Laser Safety Procedure	
Enabling Policy Statement; Executive Owner; Approval Route:	Our Safety - Chief Operating Officer - Compliance Committee
Associated Policy Statements:	
Authorised Owner:	Director of Health and Safety
Authorised Co-ordinator:	Health and Safety Officer (Hazardous Materials)
Effective date:	7 June 2023
Due date for full review:	6 June 2026
Sub documentation:	Laser Safety Code of Practice New Laser Worker Induction

Approval History

Version	Reason for review	Approval Route	Date
1.0	New Procedure	University Compliance (Health, Safety and Wellbeing) Committee	7 June 2023

1. Purpose

This Procedure sets out the University's management arrangements for the use of lasers. It requires that the potential for harm to staff, students and other persons from work with laser equipment is either prevented, or where this is not reasonably practicable, is adequately controlled.

2. Scope and Exceptions to the Procedure

This Procedure applies to all lasers and their use on University premises and in connection with University activities.

It applies to staff, students, contractors, and visitors who are working directly with lasers or who are carrying out any laser or non-laser work in a laser laboratory.

This Procedure is not designed to replace government published guidance on the Control of Artificial Radiation at Work Regulations (2010) or guidance contained in the European Standard EN 60825-1: 2014 Safety of laser products.

This Procedure does not apply to:

- Class 1 laser devices that are classified by the manufacturer as Class 1, sold as Class 1, and used as the manufacturer intended, without modification.
- Class 1C laser devices that are classified by the manufacturer as Class 1C, sold as Class 1C, and used as the manufacturer intended without modification, in either halls of residence or businesses on campus.

  Note: Class 1C laser devices used for research purposes are not exempt.

- Class 2 laser devices that are classified by the manufacturer as Class 2, sold as Class 2, and used as the manufacturer intended, without modification.
- Point-of-sale checkout scanners in businesses on campus and other laser-based barcode or QR code readers that are used as intended by the manufacturer without modification, and which may be classified as either Class 1M or Class 2M.

3. Definitions and Terminology

Laser – any device which can be made to produce or amplify electromagnetic radiation in the wavelength range from 180nm to 1mm primarily by the process of controlled stimulated emission.

Laser Laboratory – any laboratory that contains at least one laser of Class 1M, 2M, 3R, 3B or 4 where the laser has not been rendered Class 1 via engineering during normal operation.

Laser Controlled Area – any laser laboratory containing at least one laser of Class 3B or 4 where the laser has not been rendered Class 1 via engineering during normal operation.

Laser Worker – any member of staff, student or visitor who has completed the University of Surrey's *Safe Use of Lasers* course, is registered as a Laser Worker, and works in a Laser Laboratory, either full or part time.

The following abbreviations are used in this Procedure:

- Coordinating Laser Safety Officer (CLSO)
- Departmental Laser Safety Officer (DLSO)
- Laser Supervisor (LS)
- Radiation Protection Adviser (RPA)
- Standard Operating Procedure (SOP)
- Maximum Permissible Exposure (MPE)

- Nominal Ocular Distance (NOHD)

4. Procedural Principles

4.1 Commitment

Compliance with the requirements of this Procedure will ensure:

- The University meets its statutory obligations in respect of legislation.
- The safe management of lasers and laser devices.
- That exposure to non-ionising radiation is kept 'as low as reasonably practicable'.
- Everyone is aware of their roles and responsibilities.
- The safety and health of staff, students and visitors whilst working with lasers.
- The safety and health of others (including contractors, members of the public) is not compromised by those persons working with lasers.
- That staff, students and others who are authorised to work with lasers are appropriately informed, instructed, and where necessary trained and supervised.

4.2 Arrangements

In order to meet the above objectives, the University will:

- Clearly define the organisational arrangements for achieving compliance (see roles and responsibilities section of this Procedure).
- Ensure resources are made available to achieve compliance.
- Prepare and implement a Code of Practice for Laser Safety that sets out in detail how the risks from lasers will be managed.
- Periodically review and monitor the effectiveness and implementation of the above Code of Practice, so that the Code remains relevant and up to date.
- Introduce requirements for the registration of lasers and laser equipment before it is brought into use.
- Implement requirements for the registration of laser workers.
- Establish compulsory training requirements (including refresher training) for laser workers.
- Establish contingency arrangements to deal with a laser incident.
- Review laser management arrangements periodically or whenever there are changes in relevant legislation, guidance, or University activities.

