

**Tulane University**  
**Laser Safety Manual**  
**Standard Operating Procedures**

**May 16, 2001**

Introduction

The purpose of this manual is to insure the safe use of lasers at Tulane University by identifying hazards, providing recommendations for proper use, providing for medical surveillance and for laser safety training for individuals using lasers. In furtherance of this goal, the University has adopted the American National Standard for the Safe Use of Lasers, ANSI Z136.1-2000. ANSI Z136.1-2000 is recognized as a minimum safety standard for laser safety.

Scope

The requirements of this program are applicable to all lasers used in research, instructional laboratories, or in any other application at Tulane University.

Policy Statement

"Each location in the Health Sciences Center where non-ionizing radiation in the form of lasers is utilized will review such usage and establish the appropriate safety and health procedures. Such procedures will address usage, condition and health of those involved, and applicable safety standards as established in ANSI Z136.1."

This particular policy is substantial and significant as a requirement for all branches of the University as well as to the Health Sciences Center, and as such, shall be adopted as a University-wide requirement.

Administration

Responsibility for the administration of the safety standards contained in the Laser Safety Program Manual lies with the Office of Environmental Health and Safety (OEHS). The director of OEHS shall designate a Laser Safety Officer (LSO) and Deputy LSO to be responsible for the implementation of appropriate safety standards. The LSO and/or his deputy shall be individuals with "the authority and responsibility to monitor and enforce the control of laser hazards, and to effect the knowledgeable evaluation and control of laser hazards". Furthermore, the LSO and his deputy will have the responsibility to suspend, restrict, or terminate the operation of a laser or laser system that he deems possess inadequate control and/or safety measures.

LSO Specific Responsibilities

- The LSO shall pre-approve the purchase and/or requisition of any laser or laser system by any person under the employ of Tulane University and its associated satellites. This shall extend to all laser devices or laser systems that merit classification as such.
- The LSO shall classify, or verify classification of, lasers and laser systems used under his jurisdiction.
- The LSO shall be responsible for evaluating hazards in laser work areas, including the establishment of Nominal Hazard Zones (NHZ).
- The LSO shall be responsible for ensuring that prescribed control measures are in effect. This shall include, but not necessarily be limited to, such actions as establishing a NHZ, approving Standard Operating

Procedures (SOP's), conducting periodic facility audits, and training.

- The LSO shall recommend or approve Personal Protective Equipment (PPE) i.e. eyewear, clothing, barriers, screens, etc., as may be required to assure personal safety. He shall also audit periodically to ensure that proper working order of all PPE.
- The LSO shall inspect Tulane lasers and laser systems annually. In cases where lasers are not embedded/enclosed, signage and PPE shall be checked and personnel training initiated. He shall also accompany regulatory agency laser equipment inspectors, such as those representing OSHA, FDA/CDRH, state agencies, etc., and document any discrepancies noted. The LSO will ensure that corrective action is taken where needed.
- The LSO shall grant approval of a laser or laser system for operation if he is satisfied that laser hazard control measures are adequate. These controls include, but are not limited to; SOP's for maintenance and service operations within enclosed systems, and operating procedures for Class 3b and Class 4 systems. These procedures should include sufficient consideration to assure safety from electrical hazards.

### Laser Classification

Lasers and laser systems are grouped according to their ability to cause injury. Lasers manufactured after August 1, 1976 are classified and labeled by the manufacturer. Information on all lasers must include:

- a) Class
- b) Maximum output power
- c) Pulsed duration (unless CW)
- d) Laser medium or emitted wavelengths

*Class 1*-Low-power lasers and laser systems, generally between .04 and .22 milliwatts (mW). They are incapable of causing any damage to the eye and are, as a result, exempt from any control measures. Examples of this type of laser are those embedded in CD players and laser printers.

*Class 2*-Visible, low-power lasers or laser systems that operate at less than 1 mW. They are capable of causing damage to the eye if viewed for an extended period of time. The natural aversion response, or blinking, is generally considered to take place within .25 seconds. This response, unless intentionally overridden, will typically protect one's eyes from a Class 2 laser. An example of this type of laser is a barcode reader found in grocery and retail stores.

*Class 3*-Medium-power lasers and laser systems that are capable of causing eye damage with short duration exposures (<.25 seconds) to the direct or specular beam.

