

Chapter 4: Personal Protective Equipment

LIMITS OF EXPOSURE TO LASER RADIATION

A. All Employees

The criteria for Maximum Permissible Exposures (MPE) to laser Radiation are explained in Section 8 of ANSI Z136.1. The MPE is the level of laser radiation to which a person may be exposed to without hazardous effect or biological changes in the eyes or skin.

B. Biological Effects of Laser Light

Damage done to tissue by laser light depends on four factors:

1. Frequency of light
2. Power density of the beam
3. Exposure time
4. Type of tissue struck by the beam.

Damage is caused by thermal effect, acoustic transient or other phenomena.

When laser light is absorbed by tissue, the energy produces heat, which in turn causes a rapid rise in temperature. This temperature rise may cause the tissue protein to denature. Tissues that are most apt to absorb heat are most susceptible to laser light. For this reason, the eyes and the skin are the organs, which are most readily affected by lasers. If the absorption is rapid and localized, there may be a literal explosion occurring in the absorbing tissue.

Laser light may also be transformed into a mechanical compression wave (acoustic energy), and a sonic transient wave may build up. If this occurs near the surface, the sonic wave may cause a rupture.

C. Eye Protection

The following factors shall be considered in determining the appropriate protective eyewear to be used:

- Wavelength of laser output
- Potential for multiwavelength operation
- Radiation exposure or irradiance
- Maximum permissible exposure
- Optical density of eyewear at laser output wavelength

- Visible light transmission requirement
- Peripheral vision requirement
- Radiant exposure or irradiance and the corresponding time factors at which laser safety eyewear damage (penetration) occurs, including transient bleaching
- Need for prescription glasses
- Comfort and fit

D. Other Personal Protective Equipment

- Heat resistant gloves and facemasks should be worn when cryogenic liquids are handled (i.e. pouring and filling from Dewar and thermo bottles).
- Protective clothing should be used whenever personnel may be exposed to levels of ultraviolet radiation above the maximum permissible exposure limits.
- Other personal protective equipment may be required whenever engineering controls cannot provide protection from a harmful ancillary environment.

GUIDELINES FOR MEDICAL SURVEILLANCE

A. Scope

The reasons for performing medical surveillance for personnel working in a laser environment are the same as for other potential health hazards and for detection of biological change or damage. Risks to workers using lasers are primarily from accidental acute injuries.

B. Preassignment Medical Examinations

The purpose of this examination is to establish a baseline against which damage (primarily ocular) can be measured in the event of an accidental injury. The wavelength of the laser is the determinant of which protocols are required. Examinations should be performed by, or under the supervision of an ophthalmologist or other qualified physician.

C. Termination Medical Examinations

The primary purpose of termination examination is for the legal protection of the University against unwarranted claims for damage that might occur after an employee leaves the University.

D. Records

Laboratory Safety will maintain records of medical surveillance for 30 years.

E. Access to Records

The results of the medical surveillance will be discussed with the employee. All non-personally identifiable records of the medical surveillance examinations should be made available on written request to authorized physicians and medical consultants, for epidemiological studies. The record of individuals will be furnished upon request to their private physician.