Control Measures:

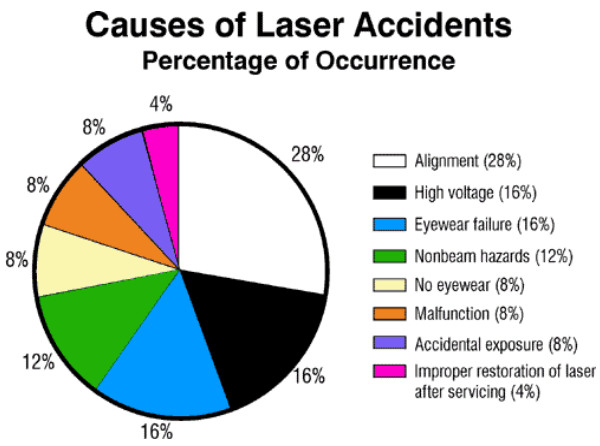
Proper control measures ensure that exposure to the eyes & skin are minimal during operation & maintenance.

- **Engineering:** Warning lights, Shutters/Attenuators, Beam Housings, Interlocks, Laser Curtains, Remote Firing Controls

- **Administrative:** Training, Written Standard Operating Procedures (SOPs), Posting Warnings Signs/Labels, & PPE.

- **Personal Protective Equipment (PPE):** Laser protective eyewear may include goggles, face shields, etc. to reduce the potential ocular exposure. Information regarding appropriate eyewear for a specific laser may be obtained from the manufacturer at the time of purchase. Laser protective eyewear shall be specifically selected to withstand either direct or indirect or diffusely scattered beams depending upon the anticipated circumstances of exposure.

IMPORTANT: Laser curtains & drapes installed in laboratory units shall comply with the flame resistant requirements of the New York City Fire Code, Chapter 8.



Safe Work Practices:

- Wear appropriate/required PPE (consult EH&S if not certain of PPE)
- Use minimum power/energy required
- Reduce laser output with shutters/attenuators
- Terminate laser beam with beam trap
- Use diffuse reflective screens & remote viewing systems during alignments
- Remove unnecessary objects from vicinity of laser
- Keep beam path away from eye level (sitting or standing)
- Cover reflective objects in the room

Laser Safety Policy Highlights:

Procurement: Before purchasing a Class 3 or 4 lasers, the Principal Investigator (PI) shall submit a Laser Registration Form. LRF should be filled out for existing lasers as well.

Transfer: PI shall notify EH&S if any laser is transferred to another laboratory or campus.

Laser Registration Form (LRF): PI shall fill out the LRF (www.ehs.columbia.edu/laserregistration.html) & submit to EH&S for review, approval & signature.

Laser System Inspection Checklist: The inspection checklist (www.ehs.columbia.edu/inspectionchecklist.html) shall be used in conjunction with the LRF to ensure that your laser is in compliance with all applicable standards.

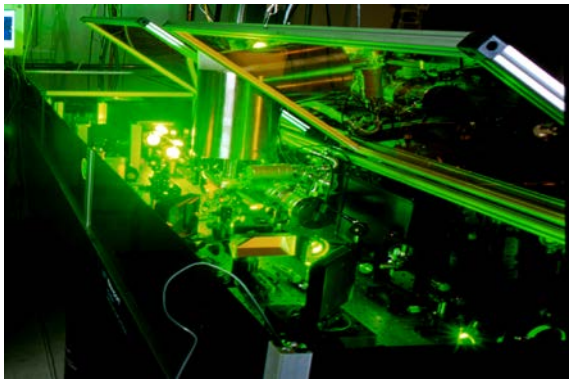
Laser Safety Training: PI shall ensure that their staff using lasers is trained. EH&S provides laser safety training on the 1st Tuesday of every month (www.ehs.columbia.edu/training). Lab based safety training could also be arranged.

