

Lasers

Introduction

Lasers come in various shapes and forms, they do not all have the same capabilities or damaging potentials. They have many uses in teaching, research, manufacturing, medicine, dentistry, shop checkouts and most commonly at work in the office. Lasers emit radiation as narrow concentrated beams of light, not necessarily visible to the human eye. The optical and skin hazards presented by lasers vary markedly according to the wavelength and power of the output. The hazards of lasers are often associated with the ability of the laser to damage eyesight or burn skin, but quite often the radiation or optical hazards are not the ones that present the greatest risk.

The majority of laser systems are potentially hazardous. The extent of the hazard presented can be identified by the class of laser in question and the way it is to be used within the system, the location of the laser, the skill and experience of those who use the system and the possible access by others who do not. It is the intention of Shropshire Council to ensure that the hazards arising from the use of lasers are reduced to a minimum and that any possible risk to the health of all employees (and others who may be affected) is avoided.

This arrangement describes the measures that relevant departments who use lasers will have taken to fulfil this intention, the need for the co-operation of all employees mainly in the field of teaching, surveying and of visiting lecturers/specialists to ensure that these measures are effective and the consequences that may follow if these measures are ignored or changed. The measures stated here are primarily defined by the legal requirements to provide safety at work.

Control of Artificial Optical Radiation at Work Regulations 2010

These Regulations came into force on 27 April 2010. They require you to protect the eyes and skin of your workers from exposure to hazardous sources of artificial optical radiation (AOR). AOR includes light emitted from all artificial sources in all its forms such as ultraviolet, infrared and laser beams, but excludes sunlight.

Arrangements of securing health and safety of employees

Service areas involved with the use of lasers will, in consultation with employees and their representatives:

- Arrange for any person expected by the Service Area to use, service or maintain a laser system to follow a prescribed training programme before doing so.
- Make users of laser systems aware of any specific local rules concerning particular laser systems and keep records of such local rules along with evidence that employees have read them and understood them.
- Ensure that all lasers in use within the Service Area at workplaces conform to the requirements of BS EN60825-1: 2014 or any other UK relevant standard related to radiation safety of lasers (a record will be kept of the classification, location and service history of every laser used within the Service Area).
- Install adequate engineering and administrative controls to achieve safe working conditions (summarised in the table below) and if further controls are required, personal protective equipment will be provided to protect the skin and the eye (the controls will extend beyond

protection from laser radiation to include protection from all hazards associated with the use of lasers)

- Keep records of the results of any examinations provided by the Service Area and will also arrange for a medical examination by a qualified specialist to be carried out immediately after a suspected over-exposure of the eye (it is recommended that this examination be referred to the central agency of the Professorial Unit, Moorfields Eye Hospital, 162 City Road, London. EC1V 2PD – Tel: 020 7253 3411).
- Arrange for all accidents involving laser radiation or the associated hazards of laser systems to be reported immediately to the Service Areas laser supervisor/radiological safety officer/responsible person: A Business World/ERP incident report must be completed and must include details of time, date, person(s) involved, laser(s) involved and accident details, particularly potential damage to the eye: all such accident reports will be recorded by the Service Area manager.
- In the event of any employee behaving in such a way as to endanger his or her own health or the health of any other person, managers must consider what disciplinary measures will be taken to prevent a re-occurrence.

Safe system of work

Beyond the control measures summarised in the table below, the following general points must be considered to ensure the safety of lasers operators and other people present.

- Laser systems should be used on the lowest possible power output to accomplish the task required.
- Intra-beam viewing (which should be impossible if the engineering and administrative controls are sufficient) should be prevented/forbidden.
- Lasers should be installed in controlled areas with random access denied to any persons other than those trained to use them.
- Lasers should be enclosed in systems which prevent unnecessary exposure to any person, which keep beam paths as short as possible and which secure the laser to prevent its displacement within the system and accidental misalignment of the beam leading to unexpected beam paths and reflections.
- Beam alignment should use low power non-coherent light rather than the laser beam itself.
- Controlled areas should be kept clear of any unnecessary clutter not associated with the use of the laser system.
- Laser systems should never be left running unattended without suitable warning signs and notice of the name and method of contact of the person responsible for that system.
- Service Area managers must ensure that all protective clothing and eye wear provided is suitable for the laser system involved, taking note of the power and mode of the system and the wavelength(s) generated by the system. The equipment must be clearly labelled as suitable for that system. Advice on suitability should always be sought from the manufacturer of the equipment.

