

Laser Safety Procedures

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1. Governing Policy

[Work Health and Safety Policy](#)

[Work Health and Safety Management System](#)

2. Purpose

These procedures describe the requirements:

- a. for the identification, assessment, control and use of laser radiation, and
- b. to ensure the University meets the requirements of the [Work Health and Safety legislation](#).

3. Scope

These procedures apply to all Flinders University workers, students, visitors and others using lasers at University workplaces or University business.

4. Definitions

Accessible emission limit (AEL)	Maximum accessible emission permitted within a particular laser class.
Laser	• An acronym for Light Amplification by Stimulated Emission of Radiation. • A laser is any device which can be made to produce or amplify electromagnetic radiation in the 180nm to 1mm wavelength range primarily by the process of controlled stimulated emission. • Lasers emit in the ultraviolet, infrared and visible parts of the electromagnetic spectrum (meaning exposure may not be obvious).
Laser classifications as per AS/NZS IEC 60825.1	
Class 1	Laser products which are normally safe under reasonably foreseeable conditions of use, either because of the inherently low emission of the lasers themselves, or because they are totally enclosed and human access to higher levels of internal radiation is not possible during normal operation.
Class 1C	Laser products which are designed explicitly for contact application to the skin or non-ocular tissue (i.e. hair removal or medical process). This type of laser may exceed the permitted AEL for Class 1 but is eye safe by design (if engineering controls are not modified or defeated). Repeated exposure to the same area of skin may cause injury.
Class 1M	Laser products which are normally safe with unaided viewing; however present a hazard with optical viewing aids (i.e. binoculars, telescopes). Hazardous exposure can also occur if dimensions of the laser beam are reduced by using optical components in the beam path. Skin exposure is generally safe.
Class 2	Laser products emitting low levels of visible radiation (i.e. from 400 nm to 700 nm) which are safe for the skin but not inherently safe for the eyes. Eye protection is normally afforded by natural aversion responses to bright light. Skin exposure is generally safe.
Class 2M	Laser products emitting levels of visible radiation (i.e. from 400 nm to 700 nm) that exceed the permitted accessible emission limits for Class 2 but for which, because of the geometrical spread of the emitted radiation, protection of the unaided eye is normally afforded by natural aversion responses to bright light. However, the aversion response may not provide sufficient protection, and injury can occur, with optical viewing aids (i.e. binoculars, telescopes). Skin exposure is generally safe.
Class 3R	Laser products having a level of accessible emission in excess of the AELs for Class 1 (if invisible) or Class 2 (if visible) lasers.

	The risk of injury is low for accidental viewing. Intentional viewing is unsafe. Skin exposure is generally safe. Consider risk assessment of actual use particularly in low ambient light conditions.
Class 3B	Laser products having a level of accessible emission in excess of the AELs for Class 1 or Class 2 lasers. Any viewing, including accidental exposure, is unsafe for eyes. Class 3B laser products are generally low risk for skin exposure but can be harmful at output levels approaching the upper of the limit of this class.
Class 4	Laser products having a level of accessible emission in excess of the AEL for Class 3B. Unsafe for both the eyes and the skin. Diffuse reflections of the laser radiation may also be hazardous. The laser emission can also be sufficient to ignite material on which it impacts upon and to generate harmful radiation or fume hazards by interaction with target materials.

5. Register of lasers

- The University must keep a register of laser equipment used on its premises.
- College/Portfolio areas which have laser equipment must ensure it is registered with the University WHS Unit using the [Laser Equipment Registration form](#).
- When purchasing/acquiring new laser equipment, the [Plant and Equipment Safety Procedures](#) must be followed including the use of the [plant pre-purchase and commissioning checklist](#).
- Any changes to laser equipment details, including location, must be updated via the registration form.
- A completed copy of the Laser Equipment Registration Form for each laser must also be kept by the local area.
- Where a laser is used as a research tool with multiple uses, these uses should be indicated on the registration form.

6. Minimum safety requirements

6.1. General

- Australian Standard AS/NZS IEC 60825.1 Safety of laser products and AS/NZ IEC 60825.14 Safety of laser products – A user's guide give details of control measures and associated requirements for the use of various classes of laboratory laser installations.
- Equipment containing lasers must comply with Australian Standards unless alternative measures are adopted that provide equivalent or better protection as set out in the relevant standard.

