration.

Reflection. The deviation of radiation following incidence on a surface.

Watt. The unit of power or radiant flux. 1 watt equals 1 joule per second.

Maximum permissible exposure (MPE). The highest power or energy density (in W/cm² or J/cm²) of a light source that is considered safe, i.e. that has a negligible probability for creating damage. It is usually about 10% of the dose that has a 50% chance of creating damage under worst-case conditions.

IV. Policy Statements

A. Roles and Responsibilities

1. Office of Research. The Office of Research oversees laser safety in research. Oversight includes:
 - Ensure the LSO maintains and/or obtains necessary registration for all lasers used at TCU.
 - Appoints LSO and ensure LSO is properly trained and capable of serving as LSO.
 - Ensure overall program includes appropriate procedures in place for training, injury reporting, and potential violations reporting.

2. LSO. The LSO has lead responsibility and authority to ensure compliance with this policy. The LSO shall:
 - Ensure proper registration of class 3B and 4 laser with the Texas Department of State Health Services, Radiation Control Program
 - Oversee implementation of appropriate control measures
 - Perform surveys for all class 3R, 3B and 4 lasers and laser work areas at least annually. Such surveys shall include:
 - a determination that all laser protective devices are labeled correctly and properly chosen for lasers in use;
 - a determination that all warning devices are functioning within their design specifications; and
 - a determination that the controlled area is properly controlled and posted with accurate warning signs in accordance with TAC Requirements.
 - Inspect laser eyewear and other equipment, for proper condition and function

- Ensure that all laser personnel receive appropriate safety training prior to any laser use
- Maintain appropriate records. Such records include:
 - Laser Safety Audit reports
 - Laser Inventory of class 3R, 3B and 4 lasers
 - Laser Accidents and Laser Incidents
- Implement State requirements for laser use

The LSO has final authority in determining laser control measures and may approve alternate controls when these are appropriate based on the judgment of the LSO. The LSO shall have the authority to terminate laser operations at any time.

3. LSC. The LSC's duties include the following:

- Establish and maintain adequate policies and practices for the evaluation and control of laser hazards within TCU.
- Make recommendations to the LSO for appropriate laser safety training programs and materials and standard operating procedures.
- Maintain an awareness of all applicable new or revised laser safety standards.
- Facilitate compliance within their respective Departments with laser safety standards.
- Assist in investigating alleged infractions of safety rules or improper use of laser equipment brought to its attention by the LSO or other responsible personnel, and recommend remedial action to correct such infractions.

4. Environmental Management and Safety ("EMS"). The Risk Management Director will designate a specific individual to serve on the laser safety committee and support the LSO, as needed.

5. Principal Investigator ("PI"). The PI shall have the responsibility and authority to ensure laser safety compliance for their personnel and equipment. The PI shall:

- Ensure all lasers have been properly classified
- Have direct accountability for all class 3R, 3B and 4 lasers and laser work areas
- Specify and implement approved control measures for all class 3R, 3B and 4 lasers
- Establish standard procedures for laser use and alignment
- Ensure that all laser personnel receive appropriate safety training prior to using any laser
- Keep accurate records regarding personnel training
- Actively ensure lab practices are in compliance with safety requirements
- Notify LSO of laser purchases, use, transfer, and disposal within 3 months of purchase, transfer or disposal

- Notify the LSO immediately of known or suspected laser-related accidents and injuries, and cooperate with LSO and the laser safety committee during the course of their investigation and implement recommendations to prevent a recurrence. A written incident report of any actual injury must be submitted to the LSO within seven (7) days of the PI's knowledge of the incident.
6. Persons working with Lasers in research. All persons who work with class 3R,3B or 4 lasers with the beam exposed shall:
- Be authorized laser users designated by the PI. Comply with laser safety rules and work procedures
 - Immediately notify their PI or the LSO of potential accident or injury, or in case of a suspected unsafe condition.
- B. Notifications and Reports of Hazardous Exposure and Injuries.** Any suspected hazardous exposure must be reported to the LSO immediately.
- C. Control Measures.** All class 3R, 3B and 4 lasers shall be operated in a laser controlled area. The requirements for individual laser controlled areas shall be determined by the LSO. The minimum requirements for laser controlled areas are:
- Entryway controls to allow only authorized personnel or approved spectators to enter the laser control area. (Administrative controls are acceptable.)
 - Conspicuously posted sign or signs, giving adequate instruction for the protection of personnel.
 - Laser safety eyewear must be available and used in accordance with applicable procedures for class 3R, 3B and class 4 lasers.
 - Eyewear shall be selected for providing an adequate level of protection from the laser and for suitability to the wearer and environment.
 - Eyewear shall be inspected annually to ensure that the protection level has not degraded through use and beam exposure.
 - Beam control (barriers and beam blocks) to limit laser hazards within the controlled area.
 - Appropriate training of operations is required for all class 3R, 3B and 4 lasers.

V. Enforcement

Failure to comply with this Policy could result in disciplinary action, including termination of employment.

VI. Questions/Reports

If you have any questions about this Policy or would like to report a potential violation, please contact the Office of Research. Reports regarding violations of this Policy may be submitted anonymously by using the independent Ethics and Compliance Hotline at 1-877-888-0002.

VII. Policy Sponsor

Associate Provost for Research

VIII. Related Research Policies and Procedures

Research Integrity Policy
Research Integrity Procedures
Code of Conduct

IX. Effective Date

Effective Date: June 18, 2018

Revised: