

Lasers and their associated hazards

New policy number: **685**
Old instruction number: **35**
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Owner: **Assistant Commissioner, Operational Policy**
Responsible work team: **Hazardous Materials and Environmental Protection Team**

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1 Introduction

- 1.1 Since the early 1970's lasers have become embedded in everyday life. Barcode scanners, CD/DVD players and products of this type are considered safe in normal operation and are manufactured to BS 60825:1994 (amended 2002).
- 1.2 The use of high power lasers, which pose a hazard from the beam and the equipment/materials associated with the installation, has also increased significantly and it is to these that this policy is addressed.
- 1.3 There is no specific legislation covering high power lasers but, the Health and Safety at Work 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 (PPE) at Work Regulations 1992 will still apply.

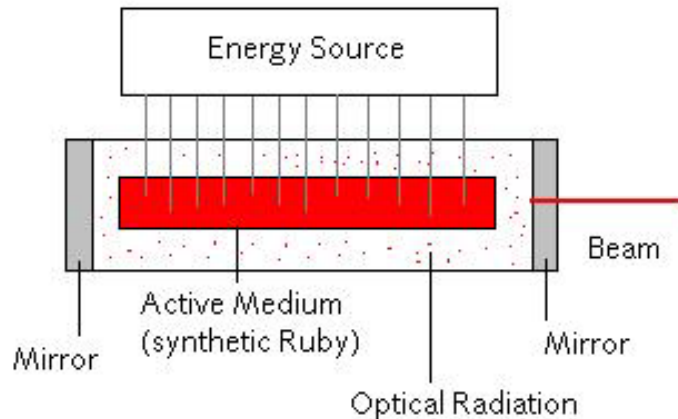
2 Locations

- 2.1 Some examples of the likely location and use of high power lasers:
 - Industrial sites, government establishments and universities (research).
 - Schools, colleges and universities (educational).
 - NHS hospitals, private hospitals and clinics (medical procedures).
 - Industrial sites and factories (industrial processes/manufacturing).
 - Outside of buildings and fibre optic installations (communications).
 - Construction sites and military establishments (surveying and ranging).
 - Outdoor events and concerts (entertainment).
- 2.2 It is important for Station Officers/Sub Officers (StnOs/SubOs) to locate facilities, with a high power laser installation, within their area and ensure that familiarisation visits are carried out on a regular basis. Information regarding the installation, e.g. type of laser, use, hazards, layout of the unit, position of emergency controls, firefighting media and fixed installations is to be recorded on the operational risk database and/or updated as appropriate.

3 Description

- 3.1 Light amplification by the stimulated emission of radiation (LASER) is the process by which a coherent, collimated beam of optical radiation is produced at a specific wavelength (100 nm – 1 mm). Some of the beams produced fall within the visible spectrum (\approx 400 nm – 700 nm).
- 3.2 In general a laser consists of a laser cavity, an active medium (within the cavity), an energy source and a pair of mirrors to reflect the optical radiation produced (one is partially mirrored to allow optical radiation to exit as a beam). The active medium may be a gas (e.g. CO₂), a crystal (e.g. synthetic Ruby), a semiconductor (e.g. Gallium Arsenide), an organic dye in solution (e.g. Malachite Green) or a type of glass (silicate or phosphate) and determines the wavelength of the beam produced.

Fig. 1 Diagram of a basic laser



3.3 The energy source is used to excite the active medium which then emits optical radiation. This is reflected back into the active medium which encourages more emissions. When sufficient emissions are produced they pass through the partially transmitting mirror as a coherent, collimated beam.

3.4 Laser products are classified by the hazard their beam creates and is generally related to the power of the laser and accessibility of the beam in normal operation. The seven classes from low to high hazard are:

- 1, 1M, 2, 2M, 3R, 3B and 4.
- Classes 1 - 2M are unlikely to damage the eye in normal operation unless viewed directly using an optical aid (e.g. eye glasses), or the beam of a class 2 or 2M laser is viewed for long periods.
- Class 3R may damage the eye when viewed directly.
- Class 3B will cause damage to the eye (possibly permanent) when viewed directly or by reflection.
- Class 4 will cause permanent damage to the eye when viewed directly or by reflection and will also damage the skin. May also present a fire hazard.

Note: A device with a low classification may contain a higher class laser but be deemed safe due to engineering design (e.g. laser printer).

LASER pointers

3.5 The Health Protection Agency (HPA), Radiation Protection Division has examined many laser pointers on sale to the public. Green laser pointers have given a particular cause for concern. Many of the tested lasers were found to be either incorrectly labelled with their class or not labelled at all. A significant proportion were found to be class 3R and several 3B.