4.3 Authorisation to work with lasers

Any person required to work in a Laser Laboratory must be authorised to undertake such activities. Such authorisation shall require the completion of the University 'LR3 Laser Worker Registration Form' which must be completed in full by the user and countersigned by the Laser Supervisor and Coordinating Laser Safety Officer (CLSO). The person must also attend a Laser Safety Induction course and refresher training at the required interval, thereafter.

4.4 Registration, acquisition and purchase of lasers

All lasers, other than those listed as exceptions in Section 2 above must be registered with the CLSO using 'LR1 Laser Registration Form' (for Classes 1M, 2M and 3R) and 'LR2 Laser Registration Form' (for Classes 3B and 4). Any person wishing to purchase, hire, borrow or import a laser to the University must obtain written authorisation from the CLSO, at least 3 weeks prior to the delivery/arrival date.

Note: As a starting principle, the University expects all laser work to be carried out to meet a Class 1 classification. Where work is carried out at a classification other than Class 1, it must be for a specific purpose, of limited duration, and a written justification must exist and be provided to the CLSO.

4.5 Risk assessment

Prior to any new activity involving work with lasers being introduced, a risk assessment must be conducted. Covering all aspects of the use of the laser, the assessment will be conducted by a member of staff, postgraduate research student or the Laser Supervisor, and approved by the Laser

Supervisor. The CLSO will provide such advice and assistance as may be necessary.

All risk assessments must be suitable and sufficient and checked against the requirements of the Control of Artificial Optical Radiation at Work Regulations (2010) and the Technical Report PD IEC/TR 60825-14:2022. The University Laser Safety Code of Practice provides further guidance on the risk assessment process.

Where the risk assessment identifies that risk controls are required which our outside those currently provided, then the laser will not be brought into service/use until the requirements identified to be necessary by the assessment have been implemented.

Completed risk assessments, and other relevant documents (i.e., Standard Operating Procedures) will be held in the immediate vicinity in which the laser is in use (see also Section 4.12). This will ensure they are available for reference purposes during use, and such other means as may be appropriate for restriction of exposure.

4.6 Restriction of exposure

Where work with lasers is to be carried out, Laser Supervisors will take all reasonable steps to ensure that exposure is restricted so far as reasonably practicable. This will be achieved by ensuring that the following hierarchy of risk control measures is in place:

(i) Engineering controls – firstly take action to control exposure by engineering controls.

(ii) Safe systems of work – then consider the use of safe systems of work, such as information, instruction and training, supervision, written standard operating procedures, etc.

(iii) Personal Protective Equipment – in the event that exposure cannot be adequately controlled by engineering controls and safe systems of work, personal protective equipment must be provided to further restrict exposure.

Note: The University requires that all laser processes that incorporate a Class 3B or Class 4 laser are:

- Engineered to meet Class 1 standard by default[1] (if not already supplied in a Class 1 enclosure by the manufacturer), or
- Include a justification for open-beam work as part of the risk assessment that explains why meeting Class 1 standards is not reasonably practicable.

The need for repeated or convenient access to the laser beam is not accepted as a justification for open beam work.

4.7 Personal Protective Equipment

Where it is legitimate to resort to personal protective equipment, this will conform to current product/design requirements. The CLSO will be available for advice on the selection of adequate and suitable personal protective equipment for restricting exposure.

Note: It is essential that where the risk assessment identifies the need for protective eyewear, this must provide protection against the specified wavelength and power of the laser beam. Where the need for protective clothing is identified, then the hands and forearms are the areas most at risk and must, therefore, be appropriately covered.

[1] Class 1 lasers are laser systems where the laser light emissions accessible to the user never exceed the Maximum Permissible Exposure (MPE) for that wavelength of laser. Systems may be Class 1 either by operating at very low power or by having a higher optical power output entirely contained during normal use.

4.8 Code of Practice

The University will produce and keep under review a Laser Safety Code of Practice which sets out in detail how the risks from lasers will be managed.

4.9 Laser Laboratory

This is a room or laboratory that must, as a minimum, have the following:

- Access for laser workers to all relevant laser safety information.
- Controlled entry, such that only authorised Laser Workers can gain access (e.g., restricted swipe access).
- Designated Laser Supervisor identified on the laboratory entrance door.