Printed on recycled paper

COLUMBIA UNIVERSITY
IN THE CITY OF NEW YORK

LASER SAFETY

Environmental Health & Safety



VISION STATEMENT

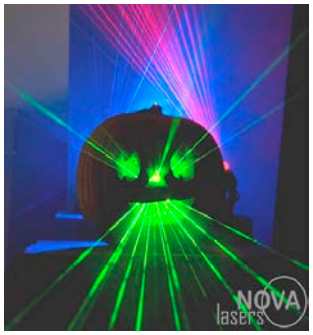
We provide expert guidance and timely service to the University Community through our commitment to health and safety. Employing best practices and collaboration, and by building long term relationships, we promote a productive and safety conscious work environment.

www.ehs.columbia.edu

Campus Contact Numbers:

Columbia University Medical Center
212-305-6780

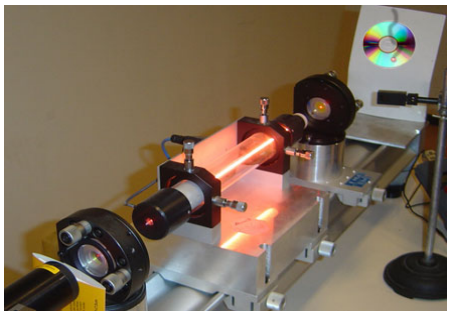
Morningside Campus
212-854-8750



Laser Safety

The acronym **LASER** stands for **L**ight **A**mplification by **S**timulated **E**mission of **R**adiation. This is a description of the process that creates laser light. The “radiation’ in the name of the laser is light radiation. There is no radioactivity associated with lasers.

The two major concerns in safe laser operation are **exposure to the beam** and **non-beam hazards**, especially the **electrical hazards** associated with high voltages within the laser and its power supply. While there are no known cases of a laser beam contributing to a person's death, there have been several instances of deaths attributable to contact with high voltage laser-related components. Beams of sufficiently high power can burn the skin, or in some cases create a hazard by burning or damaging other materials, but the primary concern with regard to the laser beam is potential damage to the eyes, which are the most sensitive body part to light.



Laser Classifications

The American National Standards Institute (ANSI) has established a laser hazard classification system in the American National Standard for Safe Use of Lasers (ANSI Z136.1-2007).

The following table summarizes this laser classification scheme and the hazard capabilities associated with each class of laser.

Laser Class	Hazards
1	Eye safe lasers; may not produce hazardous radiation
2	Continuous intrabeam viewing can cause eye damage; momentary intrabeam exposure (< 0.25 sec) is not damaging to the eye; visible radiation only
2a	Continuous intrabeam viewing can cause eye damage; the accessible radiation shall not exceed Class 1 accessible emission limit (AEL) for an exposure duration of 1000 seconds
3a	Invisible lasers having an output power < 5x the Class 1 AEL or visible laser having an output power < 5 mW; capable of causing damage through intrabeam viewing, with optical instruments or through viewing a specular reflection for < 0.25 sec
3r	Invisible lasers having output power <500 mW; as with 3a lasers, 3b lasers can cause injury through intrabeam viewing, viewing with optical instruments, or through viewing a specular reflection
4	Beam power > 500 mW; intrabeam exposure, exposure to specular- and diffuse reflections capable of causing eye- and skin damage; fire hazard due o their power density

Lasers and Eye Injury:

Damage to the eyes can occur quickly. Precautions must be taken in advance to minimize the risk since avoidance at the last moment is not a possibility. Laser emission is similar to direct sunlight exposure in that the light arrives at the eye in parallel rays, which are very efficiently focused on the retina, the rear surface of the eye that senses light.

Potential hazards to the eye depend on laser light ***wavelength***, ***beam intensity***, ***distance from the laser***, and ***power of the laser***. The wavelength of the laser radiation is significant because only light within the wavelength range of approximately 400 to 1400 nanometers can penetrate the eye sufficiently to damage the retina. Near-ultraviolet light wavelengths can damage eye layers near the surface, and can result in cataract, especially in younger persons. Light in the near-infrared can produce surface damage as well, although at a higher threshold than for ultraviolet light.