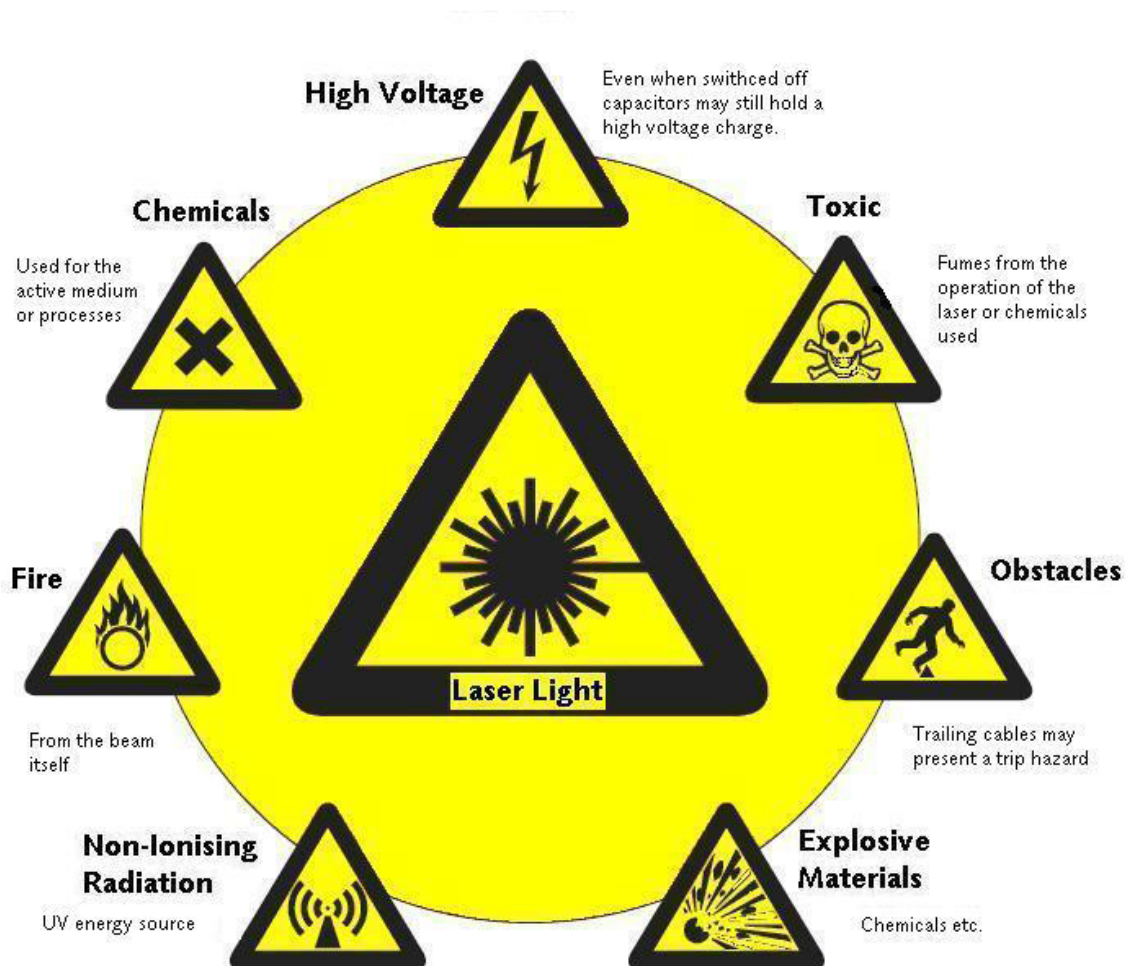
3.6 The HPA consider the professional use of class 1 or 2 pointers as a training aid in the workplace to be justified, class 3R may be justified for some applications in the workplace where the user has received adequate training.

3.7 Laser pointers have been directed into the eyes of firefighting crews whilst on the way to an incident and whilst in attendance. Crews are advised to look away from any laser pointers and request the attendance of the police. A laser pointer directed into an eye can cause lasting damage and should be reported to the police and also recorded as a near miss, or as a safety event if an injury has been caused or treatment is required.

4 General information

- 4.1 Danger to the eye or skin from the laser beam (directly/reflected/refracted) must never be underestimated (some lasers are capable of cutting steel and may be outside the visible spectrum). However, there are a number of hazards associated with a high power laser installation that must also be considered:

Figure 2: Possible hazards associated with a laser installation



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- 4.2 In some installations there may also be an additional hazard from cryogenics (liquid Nitrogen at -196°C and liquid Helium at -269°C) which are used to cool the active medium.