Non-laser workers who wish to enter or work in a Laser Laboratory must either become Laser Workers or be closely supervised at all times by an existing Laser Worker. Exceptions are made for visiting laser equipment service engineers who have provided a sufficient risk assessment for their work.

4.10 Laser Controlled Area

This is a room or laboratory that must, in addition to the requirements of a Laser Laboratory, have the following:

- The highest classification of laser that is present in the laboratory identified on the laboratory entrance door.
- An external warning indicator to show whether there is currently a laser hazard (e.g., a wall mounted warning light).
- An indication of the power and wavelengths of laser light present in the laboratory so that users can decide which protective eyewear (i.e., goggles) are required.
- All windows (including glass door panels) are blocked in such a way that no laser light can escape the laboratory. If the laboratory contains a Class 4 laser, then special consideration needs to be given to the laser resistance of the blocking material to ensure it is suitable for the task.
- A room interlock system, so if the door is unexpectedly opened during laser operation, laser emission will cease. This can be achieved via either a direct connection to an interlock built into the laser power supply by the manufacturer, or by an external shutter. If an external shutter is used, then it must be securely fixed in front of the laser such that when the shutter is closed there is no reasonable chance of access to laser emission.

Additionally, a Laser Controlled Area may have an interlock override that allows authorised Laser Workers to enter and leave the laboratory without tripping the room interlock system. Although these have been widely used for laser facilities in the past, they must not routinely be installed on new systems without written justification. The routine use of interlock overrides would not be acceptable for any other type of hazard and should not be considered as acceptable for laser facilities. The exceptional circumstances where overrides are appropriate is when there is a requirement to keeps lasers operating for reasons of laser stability or thermal effects on optics. Even when there is a sound reason to avoid powering down a laser, consideration should be given to using room interlocks to terminate laser emission by means of one or more shutters. Overrides must not be permanent and must reset after a short time delay. The time delay must not exceed 30 seconds and should be of a duration appropriate to the time it takes to enter and exit the laboratory.

It is foreseeable that there may be some exceptional circumstances where a Laser Controlled Area is designated for a very short time period. For example, if a service engineer is performing maintenance on an item of Class 1 laser equipment in a non-laser laboratory, opening of equipment may introduce a laser hazard. On these occasions, when a Laser Controlled Area is designated for a very short time period for temporary maintenance actions, some of the requirements for a Laser Controlled Area listed above may not be reasonably practicable. This is a decision that must be made in consultation

with and agreement of the CLSO. This exception is only permitted for maintenance and not for routine work or alignment.

Written instructions must be issued to staff or contractors (and to their managers) who have approval to enter a Laser Controlled Area for specific purposes such as cleaning, waste collection and maintenance or servicing work, but who are otherwise not considered Laser Workers. These instructions will take the form of a Permit to Work.

When engineers come into the University to install, maintain or repair lasers, it is essential that the Laser Supervisor obtain a copy of their risk assessment, have a protocol for hand over, and exclude all other workers from the area unless they are involved in the maintenance. The handover should make use of the 'Transfer of Area' form (see Laser Safety Code of Practice). It is essential that Laser Supervisors (and DLSOs, where applicable) consider whether maintenance work temporarily changes the maximum class of laser present in the laboratory (e.g., the removal of casing turning a previously exempt Class 1 laser into a Class 4 laser) and take the necessary precautions.

4.11 Labelling

All lasers must be labelled appropriately as detailed in European Standard EN 60825-1:2-14.

4.12 Information for laser users

Each Laser Laboratory must implement a means for Laser Workers to access relevant laser safety information and documentation. This could include laser equipment registration documents, copies of the relevant risk assessments, standard operating procedures, the ocular accident contingency plans for the laboratory, written procedures for laser alignment (if a separate alignment process is required) and copies of handover documentation for service engineers. A detailed description of safety documentation is provided in Section 3 of the Laser Safety Code of Practice.

This information may be presented as paper copies in a document holder or safety folder. Alternatively, if a department stores such information electronically in a universally accessible system (e.g., an intranet page, shared drive, or SharePoint site), then this is an acceptable provided that:

- There is a physical indication in the laboratory that this is the case and instructions on how to access the information.
- The information is readily accessible to Laser Workers in the laser laboratory, the DLSO and the CLSO, especially during annual inspections.