Engineering and Administrative Controls for Safe Use of Lasers

Controls and control measures	Type of laser		
	Class 1 (Low power)	Class 2 ($\leq 1\text{mW}$)	Class 3A ($> 5\text{mW}$) Class 3B ($> 0.5\text{W}$) Class 4 (High Power)
Remote interlock connected to door	No	No	Yes
Beam attenuator to prevent inadvertent exposure	No	No	Yes
Key control to disable laser	No	No	No - class 3A Yes - class 3B & 4

Emission indicator	No	No	No - class 3A Yes - class 3B & 4
Warning signs	No	Yes	Yes
Beam termination	No	Yes	Yes
Specular reflection	No hazard	Care required	Prevent
Eye protection	No	No	No - class 3A Yes - class 3B & 4
Protective clothing	No	No	No - class 3A Yes - class 3B & 4
Training	Not necessary	Not necessary	All users

All persons involved in the use, service and maintenance of laser systems must be aware of the associated hazards and to be trained and competent to carry out their task.

To minimise the risk of damage to the health of employees and any others who may be affected by these hazards, Shropshire Council will:

- Provide education and training
- Install engineering controls, devise administrative controls and provide protective clothing
- Reduce to the lowest possible level any potential exposure to the public.

Laser Pointers

Lasers are commonly available and some are used for presentation purposes as pointers. These laser pointers are classified at a level above Class 1 and therefore in some circumstances can cause harm, particularly by staring into the beam. Normally the eye's blink reflex affords protection to short duration accidental exposure. Where laser pointers are used instructions on their safe use should be readily available; Appendix 1 is an example of the instructions which should be provided.

Recordkeeping

Records should be kept of the following:

- The name of the laser safety officer (if appointed) and of all the departmental laser supervisors (if appointed). (In a Secondary School - Radiation Officer).
- Names of persons to whom any responsibility has been allocated, written statements of those persons' duties and an acknowledgement of receipt and understanding of those statements.
- The location and classification of all lasers used and stored within the Service Area or its outstations.
- Copies of all local rules and the lasers, their locations and/or the persons they relate to along with the date of their generation and authorship.
- Dates and details of any accidents that occur involving use of a laser.
- Dates and details of servicing and maintenance of all lasers within the Service Area.
- Training provided to employees.

Summary of statutory duties

Responsibility for laser safety lies with the user Service Area manager who must ensure that employees and others are protected from laser beams as part of the general duty to ensure any person's safety under s.2 of the Health and Safety at Work etc. Act 1974 and the Control of Artificial Optical Radiation at Work Regulations 2010. All laser systems in use should conform to the requirements of the relevant British and European Standard current at the time of manufacture.

References and Further Information

- The Health and Safety at Work etc. Act 1974
- Control of Artificial Optical Radiation at Work Regulations 2010
- Guidance for Employers on the Control of Artificial Optical Radiation at Work Regulations (AOR) 2010: <https://www.hse.gov.uk/radiation/nonionising/employers-aor.pdf>

Appendix 1

Safe use of laser pointers

Lasers are commonly available and some are used for presentation purposes as pointers. Power outputs of laser pointers can vary. Class 1 laser systems are normally safe. Class 2 and 3A systems are not hazardous under certain conditions. However, they can cause harm to the eyes particularly if the beam is stared into. Normally the eye's blink reflex affords protection to short duration accidental exposure to Class 2 and 3A lasers. Class 1 or Class 2 laser pointers are the recommended choice where a laser pointer is necessary. **Class 3B laser pointers must not be used.**

Laser pointers should only be used as a pointing device and appropriately securely stored when not in use. Persons who use laser pointers should ensure that they are aware of potential hazards and they should comply with the basic instructions below.

Instructions for use

When operating laser pointers, users must ensure that they use these in a safe manner and do not expose themselves or others to the beam. Laser pointers are not to be modified in any way.

DO: 	<ul style="list-style-type: none">• Follow the manufacturer's safety instructions.• Take care when operating the laser pointer.• Keep the 'on' button depressed only when necessary.
DO NOT: 	<ul style="list-style-type: none">• Do not keep the 'on' button depressed when not pointing at the screen.• Do not point at or towards the audience.• Do not point at mirrored surfaces.• Never look into the laser aperture.• Never look directly or stare into the beam/beam aperture when on.• Never allow unauthorised use, especially by children.

Appendix 2

Control of Artificial Optical Radiation at Work Regulations 2010

Extracted from the HSE's guidance document for Employers.