6.2. Class 1M and 2M lasers

- While unaided eye viewing is not considered to be hazardous, control measures must be in place to prevent:
 - direct viewing through magnifying viewing aids or instruments such as binoculars and telescopes.
 - the use of optical devices in the beam path that could decrease the beam diameter.
- For Class 2M lasers:

- i. control measures preventing the continuous viewing of the beam must be implemented.
- ii. the beam must be terminated at a suitable non-specular surface.

6.3. Class 2 and 3R lasers

- a. Controls to prevent continuous viewing of the direct beam must be implemented.
- b. While momentary viewing is considered low risk, direct/deliberate viewing is considered to be hazardous, Class 2 and 3R lasers must not be aimed at people and it is preferable that beams are terminated at the end of their useful path or located well above or below eye level.
- c. Class 3R lasers must not be viewed with optical viewing aids (i.e. telescopes, binoculars).

6.4. Class 3B and 4 lasers

- a. Class 3B and 4 lasers present a hazard to eyes and skin and therefore must have:
 - i. appropriate controls to prevent unauthorized access to an area whilst lasers are in use (which may include controls such as keypad entry or remote interlock as appropriate)
 - ii. beam stop or attenuator
 - iii. operate by remote control where possible
 - iv. warning signs and labelling as per IEC AS/NZS 60825.1
 - v. beams terminated at the end of their useful path
 - vi. beams as short as practicable, with minimum number of direction changes, and where practicable, be enclosed
 - vii. beams are aimed away from doors and windows to prevent accidental viewing
 - viii. elimination of specular reflections
 - ix. measures to manage hazards present due to diffuse reflections
 - x. use of appropriate eye protection (for the laser wavelength, optical density and visible light transmission)
 - xi. use of protective clothing to protect exposed skin
 - xii. medical examination of a laser user by a qualified specialist carried out immediately if there is a suspected injury
 - xiii. provision of appropriate training on safe use of equipment, including maintenance; and
 - xiv. safe work procedures for control of hazards.
- b. Room requirements for workshop and laboratory design for Class 4 lasers include:
 - i. no windows or windows need to be permanently covered
 - ii. an area for storing protective eyewear
 - iii. appropriate locks to prevent unauthorized and unprotected personnel from entering
 - iv. a non-defeatable door interlock or equivalent measures to prevent accidental exposure during laser operation
 - v. signs at entrance
 - vi. laser beam path enclosed
 - vii. beams positively terminated
 - viii. laser work area free of unnecessary specular surfaces

- ix. fire resistant curtain materials where the types of lasers in use present an ignition risk
- x. a clearly visible power cut-off switch which kills power to the laser
- xi. a warning light located outside the laboratory/workshop door to indicate when laser is operating

6.5. Training

- a. Any workers operating the laser equipment must be trained in the proper operation of the equipment including the risks, control measures and personal protective equipment.
- b. Records need to be kept locally of trained users for each laser.
- c. In addition, all users of Class 3 and 4 lasers must undertake the University laser safety training.

7. Laser risk management

- a. The WHS Regulations 2012 require the workplace to have suitable controls in place where lasers are used to ensure they do not create a risk to health and safety.
- b. Identification of hazards and assessment of risks associated with the use of the laser must be conducted to determine if any further controls need to be implemented in addition to the minimum requirements set out in AS/NZS IEC 60825.1 and AS/NZS IEC 60825.14.
- c. A risk assessment must be undertaken before a laser is first used and/or after it has been modified. The assessment must consider at least the following:
 - i. the capacity of the laser to injure people
 - ii. an evaluation of the suitability of the laser for the work
 - iii. the environment in which the laser is used
 - iv. identification of the hazards involved and assessing the associated risks, including during any maintenance
 - v. in the case of a research laser used for multiple purposes, the hazards associated with each use
 - vi. implementation of control measures including review of their effectiveness as per the [WHS Risk Management Procedures](#), and
 - vii. the level of training required for staff and students before use.
- d. Persons responsible for lasers must keep a completed copy of the risk assessment.

8. Labelling and warnings

- a. Each laser must have affixed to it labels as required by the AS/NZS 60825.1 standard.
- b. Any area where Class 3 and 4 lasers are used must have clear signage with the name of the Laboratory Manager and contact details including a telephone number where they may be contacted.

9. Safe Work Procedures

- a. Safe Work Procedures (SWPs) must be available in a College/area or research centre where Class 3 or 4 lasers are used.
- b. The safe work procedures must list the hazards associated with the particular laser(s) used, the conditions under which they can be used and the controls necessary to ensure safety.