Electronic copies of the relevant documents stored on a personal file store or shared drive with limited access are not acceptable electronic storage methods.

4.13 Undergraduate work with lasers

Wherever practicable, undergraduates will be limited to the use of Class 1 or Class 2 lasers. Where this is not practicable, undergraduates are required to be registered as a Laser Worker. Their work should always involve the lowest power laser practicable, and they will be required to follow a written scheme of supervised work.

If there is a need to demonstrate laser experiment to a group of students in a classroom or lecture theatre then Class 2 or visible Class 3R lasers can be used, providing that:

- The lecturer, technician, or demonstrator operating the laser is a registered Laser Worker.
- The demonstration is 'portable' and not permanently installed in the lecture theatre.
- A suitable risk assessment is undertaken, and controls identified implemented.
- The students are not unnecessarily exposed to the beam.

Under these specific circumstances the lecture theatre or classroom is not considered a laser laboratory and the requirements for such facilities do not apply.

4.14 Open beam work

Where justification for open beam work exists, all lasers (excluding lasers listed as exceptions in Section 2 above) must meet the minimum standards of control identified in Section 13 of the Laser Safety Code of Practice.

Routine operation of Class 3B and 4 lasers in an open beam configuration will rarely, if ever, be justified. This may apply to limited duration work, such as beam alignment or maintenance and any control requirements must be discussed and agreed with the CLSO.

4.15 Eye examinations

Initial and routine eye examinations for laser workers are not required. However, if a laser worker has concerns about their eyesight this should be discussed with their Laser Supervisor, in consultation with the CLSO and, where necessary, Occupational Health.

4.16 Laser pointers and pens

Laser pointers that are being used for the manufacturers intended purposes as presentation tools in lecture theatres, classrooms and elsewhere on campus must not exceed Class 2 (1mw, 400nm - 700). Breaching this classification limit or using laser pointers in a dangerous manner other than for their intended purpose will be considered a disciplinary offence by the University.

Where there is a compelling educational need to break this classification limit while using laser pointers (e.g., designating stars during a live astronomy lecture) there needs to be a robust written justification and assessment of the risks involved, which is approved by the CLSO.

4.17 The use of lasers for entertainment and display purposes

Lasers that are used for display purposes are of a very high power and have the potential to cause serious injury. All persons attending such as display must be protected from either accidental or reckless exposure. Lasers that are used on campus for display purposes must be operated in accordance with the latest Industry Guidance.

Further advice on the use of lasers can be obtained from the CLSO.

4.18 Roles and Responsibilities

4.18.1 Heads of Department/School have overall responsibility for implementing the requirements of this Procedure, including:

- Ensuring that risks associated with lasers are assessed and managed.
- Ensuring, where applicable, any person who is required to work with lasers is authorised.
- The provision of appropriate information, instruction, and where necessary training and supervision to users of lasers.
- Appointing (in consultation with the Coordinating Laser Safety Officer):
    - A Laser Supervisor for each laser laboratory.
    - Where their Department/School has three or more lasers (excluding lasers for which this Procedure does not apply), a Departmental Laser Safety Officer to assist them with the execution of their responsibilities.
- Ensuring the reporting, and where necessary, investigation of any incidents or accidents involving lasers using the University incident reporting system.

4.18.2 The Coordinating Laser Safety Officer (CLSO) will:

- Approve the installation of new lasers.
- Prevent or restrict the use or procurement of any lasers that they deem inappropriate or unsuitable to the task.
- Ensure that there is a sufficiently robust justification if Class 3B or Class 4 lasers are to be

used without a Class 1 enclosure.

- Provide advice on laser safety issues and guidance to Laser Workers and Laser Supervisors on completing registration forms, risk assessments, and standard operating procedures.
- Keep an up-to-date record of all lasers in the University (excluding lasers for which this Procedure does not apply).
- Keep an up-to-date record of all Laser Workers.
- Provide laser safety training and refresher training for new and existing Laser Workers.
- Carry out an annual audit/inspection of all University Laser Laboratories.
- In consultation with the Director of Health and Safety, review this Procedure and associated Code of Practice in line with any prescribed review date, or sooner if required by changes to legislation, or if the Procedure/Code is suspected to be no longer valid.
- Undertake a timely investigation into any laser-related incidents, working in conjunction with the Faculty Health & Safety Advisers if general incident investigation is not part of the CLSO's normal duties.

