

## OHS INFORMATION SHEET 29: LASER SAFETY

June 2009

Lasers are capable of producing intense collimated beams of light at specific wavelengths (visible, ultra violet and infra-red). While lasers vary greatly in power output, wavelength and purpose, the hazard potential for eyes and skin can be significant due to the concentrated energy density. AS 2211:2004 *Safety of Lasers Products* is the principal document for laser safety.

### 1. LASER CLASSIFICATION

Lasers are divided into seven classes according to accessible emission limits. NB Modifications can increase the class and subsequent hazard of a laser.

**Class 1** lasers are safe under most circumstances and are incapable of damaging the eyes or skin because of either engineered design or inherently low power output.

**Class 1M** lasers emit in the wavelength range 302.5 - 4000nm and may be hazardous if optics are used in the beam.

**Class 2** lasers emit in the visible wavelength range 400 - 700nm and have sufficient power output to cause damage to the eyes if viewed continuously. However, their outputs are low enough where eye protection is afforded by the blinking reflex. Additional hazard control measures take the form of cautionary signs or labels.

**Class 2M** lasers are similar to Class 2 however viewing may be more hazardous if the user employs optics within the beam.

**Class 3R** lasers emit in the wavelength range 302.5 - 10<sup>6</sup>nm and have the potential to cause damage to the eyes from intra-beam viewing but the risk is lower than for Class 3B lasers. Precautions are required to prevent both direct viewing and viewing with optical instruments.

**Class 3B** lasers are more hazardous because of either higher output or operation outside visible wavelengths. In addition, specular reflections i.e. non-diffuse surface reflections may also be hazardous. In general, more stringent controls are needed to prevent exposure.

**Class 4** lasers are high power devices capable of producing eye damage even from diffuse reflection. They may cause skin injuries and could also constitute a fire hazard. Examples of class 4 lasers include surgical lasers and those used in the plastic, wood and metal fabrication industries.

### 2. HEALTH EFFECTS OF LASER USE

#### Eye

Eyes are the most susceptible to damage from lasers. Different parts of the eyes are susceptible to different wavelengths. Damage can occur from heating, photochemical reactions and explosive rupture. Appropriate controls are essential to prevent ocular damage.

#### Skin

Skin is less at risk from damage caused by lasers, but exposure to lasers still need to be managed appropriately to minimise the potential for skin burns.

## Other

In addition to laser radiation, there are additional hazards such as collateral radiation, electrical shock, fire, cryogenics, mechanical hazards, vapours and chemicals, which all need to be considered when completing a risk assessment.

### **3. HAZARD CONTROL AND SAFE PRACTICE**

Laser hazards may be controlled by the use of engineered controls, administrative controls and personal protective equipment, either singly or in combination. As a general principle, engineered controls are preferred where appreciable hazards exist, although these may need to be supplemented by the use of appropriate eye protection.

The control measures and the associated requirements of all laser classifications are listed in detail in AS/NZS 2211.1 Safety of Laser Products.

#### Engineering Controls

Lasers require certain built-in safety features dependent on their classification. These engineering control measures incorporated into the design of the laser system may include:

- Protective housings
- Remote interlocks
- Access panels
- Master switches
- Enclosed or semi-enclosed beam paths

#### Administration Controls

To aid in managing the risk associated with the use of lasers, the following controls are to be implemented where lasers are used:

- Appointing a Laser Safety Officer
- Safe Working Procedures
- User Registration
- Training
- Record Keeping
- Correct Labelling of Device
- Eye and Skin Examinations

#### Personal Protective Equipment

The main form of PPE is protective eyewear, but in the case of class 4 lasers should also include protective clothing and footwear. Details on protective eyewear can be found in AS/NZS 1337.4 and AS/NZS 1337.5.

### **4. LASER SAFETY OFFICER**

A Laser Safety Officer is a designated School/Departmental staff member who has received training to an appropriate level and is knowledgeable in the evaluation and control of laser hazards. The LSO would have responsibility for the suitable training of laser users and oversight of the control of laser hazards. At Monash University, a Laser Safety Officer must be appointed where Class 3 or 4 lasers are used.

For further information please contact the Radiation Protection Officer, Occupational Health and Safety on 9905 1060 or via email email at [ohsehelpline@adm.monash.edu.au](mailto:ohsehelpline@adm.monash.edu.au)

#### References

AS/NZS 2211.1 Safety of Laser Products. Laser Safety Part 1: Equipment classification, requirements and user's guide (2004).

AS/NZS 1337.4 Personal eye-protection - Filters and eye-protectors against laser radiation (laser eye-protectors)

AS/NZS 1337.5 Personal eye-protection - Eye-protectors for adjustment work on lasers and laser systems (laser adjustment eye-protectors)

University of Queensland, Laser Safety Guidelines.