Table 1 Work activities which use hazardous levels of Artificial Optical Radiation

What industries use hazardous sources of intense light?	What are the hazardous activities?	How might workers be harmed by the intense light?	What key measures do you need to consider?
Metal Working	<ul style="list-style-type: none"> • Welding (arc and oxyfuel). • Plasma cutting 	<ul style="list-style-type: none"> • Damage to eyes – photokeratitis and photoconjunctivitis ('arc eye'), photochemical damage to the retina (blue light hazard). • Damage to skin – UV burn (erythema) 	<ul style="list-style-type: none"> • Provide face shields, coveralls and gloves • Protect others using screens/curtains/restricted access • Provide information and training • Display appropriate warning signs • Monitor and enforce use of control measures • If any workers are over-exposed, provide medical examination and consider whether follow-up health surveillance is appropriate.
Pharmaceuticals and research	<ul style="list-style-type: none"> • Ultraviolet sterilisation and induced fluorescence 	<ul style="list-style-type: none"> • Damage to eyes – photokeratitis and photoconjunctivitis ('arc eye'), photochemical damage to the retina (blue light hazard). • Damage to skin – UV burn (erythema) 	<ul style="list-style-type: none"> • Provide protective eyewear and make sure other areas of skin are not exposed (i.e. provide lab coats and gloves). • Protect others using screens/curtains/restricted access. • Provide information and training. • Display appropriate warning signs. • Monitor and enforce use of control measures. • If any workers are over-exposed, provide medical examination and consider whether follow-up health surveillance is appropriate.
'Hot industries'	<ul style="list-style-type: none"> • Proximity to furnaces, burners and hot metals/ glass 	<ul style="list-style-type: none"> • Damage to eyes and skin – mainly early onset of cataract risk. • Thermal discomfort 	<ul style="list-style-type: none"> • Engineered measures – remote controls, screening, interlocks, clamps to hold material. • Provide face shields, goggles or other protective eyewear, coveralls and gloves. • Enforced maximum working periods – routine change of activity. • Protect others using screens/curtains/restricted access • Provide information and training • Display appropriate warning signs • Monitor and enforce use of control measures • If any workers are over-exposed, provide medical examination and consider whether follow-up health surveillance is appropriate

What industries use hazardous sources of intense light?	What are the hazardous activities?	How might workers be harmed by the intense light?	What key measures do you need to consider?
Printing and paint (motor vehicle repairs)	<ul style="list-style-type: none"> • Ultraviolet curing of inks and paints 	<ul style="list-style-type: none"> • Damage to eyes – photokeratitis and photoconjunctivitis ('arc eye'), photochemical damage to the retina (blue light hazard). • Damage to skin – UV burn (erythema) 	<ul style="list-style-type: none"> • Engineered measures – screening, automation, remote control. • Provide face shields, goggles or other protective eyewear and ensure other areas of skin are not exposed by providing coveralls and gloves. • Protect others using screens/curtains/restricted access. • Provide information and training. • Display appropriate warning signs. • Monitor and enforce use of control measures. • If any workers are over-exposed, provide medical examination and consider whether follow-up health surveillance is appropriate.
Medical and cosmetic treatments	<ul style="list-style-type: none"> • Laser surgery (Class 3B and 4 lasers). • UV and blue light therapy. • Intense Pulsed Light (IPL) 	<ul style="list-style-type: none"> • Damage to eyes from laser beams/IPL, including blindness. • Laser/IPL burns to skin 	<ul style="list-style-type: none"> • Specialist advice may be needed for laser work. • Provide face shields, goggles or other protective eyewear and coveralls etc. • Provide gloves where appropriate (it is recognised that thin nitrile gloves may be needed for dexterity and that these will offer limited protection against laser burns). • Designated treatment rooms with restricted access. • Curtains around equipment. • Workers are at a distance from patients who are exposed. • Provide information and training. • Display appropriate warning signs. • Monitor and enforce use of control measures. • If any workers are over-exposed, provide medical examination and consider whether follow-up health surveillance is appropriate.
Industry, research and education	<ul style="list-style-type: none"> • Class 3B and 4 lasers 	<ul style="list-style-type: none"> • Damage to eyes, including blindness. • Laser beam burns to skin. • Potential fire risk 	<ul style="list-style-type: none"> • Specialist advice may be needed. • Engineered measures – enclosure, controlled areas, interlocks, remote controls, screening, clamps to hold material. • Designated laboratories with restricted access • Provide face shields, goggles or other protective eyewear and coveralls/lab coat • Provide gloves where appropriate (it is recognised that thin nitrile gloves may be needed for dexterity and that these will offer limited protection against laser burns). • Include laser sources as part of fire risk assessment. • Provide information and training. • Display appropriate warning signs. • Monitor and enforce use of control measures. • If any workers are over-exposed, provide medical examination and consider whether follow-up health surveillance is appropriate