Note: The CLSO will carry out the duties of the DLSO in Departments where there are less than three lasers.

4.18.3 Departmental Laser Safety Officers (DLSO) support the Head of Department/School and the CLSO by ensuring that the Code of Practice is implemented within their Department/School. The DLSO will:

- Assist their Head of Department/School with the implementation of this Procedure for the areas under their supervision.
- Inform, and keep up to date, the CLSO with any planned laser procurement or significant changes to laser laboratories.
- Ensure that new laser workers are registered with the CLSO before they begin work.
- Provide advice on completing laser-related documentation, including risk assessments.
- Assist with the provision of a justification if Class 3B or Class 4 lasers are to be used without a Class 1 enclosure.
- Ensure that undergraduates working with lasers are using the minimum power laser practicable and follow a written scheme of supervised work.
- If they do not feel able to provide a full answer to an enquiry from a laser worker, they should refer the laser worker's question to the CLSO.
- Report any laser-related incidents that they are aware of to the CLSO and record on the university incident reporting system.

Note: The CLSO will carry out the duties of the DLSO in Departments where there are less than three lasers.

4.18.4 Laser Supervisors (LS) should be the Research Supervisor or Principal Investigator for the laser laboratory, and have responsibility for their individual research projects, ensuring all work with lasers is risk assessed and, where appropriate, covered by standard operating procedures. For their research projects, LS will ensure that:

- The purchase, hire, borrowing or import of a Class 3B or 4 laser is not undertaken without notifying the CLSO in advance. Notification of intention to procure must be conducted at the earliest opportunity (and at least 3 weeks prior to the delivery/arrival date) and must be accompanied by a completed LR2 form and risk assessment. Only once the CLSO has approved the set-up, documentation, and use of the laser, can it be brought into operation.
- All lasers under their supervision are registered (excluding lasers listed as exceptions in Section 2 above) with the CLSO using either 'Laser Registration Form LR1' (for Classes 1M, 2M and 3R) or 'Laser Registration Form LR2' (for Classes 3B and 4).
- A suitable and sufficient risk assessment and standard operating procedure is undertaken

for all laser activities and risk controls implemented. This includes ensuring that risk assessments meet the requirements of the Control of Artificial Optical Radiation at Work Regulations 2010 and that assessments consider the need for open beam work, such as alignments.

- All laser workers and others who need to enter the laboratory/controlled area are trained and instructed on safe use of laser(s) and, where necessary, supervised.
- There is a written justification if Class 3B or Class 4 lasers are to be used without a Class 1 enclosure.
- The disposal of any laser (when no longer required) is made in consultation with the DLSO (or CLSO) and in accordance with relevant regulatory requirements.
- Report any laser-related incidents that they are aware of to the CLSO and record on the university incident reporting system.

4.18.5 The University's Radiation Protection Adviser (RPA) will, upon request, provide advice and consultation on the use of lasers within the University and must be contacted through the CLSO.

4.18.6 Laser Workers have responsibility for their own safety and that of others who may be affected by their acts or omissions. Laser Workers must:

- Comply with the requirements of this Procedure and Code of Practice.
- Work in accordance with the findings of any risk assessment, and the requirements of any information, instruction and training, including standard operating procedures.
- Not leave any laser experiment running unattended, unless a risk assessment has established that it is safe to do so.
- Immediately report to the CLSO any accident or incident involving lasers.
- Bring, without delay, to the attention of the DLSO or LS any hazards identified or improvements they think necessary.

5. Governance Requirements

5.1 Implementation: Communication Plan

The Procedure will be available via the University Procedures pages.

Relevant Health and Safety Committees will be notified, and information disseminated through line management. Faculty Health and Safety Committees will also be informed, as required.

This Procedure and the Code of Practice are communicated through training to Laser Workers.

This Procedure, Code of Practice, and relevant supporting documentation are also published on the University Health and Safety intranet site.

5.2 Implementation: Training Plan

Before any work with lasers, all Laser Workers must:

- Attend the University of Surrey's 'Laser Safety Induction' course, and
- Complete a LR3 Laser Worker Registration Form and submit it to the CLSO following completion of the above training.