10. Lasers in construction or building operations

- a. Lasers used in surveying, building or construction must be used in compliance with Australian Standard AS/NZ 2397 *Safe use of lasers in the building and construction industry*.
- b. Class 3B and Class 4 lasers must not be used in construction work.

11. Lasers in health care

- a. The use of lasers in dental and medical practice must comply with Australian Standard AS/NZS 4173 *Safe use of lasers and intense light sources in health care*.

12. Portable lasers and associated instruments

- a. Portable lasers and associated instruments (e.g. theodolites, total stations, laser scanners, robots, laser levels) must be risk assessed and controls implemented for each specific use and location. Controls to protect exposure to members of the public or others must be considered where relevant.

13. Intense light sources

- a. Intense light sources such as some LEDs may pose similar risks to eyes and skin and must be risk assessed and controls implemented for each specific use and location.
- b. Other light sources including non-ionising UV and visible sources are considered under the IEC 62471 *Photobiological safety of lamps and lamp systems* standard.

14. Laser pointers

- a. Laser pointers with an AEL of greater than 1 milliwatt (1mW) are classed as a prohibited weapon and must not be used other than for astronomical use as part of a course of study as outlined in the Summary Offences (Weapons) Amendment Act 2012 and Summary Offences Regulations 2016.
- b. Laser pointers with an AEL of <1mW may be used for teaching purposes.

15. Laser displays and shows

- a. The use of lasers in displays, shows and presentations must comply with the current version of AS/NZS IEC 60825.3: *Safety of laser products - Guidance for laser displays and shows*.

16. Laser disposal or transfer of ownership/management

- a. When lasers are considered for disposal or transfer of ownership/management, the decommissioning and/or disposal process outlined in the Plant and Equipment Safety Procedures must be followed.
- b. Any lasers disposed of or transferred to another owner must be informed to the University Laser Safety Officer and the University Laser Register updated.

17. Standards

- a. Users of lasers must, at a minimum, comply with the following Australian Standards:
 - AS/NZS IEC 60825.1 *Safety of laser products – Equipment classification and requirements*
 - AS/NZS IEC 60825.14 *Safety of laser products – A user's guide*
 - AS/NZS IEC 60825.3 *Safety of laser products - Guidance for laser displays and shows*

- AS/NZS IEC 60825.4 Safety of laser products – Laser Guards
 - 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)
 - AS/NZS 2397 Safe use of lasers in the building and construction industry
 - AS/NZS 4173 Safe use of lasers and intense light sources in health care
- b. Where areas do not comply with specific requirements as set out in the Australian Standards, alternative measures that provide equivalent or better protection, as consulted and agreed with the University Laser Safety Officer, must be adopted.
- c. The implementation of control measures not specified by the Australian Standards must be risk assessed and controlled in line with these procedures and in consultation with the University Laser Safety Officer.

18. Responsibilities

Vice-Presidents and Executive Deans of College and Portfolio Heads	a. Where lasers are used, ensure that systems are in place to ensure that these procedures are implemented effectively in their College/Portfolio.
Supervisors, managers and researchers	b. Implement these procedures in their area of responsibility. c. Ensure laser users are suitably trained in the safe operation of lasers. d. Provide suitable PPE to laser users where required. e. Ensure that any laser incidents are reported.
Property, Facilities and Development Project Officers	f. Ensure that use of a laser or laser product in building or construction by University staff and/or contractors at University sites or premises is in accordance with AS/NZS 2397.
Laser Safety Officer	g. A Laser Safety Officer must: i. Be appointed where Class 3B or 4 lasers are present in a workplace. ii. Maintain a register of all potentially hazardous laser products. iii. Monitor compliance with these procedures for safe laser use. iv. Take immediate and appropriate action when non-compliance is observed. v. Participate in the review of this procedure. vi. Assist laser users with laser risk management, including safety precautions to be implemented. vii. Ensure that each area or research centre which uses Class 3R, Class 3B or Class 4 lasers maintains a register of the equipment in their possession. viii. Conduct audits on areas that have and use lasers.

Staff and students	h. Comply with safety instructions and procedures, undertake any required training, and use control measures and/or personal protective equipment to ensure their own health and safety and the health and safety of others. i. Work safely and not put themselves or others at risk of injury from exposure to lasers
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19. Related documents

[WHS Regulations 2012](#)

[WHS Risk Management Procedures](#)

[Plant Safety Procedures](#)

[Personal Protective Equipment](#)

20. Forms

[Laser Equipment Registration Form](#)

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