Laser safety management

What are the legal issues from the use of lasers?

There is new specific legislation from 27th April 2010 covering the use of lasers in the UK called The Control of Artificial Optical Radiation at Work Regulations (AOR).

However, general safety legislation will also apply, such as the Health and Safety at Work, etc. Act 1974, the Management of Health and Safety at Work Regulations 1999, the Provision and Use of Work Equipment Regulations 1998 and the Personal Protective Equipment at Work Regulations 1992.

A suitable and sufficient assessment of the risks from the use of the lasers should be made by the employer.

The supply and sale of lasers is covered by consumer legislation, such as the Consumer Protection Act 1987, the Trades Description Act 1968, and regulations made under these Acts. The General Product Safety Regulations 2005 require products to be safe. Any products sold as toys will need to comply with the essential safety requirements of the Toys (Safety) Regulations 1995. Laser products should comply with the current British Standard on Laser Safety, BS EN 60825-1:2007. For many products, compliance with this Standard will be one way of meeting the requirements for CE marking under European Directives.

The new AOR Regulations mentioned above are as a direct result of a European Directive that has recently been published, which covers the safety of optical radiation, including that from lasers, in the workplace. (See appendix 1 below)
What does Class 1, 1M, 2, 2M, 3R, 3B or 4 mean?

Laser products are classified to take account of the amount of laser beam to which you can get access when the product is in normal use or during routine user maintenance. A laser product may contain a laser of a higher class and this may be accessible during servicing. Labels on the product should provide guidance on the laser beam hazard. Full details about the classification scheme can be found in the current British Standard on Laser Safety, BS EN 60825-1:1994, as amended. A brief description of each laser class follows.

**Class 1** lasers are products where the irradiance (measured in watts per metre square) of the accessible laser beam (the accessible emission) does not exceed the Maximum Permissible Exposure (MPE) value. Therefore, for Class 1 laser products the output power is below the level at which it is believed eye damage will occur. Exposure to the beam of a Class 1 laser will not result in eye injury and may therefore be considered safe. However, some Class 1 laser products may contain laser systems of a higher class but there are adequate engineering control measures to ensure that access to the beam is not reasonably likely. Examples of such products include laser printers and compact disc players. Anyone who dismantles a Class 1 laser product that contains a higher class laser system is potentially at risk of exposure to a hazardous laser beam. A laser that is inherently safe and cannot exceed the MPE under any circumstances is exempt from the classification system.

**Class 1M** lasers are products which produce either a highly divergent beam or a large diameter beam. Therefore, only a small part of the whole laser beam can enter the eye. However, these laser products can be harmful to the eye if the beam is viewed using magnifying optical instruments. Some of the lasers used for fibre-optic communication systems are Class 1M laser products.

**Class 2** lasers are limited to a maximum output power of 1 milliwatt (abbreviated to mW, one thousandth of a watt) and the beam must have a wavelength between 400 and 700 nm. A person receiving an eye exposure from a Class 2 laser beam, either accidentally or as a result of someone else’s deliberate action (misuse) will be protected from injury by their own natural aversion response. This is a natural involuntary response that causes the individual to blink and avert their head thereby terminating the eye exposure. Repeated, deliberate exposure to the laser beam may not be safe. Some laser pointers and barcode scanners are Class 2 laser products.

**Class 2M** lasers are products which produce either a highly divergent beam or a large diameter beam within the wavelength range 400 to 700 nm. Therefore, only a small part of the whole laser beam can enter the eye and this is limited to 1 mW, similar to a Class 2 laser product. However, these products can be harmful to the eye if the beam is viewed using magnifying optical instruments or for long periods of time. Some lasers used for civil
engineering applications, such as level and orientation instruments are Class 2M laser products.

**Class 3R** lasers are higher powered devices than Class 1 and Class 2 and may have a maximum output power of 5 mW or five times the Accessible Emission Limit (AEL) for a Class 1 product. The laser beams from these products exceed the maximum permissible exposure for accidental viewing and can potentially cause eye injuries, but the actual risk of injury following a short, accidental exposure, is still small.

**Class 3B** lasers may have an output power of up to 500 mW (half a watt). Class 3B lasers may have sufficient power to cause an eye injury, both from the direct beam and from reflections. The higher the output power of the device the greater the risk of injury. Class 3B lasers are therefore considered hazardous to the eye. However, the extent and severity of any eye injury arising from an exposure to the laser beam of a Class 3B laser will depend upon several factors including the radiant power entering the eye and the duration of the exposure. Examples of Class 3B products include lasers used for physiotherapy treatments and many research lasers.

**Class 4** lasers have an output power greater than 500 mW (half a watt). There is no upper restriction on output power. Class 4 lasers are capable of causing injury to both the eye and skin and will also present a fire hazard if sufficiently high output powers are used. Lasers used for many laser displays, laser surgery and cutting metals may be Class 4 products. Many Class 4 laser products are safe during normal use, but may not have all of the protection measures required for a Class 1 product. An example would be an enclosure with an open roof; it is possible that someone could get a ladder and climb over the enclosure to get access to the laser beam.

