



LASER SAFETY PROGRAM

I. Purpose

- a. The Tennessee Tech University Laser Safety Program is designed to ensure the safe use of lasers by University personnel.

II. Applicability

- a. All University personnel, including faculty, staff, and students, are expected to implement these practices, precautions, and operating techniques for lasers as a means of promoting a safe and healthful environment for the University community. All class 3b and 4 lasers must be inventoried with Environmental Health and Safety. Laser safety procedures follow ANSI Z136.1- 2014, "American National Standard for Safe Use of Lasers". A copy of the standard is available for review at the Environmental Health and Safety office.

III. Scope

- a. University personnel that design, construct, use, possess, or maintain lasers and laser systems shall comply with all Federal regulations. Each investigator who uses a class 3b or 4 laser system is encouraged to obtain a copy of the ANSI standard to keep in the laboratory. The standard contains useful charts, tables and sample calculations to help with hazard evaluations in the lab. One source for the standard is Laser Institute of America, 13501 Ingenuity Drive, Suite 128, Orlando, FL 32826.

IV. Responsibilities

- a. Laser Safety Officer:
 - i. The University Laser Safety Officer (LSO) is responsible for monitoring laser use and safety.
 - ii. The LSO is authorized to conduct unannounced inspections and may require termination of any activity determined to create imminent danger to personnel or facilities.
 - iii. The LSO provides basic laser safety awareness training and maintains training resources and some supplies (signs, labels, etc.) to assist laser owners and operators.
- b. Environmental Health and Safety:
 - i. Environmental Health and Safety (EHS) maintains an inventory of lasers, makes available training materials on laser safety, provides consultation, and issues and maintains this Laser Safety Program.

- c. Department Chairs:
 - i. The principal investigator (PI), or faculty member in charge of a laboratory, is responsible for safety associated with laser use in his or her area. For class 3b and 4 lasers, this responsibility includes, but is not limited to:
 1. Developing written operating, safety and emergency procedures;
 2. Performing a hazard evaluation in each laboratory;
 3. Training operators in operating, safety and emergency procedures;
 4. Procuring protective eyewear appropriate for the wavelength of the laser radiation and requiring its use;
 5. Proper posting of signs and warnings;
 6. Complete the Laser Inventory Form with EHS;
 7. Notifying EHS when a laser system is permanently taken out of service.
 8. EHS recommends that affected departments purchase a copy of the ANSI Z136.1-2014 and make it available to department personnel;
 9. Maintaining records, including but not limited to training records and hazard assessments;
 10. Coordinating laser and laser system purchases with the LSO;
 11. Ensuring that appropriate medical surveillance is implemented.

V. Laser Inventory

- a. All Class 3b or Class 4 lasers or laser devices brought to the Tennessee Tech University must be inventoried.
 - i. A Laser Inventory Form must be completed for all Class 3b or 4 lasers.

VI. Laser Classification

- a. Lasers and laser systems are classified based on their capacity for injuring personnel. Lasers manufactured after August 1, 1976, are classified and labeled by the manufacturer. Lasers and laser systems that are constructed or modified in the laboratory shall be classified by the Principal Investigator. Classes of lasers include the following:
 - i. Class 1 lasers and laser systems do not emit accessible levels of radiation capable of causing eye injury under normal operating conditions. Class 1 lasers are exempt from most control measures and from inventory with EHS. (A more hazardous laser that is not accessible during normal operating conditions may be embedded in a Class 1 product.)
 - ii. Class 1M lasers and laser systems do not emit levels of radiation capable of causing eye injury unless the beam is viewed with an optical instrument, such as an eye-loupe or a telescope. These lasers are exempt from most control measures other than preventing potentially hazardous optically aided viewing; they are exempt from inventory with EHS.

- iii. Class 2 lasers and laser systems are visible light lasers that are incapable of causing eye injury unless intentionally viewed directly for an extended period. The normal aversion response to bright light (blinking) protects the eye from a momentary exposure. These lasers are exempt from inventory with EHS.
- iv. Class 2M lasers and laser systems do not emit levels of radiation capable of causing eye injury unless the beam is viewed with an optical aid, such as an eyepiece or a telescope. These lasers are exempt from most control measures, and they are also exempt from inventory with EHS.
- v. Class 3R lasers and laser systems, while generally not posing a serious eye hazard unless viewed through optical instruments, may present an eye hazard from direct or specular viewing if the eye is focused and unmoving. Inventory with EHS is not required.
- vi. Class 3B lasers and laser systems pose immediate eye and skin hazards from exposure to the direct beam; specular reflections may pose an eye hazard. These lasers do not normally pose risk of fire, diffuse reflection injury, or laser generated air contaminants. Inventory with EHS is required.
- vii. Class 4 lasers and laser systems pose a serious eye hazard from viewing the direct beam, specular reflections, and diffuse reflections. Class 4 lasers and laser systems also pose skin hazards, fire hazards, and may produce laser generated air contaminants. Inventory with EHS is required.

VII. Training

- a. All laser users (including PIs) must complete the Basic Laser Safety training with EHS before beginning operations.
 - i. This training will cover laser characteristics, general theory, and safety procedures. Each participant will be certified upon completion of course work and demonstration of satisfactory understanding of the training information.
 - ii. Verification of training will be reviewed for each operator during annual facility inspections.
 - iii. Laser manufacturers also offer hands on and safety training seminars for the use of their laser systems. PIs using these systems must have training material reviewed by the LSO.
 - 1. Records of this training must be available to EHS upon request.

VIII. Exposure Incidents and Medical Services

- a. Timely medical attention shall be sought in the event of an obvious or suspected injury from exposure to laser radiation. Employees with eye injuries resulting from exposure to laser radiation in the retinal hazard region shall be examined by an ophthalmologist. Medical surveillance should be considered for employees known to be at risk due to exposure to laser radiation from Class 3B or Class 4 lasers and laser systems.
- b. Employees injured on the job must utilize one of the medical providers authorized by the State of Tennessee under its Workers' Compensation program. Employees should

contact the Benefits Section of Human Resources for additional information. Laboratory supervisors are encouraged to post information on the location of nearest approved medical services providers for quick reference.

- i. Please review the TTU Human Resources procedures for documentation of accidents.
- c. All laser-related illnesses and injuries shall be reported to EHS for investigation.

IX. Laser Hazard Evaluation

- a. A laser hazard evaluation shall be performed to identify all hazards associated with a laser or laser system and to determine the necessary control measures. The LSO can provide assistance in performing the hazard evaluation. A hazard evaluation must take into account the following aspects:
 - i. The laser or laser system's capability of injuring personnel,
 - ii. The environment in which the laser is used,
 - iii. The personnel who may use or be exposed to the laser radiation,
 - iv. These aspects shall include evaluation of potential electrical hazards, laser-generated air contaminants, collateral and plasma radiation, fire hazards, explosion hazards, compressed gas hazards, laser dyes and solvents, and noise.

X. References and Associated Standards

American National Standard Z136.1-2014
OSHA Technical Manual (OTM) Section III: Chapter 6, Laser Hazards
OSHA 29 CFR 1910.132 Personal Protective Equipment
OSHA 29 CFR 1910.133 Eye and Face Protection
University of Memphis, Laser Safety Program, 2014
Northwestern University, Laser Safety Handbook, 2011
21 CFR 1040.10(f)
IEC 60825-1, Ed. 2, 2007-03 Clause 4