# FACT SHEET

Laser Safety

## Hazards of Lasers and How to Avoid Them

### Non-Laser/Beam hazards

LASER hazards are not limited to the hazards associated with the beam itself. Listed are examples of non-beam, hazards associated with LASER use:

a. Toxic gases such as F2 or Cl2 (excimer lasers, like the ones used in laser eye surgery).

b. Toxic dyes and solvents (liquid dye lasers). Many dyes are toxic and carcinogenic

c. Explosion hazards from high-pressure arc lamps used to produce laser radiation.

d. Fire hazards presented by ignition of flammable and combustible materials by high power laser beams.

e. Laser-generated air contaminants (Class 4 lasers). Particles and gases are emitted after the beam impacts some surfaces.

f. X-ray, ultraviolet or radiofrequency/microwave radiation.

### Controlling LASER Hazards

**- Engineering control** measures (protective covers on lasers, interlocks, beam stops, activation warning systems, etc.) are your first line of defense against laser hazards, and should be used to their full advantage. Do not defeat these control measures!!

- Always position laser beams above or below the normal eye levels of seated or standing personnel. Use the lowest possible laser power required for a study, and enclose as much of the beam as possible.

**- Administrative Controls** such as training, written standard operating procedures and appointment os a laboratory LASER safety officer are criticl components of a LASER safety program
Do not work with a LASERs unless…
a. You are adequately trained in laser safety, and in the specific laser standard operating procedures to be used.
b. Provided with information about the specific hazards associated with the LASER you will be using.
c. Are familiar with all engineering controls that are in place
d. Have been authorized by the Principal Investigator (or their designee – such as a lab LASER safety officer) to do the work.

**- Personal Protective Equipment** such as appropriate laser safety eyewear must also be used as part of the overall LASER safety program
When selecting appropriate LASER safety eyewear, make sure:
1. They were manufactured for use with the type of laser (Argon, Ruby, Nd:YAG, etc.) to be used.
2. They afford sufficient eye protection (optical density) at the appropriate wavelength(s).
3. They pass enough visible light so that your experiment may be conducted safely (without tripping)

## General LASER safety rules:

- Never stare directly into a laser beam, regardless of the class of the laser, even if eye protection is worn. Use an indirect means (a device, not your eyes!) to observe the beam.
- Post laser warning signs, specifying the type and class of the laser used, and any special precautionary instructions, at appropriate locations to alert those entering a laser use area of possible optical (and other) hazards.
- Properly attach lasers and the optical components (such as mirrors) to the optical table to avoid eye injuries due to the inadvertent movement of such items during an experiment. If you drop something onto the table, mirrors, etc., might move if not properly attached.
- Exclude visitors and other non-lab personnel from laboratories in which Class 3b or Class 4 lasers are in use. Visitors are often unaware of the hazards presented by the lasers.
- Use the buddy system (make sure somebody else is nearby) when working with high voltage equipment; all personnel working with this equipment should be trained in cardiopulmonary resuscitation (CPR).
- Give sufficient attention to non-beam hazards (toxic gases and chemicals, electrical hazards, etc.) to prevent injuries and illnesses which could be caused by them.

## TEN MOST COMMON CAUSES OF LASER-PRODUCED EYE INJURIES

1. Unanticipated eye exposure during laser alignment. Most accidents occur during alignment!
2. Fatigue, leading to carelessness or inappropriate shortcuts; horseplay.
3. Misaligned optics, upwardly-directed beams, and beams at eye-level.
4. Available eye protection not worn, or the wrong eyewear worn.
5. Overconfidence; feeling of complacency or invincibility.
6. Equipment malfunction.
7. Operator unfamiliar with laser equipment (not sufficiently trained).
8. Improper restoration of equipment following service.
9. Failure to follow standard operating procedures due to hurrying, etc.
10. Manufacturer-installed safety features (protective housing, interlocks, beam stop,

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