Additionally, new laser workers must receive appropriate instruction and guidance from their Laser Supervisor regarding the specific laser equipment that they will be using. They must also have confirmed with their Laser Supervisor that they have understood the contents of this Procedure and other written guidance given to them. The provision of this training on specific laser equipment must be recorded locally.

Existing registered laser workers are required to attend the above laser training course to have

their training refreshed if they are working with lasers or planning to work with lasers in the immediate future, and either:

- It has been over three years since the last time they attended the course, or
- They have not carried out any laser work for a period of over 6 months.

5.3 Review

The CLSO will monitor for required changes and updates. Minor changes will be reviewed by members of the Laser Safety Forum and approved by the Compliance (Health, Safety and Wellbeing) Committee. Major reviews will also be reviewed by the Laser Safety Forum, prior to submission to the Compliance (Health, Safety and Wellbeing) Committee for approval, and if required, noted at Executive Board.

This Procedure will be reviewed every three years or in line with changes in legislation, if sooner. The Health and Safety Consultative Committee will be consulted during the review process, as required.

5.4 Legislative Context and Higher Education Sector Guidance or Requirements

5.4.1 Applicable Legislation

This policy complies with the requirements:

- Health and Safety at Work Act 1974.
- The Control of Artificial Optical Radiation at Work Regulations 2010.
- European Standard Safety of laser products (EN 60825-1:2014).
- Personal Protective Equipment at Work Regulations 1992.
- European Standard Personal eye-protection equipment. Filters and eye-protectors against laser radiation (laser eye-protectors) (EN 207: 2017).
- Personal eye-protection. Eye-protectors for adjustment work on lasers and laser systems (laser adjustment eye-protectors) (BS EN 208: 2009).

Note: This Procedure also acknowledges the information contain in good practice guides PD IEC TR 60825-14 *Safety of laser products – Part 14: A user's guide and Non-binding guide to good practice for implementing Directive 2006/25/EC 'Artificial Optical Radiation'*.

5.4.2 Legislative context

This Procedure sets out to comply with the required 'duty of care' placed upon the University. Under Health and Safety Law a 'duty of care' is generated between organisations and individuals when carrying out activities that could foreseeably cause harm.

The primary duty of care is owed through the employer-employee relationship in which the employer owes a duty of care to ensure that work activities that could result in harm to the employee are assessed and controlled. That duty of care is put into practice by the line management responsibilities as set out in the hierarchy of the organisation.

This duty of care cannot be delegated away; instead, the act of delegation must be accompanied by a realistic and workable system of monitoring or supervision to ensure that the delegated task has been adequately implemented (i.e., the responsibility is not met by giving directions; it is met when those directions have been confirmed as carried out). The result is a cascade of delegated accountability that runs through the organisation via the line management network, accompanied by a system of monitoring, supervision, and feedback.

The duty of care extends to assurance that services provided by others (be they another department of the University or contractors) are undertaken safely. The level of assurance required should be commensurate with the risk of the activity. In addition, anyone carrying out an activity owes a duty of care to anyone who may be put at risk by the activity, such as students,

staff, and visitors.

5.5 Sustainability

This Procedure has no impact on carbon emissions or on energy consumption.

6. Stakeholder Engagement and Equality Impact Assessment

6.1 An Equality Impact Assessment was completed on **16/03/2023** and is held by the Authorised Co-ordinator.

6.2 Stakeholder Consultation was completed, as follows:

Stakeholder	**Nature of Engagement**	**Date**	**Name of Contact**
Governance	Development and creation of this Procedure v1.0.	20 March 2023	Andrea Langley, Regulatory Compliance Manger
Members of Laser Safety Forum	Development and creation of this Procedure v1.0.	20 March 2023	Member of this Forum.
Members of the Compliance Management Group	Development and creation of this Procedure v1.0.	20 March 2023	Members of this Committee.
Health and Safety Consultative Committee	Development and creation of this Procedure v1.0.	20 March 2023	Members of this Committee
Equality, Diversity and Inclusion	Development and creation of this Procedure v1.0.	20 March 2023	Jo McCarthy-Holland, Equality & Diversity Advisor.
Sustainability	Development and creation of this Procedure v1.0.	20 March 2023	Martin Wiles, Head of Sustainability.