*Class 3a*-Lasers or laser systems that operate at less than 5mW. They would normally not produce a hazard if viewed for only momentary periods with the unaided eye. They may, however, pose a problem if used for the purpose of collecting optics. Caution labels warning personnel to avoid direct beam viewing are required. Examples of this class are solid state laser pointers.

*Class 3b*-Lasers or laser systems that operate at 500mW. They can produce a hazard if viewed directly or through reflections. Control measures include area entry requirements, warning labels, and PPE.

*Class 4*-High-power lasers or laser systems capable of causing severe eye damage with short-duration (<.25 seconds) exposure to direct, specularly reflected, or diffusely reflected beam. This class of laser is also capable of causing severe damage to skin and other tissues as well as igniting flammable and combustible materials.

## Laser Hazards

- 1) Eye-Acute** ocular exposures to lasers of certain wavelengths and/or power can cause corneal or retinal burns. Chronic exposure to excessive levels may result in corneal damage, retinal injury, or cataracts.
- 2) Skin-Acute** exposures to high levels of optical radiation may cause skin damage in the form of burns. Carcinogenesis may occur for ultraviolet wavelengths of 290-320 nm.
- 3) Electric shock**-Most lasers produce high voltages that can be deadly.
- 4) Fire hazards**- Class 3 and 4 lasers pose a fire hazard.
  - a) Flammable materials** may be ignited by direct beams or specular reflections from high power continuous wave infrared lasers.
  - b) The solvents used in dye lasers** are flammable. High voltage pulse or flash lamps may cause ignition.
- 5) Explosion hazards** - There have been several reports nation-wide of explosions caused by an accumulation of dust in the ventilation systems of lasers and laser systems. This hazard is easily and inexpensively avoided by regular maintenance.

## General Laser Safety Recommendations and Requirements-

- 1) Eye Protection**- Principal investigators or staff who operate or supervise the operation of a laser are responsible for determining the need for laser eye protection for a particular laser or laser system. The LSO may recommend or approve such equipment. If necessary, eye protection will be provided to visitors to the area where the laser is in use. Contact your LSO or the Laser Institute of America for a copy of the pamphlet, "Guide for the Selection of Laser Eye Protection" to assist you and your staff in choosing the appropriate eyewear for use with your laser or laser system.
- 2) Always use the minimal laser radiant energy** required by your specific application.
- 3) To maximize beam control and thereby minimize direct eye exposure, adhere to the following precautions:**
  - a) Orient the laser** so that the beam is not directed toward entry doors or aisles
  - b) Securely affix the laser or laser system** to a stable platform in order to maintain the beam in a fixed position during operation.
  - c) Never look directly at a laser beam or a specular reflection, regardless of the power level used**
  - d) Confine primary beams and dangerous reflections to the optical table**
  - e) Clearly identify beam paths and ensure that they do not cross populated areas or traffic paths**
  - f) Terminate the beam at the end of its useful path**
  - g) Minimize specular reflections**

## Compliance

All employees will comply with safety rules and procedures prescribed by the supervisor and/or the LSO.

The employee shall be familiar with all standard operating procedures.

Accident Reporting

When an employee operating a laser or laser system knows that an accident involving a laser has occurred, and that accident caused an injury, he will immediately inform the supervisor. If the supervisor is not available, the employee should contact the LSO.

Warning Signs and Labels

Signs used to indicate laser operating facilities must use signs that are in accordance with American National Standard Specification for Accident Prevention Signs, ANSI Z535 series, or the most current revision thereof. The following are the basic signal words to be used with ANSI Z535 designed signs and labels:

- 1) Caution-The signal word "Caution" shall be used with all signs and labels associated with Class 2 lasers or laser systems and all Class 3a lasers and laser systems that do not exceed the appropriate MPE for irradiance.
- 2) Danger-The signal word "Danger" shall be used with all signs and labels associated with all Class 3a lasers and laser systems that exceed the appropriate MPE for irradiance and all Class 3b and Class 4 lasers and laser systems.

Validation and History for Laser Safety Manual

I hereby certify that I have reviewed the contents of this manual and attest that it reflects the current operating policy for Tulane University of New Orleans and its associated campuses and satellites.

James J. Balsamo, Jr., MPH, MHA, RS, DAAS, CSP, CHMM

Director of Tulane University Environmental Health and Safety Office

Signature \_\_\_\_\_ Annual Review Date \_\_\_\_\_