

Laser Safety

OVERVIEW

The purpose of the Laser Safety Policy is to ensure that all lasers and laser systems at University locations are operated in a safe manner. Safe laser operation is important to protect personnel, students, guests, and property from laser radiation and collateral hazards. Collateral hazards include:

- Risk of electrical shock.
- Fire hazard from a beam or from use of dyes and solvents.
- Chemical exposures from use of chemicals and vaporization of targets.

Units are to use the WSU Laser Safety Guide/Template in the development and implementation of the unit's laser safety program. Each unit that operates Class III and IV lasers must have a written unit laser safety program and must complete the template.

A unit that operates Class I and II lasers is not required to have a written laser safety program and does not need to complete the template. However, unit personnel should become familiar with the laser safety guide and take specific precautions to ensure the safest workplace possible.

See [Definitions](#) for definitions applicable to this policy.

RESPONSIBILITIES

Department Chair/ Director

Department chair or director responsibilities include ensuring that the Laser Safety Policy is implemented.

Supervisor/ Principal Investigator (Unit Laser Safety Officer)

The supervisor/principal investigator (PI) is the unit laser safety officer. Supervisor/PI responsibilities include:

- Reviewing the WSU Laser Safety Guide/Template for units with Class I and II lasers and taking specific precautions to ensure the safest workplace possible.
- Completing, implementing, and following the WSU Laser Safety Guide/Template for units with Class III and IV Lasers. Once complete, the template becomes the unit's written laser safety program.

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Supervisor/PI (cont.)

To obtain the guide/template, contact Environmental Health and Safety (EH&S); telephone 509-335-3041; or see the EH&S website at:

ehs.wsu.edu/

Select **Laboratory Safety**, then
Select **Laser Safety**.

- Reviewing and updating the unit's laser safety program, as necessary.
- Completing an Incident Report to report any accident or injury associated with lasers (see *SPPM 2.24*).

Operator

Laser operator responsibilities include:

- Knowing the requirements for safe operation of the laser. Following the safety procedures provided in the laser manufacturer's manual and the WSU Laser Safety Guide/Template or the unit's laser safety program.
- Performing only those operations and procedures authorize by the supervisor/PI (unit laser safety officer).
- Restricting access to controlled areas and ensuring that only trained or properly escorted personnel are allowed access into controlled areas when lasers are in operation.
- Reporting all accidents and injuries to the supervisor/PI.

Environmental Health and Safety (EH&S)

Environmental Health and Safety responsibilities include:

- Updating the WSU Laser Safety Guide/Template.

Environmental Health and Safety provides copies of the guide/template upon request; telephone 509-335-3041; and on the EH&S website at:

ehs.wsu.edu/

Select **Laboratory Safety**, then
Select **Laser Safety**.

- Reviewing unit laser safety programs.

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EH&S (cont.)

- Assisting in determining maximum permissible exposure limits, nominal hazard zones, laser controlled areas, and proper personal protective equipment (eyewear optical density).

See [Definitions](#).

- Providing training and/or training materials, upon request.

PROGRAM

Laser Safety

Where lasers are operated, units must protect personnel, students, guests, and property from the hazards associated with lasers and laser systems.

WSU Laser Safety Guide/Template

Environmental Health and Safety developed the WSU Laser Safety Guide/Template to assist units in fulfilling laser safety responsibilities. Unit supervisor/Pis use the guide/template to develop unit laser safety programs to ensure that:

- Laser radiation in excess of the maximum permissible exposure limit does not reach the human eyes or skin.
- Personnel are adequately protected against collateral hazards.

The guide describes the procedures used to protect individuals from laser hazards, but does not describe laser theory or uses of lasers in detail. Laser operators should have sufficient knowledge and training in theory and operation prior to placing a specific type of laser in service.

Unit's Laser Safety Program

The supervisor/PI of Class III and IV lasers completes Steps 1 through 7 in Section C.2 of the WSU Laser Safety Guide/Template. The completed guide/template is the unit's written laser safety program. The supervisor/PI is responsible for implementing the laser safety program as written.

DEFINITIONS

The definitions below provide a basic explanation of the following terms. See the WSU Laser Safety Guide/Template for additional information.

Class I (1, 1M) Laser

A class I or 1, 1M laser is a laser that is unable to emit laser radiation at known hazard levels. Class 1M lasers are defined as *eye safe* except when used with optical aids. (Contact EH&S for regarding the use of optical aids with Class 1M lasers.)

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Class II (2, 2M) Laser

A class II or 2, 2M laser is a low power visible laser incapable of emitting radiation at levels known to cause skin or eye injury within the time period of human aversion response (0.25 seconds).

Class IIIa (3R) Laser

A class IIIa or 3R laser is a medium power visible light laser. Viewing the beam may be hazardous under certain conditions. Some limited controls are usually recommended.

Class IIIb (3B) Laser

A class IIIb or 3B laser is a medium power visible and invisible light laser that presents a potential eye hazard if viewed directly (intrabeam) or with optics (specular). Class IIIb or 3B lasers do not present a hazard to the eye for diffusely-scattered radiation or a skin hazard, except at the highest power.

Class IV (4) Laser

A class IV or 4 laser is a high power visible and invisible light laser that is hazardous to view under any conditions. Class IV or 4 lasers have the potential to damage both the skin and eyes through direct (intrabeam) or scatter (diffused) conditions. Such lasers also have the potential to cause fires and produce gases or other by-product hazards.

Laser

A laser is a device that produces an intense, coherent, directional beam of light. The term laser is also an acronym for *light amplification by stimulated emission of radiation*.

Laser-Controlled Area

A laser-controlled area is an area where the occupancy and activity of those within is subject to control and supervision for the purpose of protection from radiation hazards.

Laser System

A laser system is an assembly of electrical, mechanical, and optical components that includes a laser.

Maximum Permissible Exposure (MPE)

Maximum permissible exposure (MPE) is defined as the level of laser radiation to which a person may be exposed without hazardous effect or adverse biological changes in the eye or skin.

Nominal Hazard Zone (NHZ)

Nominal hazard zone is defined as 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.

Optical Density (OD)

Optical density is defined as a logarithmic expression for the attenuation produced by an attenuating medium, such as an eye protection filter. $OD = \log_{10} (I_i/I_t)$ where I_i is the incident irradiance and I_t is the transmitted irradiance.