**Why do some lasers have the Class as Roman numerals?**

In the United States of America it is a legal requirement for laser products to comply with the requirements of a Federal Product Performance Standard. Lasers classified in accordance with this Standard are assigned to Classes I, IIA, II, IIIA, IIIB or IV. There are subtle differences between this Standard and the British Standard. This has caused a great deal of confusion with laser products labelled to the American Standard. Further advice should be sought on products labelled with Roman numerals intended for use in the UK. To comply with the requirements for CE marking in Europe, most laser products will need to be labelled in accordance with the British Standard on laser safety.

**When do I need to appoint a Laser Safety Officer?**

The British Standard user’s guide for laser safety, PD IEC TR 60825-14:2004, recommends that a Laser Safety Officer (LSO) is appointed where Class 3B and Class 4 lasers are used. Employers may also consider whether an LSO is needed for the use of Class 1M and Class 2M lasers. The degree of training and competence of a person appointed as a Laser Safety Officer needs to be
balanced against the risks from the work with the laser, including any maintenance or servicing operations. In some cases, laser safety expertise is only required at the start of the work with the laser product and when any changes are made. Under such circumstances it would not be reasonable to train an employee in all aspects of laser safety – without regular application of the training they would soon forget some of what they had learnt. At the other extreme, for example in research environments, the LSO may be involved with regular assessments and advice regarding laser safety. Further information can be found in PD IEC TR 60825-14: 2004, Safety of Laser Products - Part 14: A user's guide, and in PD CLC/TR 50448:2005, Guide to levels of competence required in laser safety.

What is a Laser Protection Adviser?

The term Laser Protection Adviser (LPA) is a term used for a person who can be consulted on complex laser safety management issues. This person may be employed by the organisation with the laser(s) or may be an external consultant. The term may also be applied to an organisation.

In private and voluntary, National Minimum Standards have been published. One of these Standards requires practices using Class 3B and Class 4 lasers, and intense pulsed light sources, to have access to safety advice from a certificated LPA.

The HPA acts as LPA to a range of users of lasers. A number of HPA staff are certified LPAs under the comprehensive certification scheme of the organisation.

Do I need laser safety goggles?

Ideally, the laser product should be designed so that laser safety goggles are not needed, even during maintenance and servicing operations. It would not usually be acceptable to require the use of goggles to ensure safety while carrying out routine operations. However, if goggles are required then further advice should be sought.

Do I need to register my use of a laser with anyone?

Apart from the use of medical lasers in private practice and display lasers, there is no need to inform anyone that you are using a laser. However, specific conditions may apply in some areas, such as for laser beams that may influence air or marine traffic. Employers will need to consider their use of lasers as part of their risk assessment process carried out under the Management of Health and Safety at Work Regulations. If the risk assessment shows that employees of another employer may be at risk then there will be a duty to collaborate on potential issues.
How can I keep up to date with developments in laser safety?

The HPA jointly runs the Laser Safety Forum with the Wolfson School of Mechanical and Manufacturing Engineering at Loughborough University. The Laser Safety Forum provides a mechanism for those interested in laser safety to share experiences and this is achieved through an annual meeting and an occasional newsletter, *Laser Safety Matters*. The Laser Safety Forum is aimed primarily at past participants on the HPA/Loughborough University laser safety courses, but is open to all who have an interest in laser safety, including manufacturers, suppliers, users and enforcing officers.

Whom should I contact if I have more questions?

Please email laser@hpa.org.uk if you have a specific question.

The HPA Radiation Protection Division can provide advice from each of its three sites.

- [Chilton](#)
- [Leeds](#)
- [Glasgow](#)
Appendix 1

New legislation for occupational exposure to optical radiation

The European Commission (EC) has published a Directive on the minimum health and safety requirements regarding the exposure of workers to risks arising from artificial optical radiation (Directive 2006/25/EC).

The full text of the Directive is available from the EC website at eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32006L0025:EN:NOT.

Member states must bring into force national legislation to implement the Directive by 27 April 2010. The Health and Safety Executive (HSE) is taking the lead for this in the UK. The HSE issued a consultative document (http://www.hse.gov.uk/consult/condocs/cd227.htm) on 9 November 2009, with comments due by 5 February 2010.

Key points from the Directive

- It only applies to artificial optical radiation, e.g. the sun is excluded.
- It only applies to the exposure of workers.
- Employers will need to assess the risk to their employees (already a requirement under existing legislation).
- Exposure limits are based on the recommendations of the International Commission on Non-Ionizing Radiation Protection, which are available at www.icnirp.org/pubOptical.htm.
- The EC is required to draw up a practical guide to help employers, in particular small and medium-sized enterprises, to understand better the technical provisions of the Directive.

The Radiation Protection Division of the HPA was contracted by the EC to produce a draft of the practical guide. This work was completed at the beginning of 2009. The final version of the guide is expected to be published by the EC towards the end of 2009. The draft practical guide was produced in English, French or German. Applications for a copy can be made by emailing laser@hpa.org.uk. These are provided on the understanding that they are for information only and must not be copied except for educational purposes.

Further guidance can be found at: www.hse.gov.uk/radiation/nonionising/employers-aor.pdf