5 Operational procedure

- 5.1 Incidents at facilities that do not involve the laser installation should be dealt with using the appropriate operational procedures. However, ICs must ensure that personnel do not enter the area/room containing the laser and associated equipment.
- 5.2 At incidents in facilities where the laser and/or associated equipment is involved or likely to become involved, the following additional procedures must be adopted:

- Ensure close liaison with the site 'responsible person' and/or the laser operator/technician is maintained during the incident (e.g. ask for laser to be turned off, ascertain if installation uses cryogen).
- Locate and identify the emergency controls and if practicable position a safety officer to control access to the area/room where the laser installation is contained.
- Brief crews to heed warning signs/lights and not to move hastily into screened areas/rooms that may contain the laser installation (knock and wait for reply if appropriate).
- Early use of breathing apparatus (BA) may be advised (fumes etc).
- Brief crews that installation does/does not/may contain cryogen which could cause burns and may displace the air leading to oxygen deficiency.
- If deemed necessary to immediately enter the area/room containing the laser installation the emergency isolation switch must be operated and crews must proceed with caution, directing their vision towards the floor to avoid viewing the laser beam (some laser installations use capacitors that hold a high voltage charge which allows the laser to operate for a short period after the main power is switched off).

Note: Permanent damage to the eye will result if the laser beam enters the eye directly or by reflection/refraction (class 4 lasers).

6 Associated policies

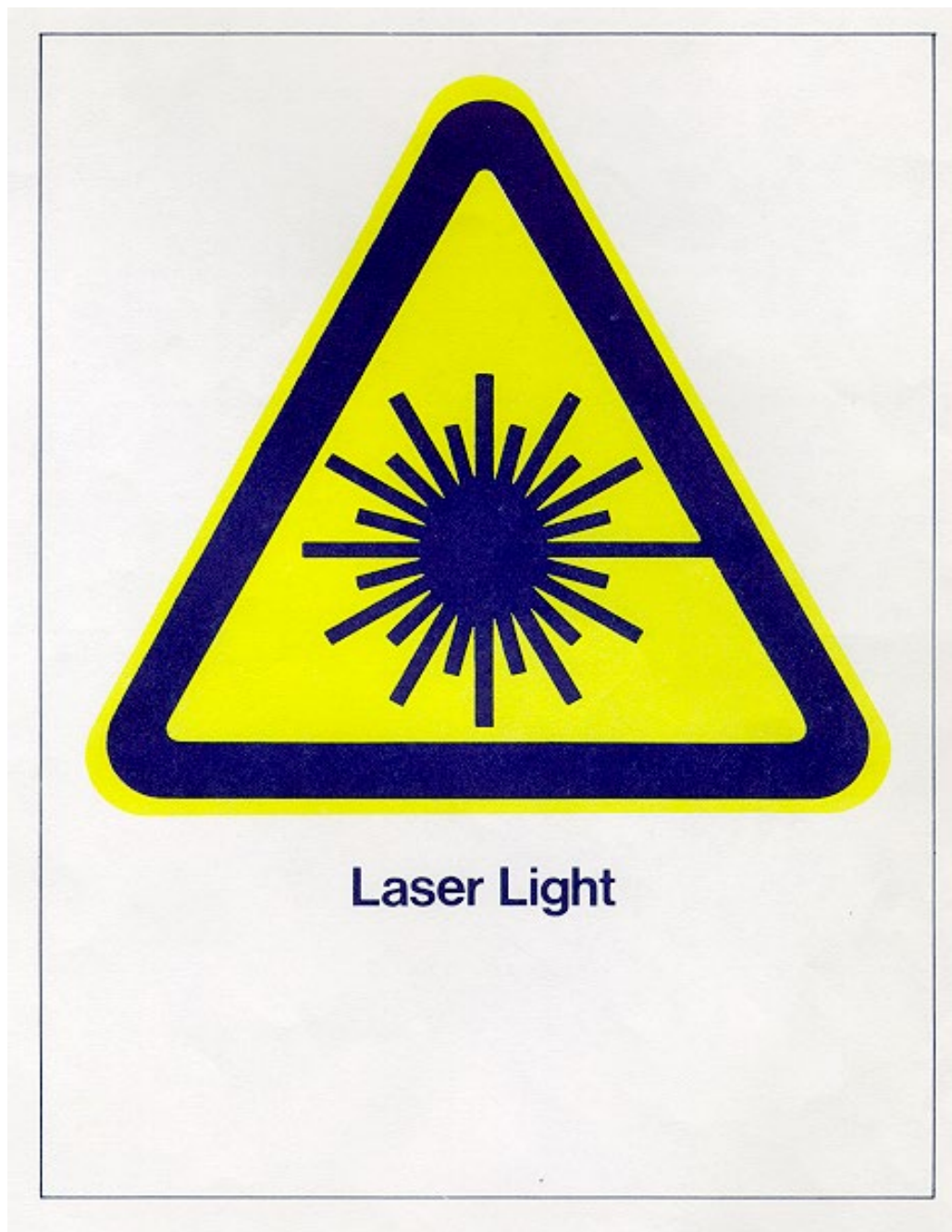
Cancelled policy

- 6.1 Policy number 35 - Lasers and their hazards dated July 1980 is cancelled and replaced by this policy.

Related policy





- 6.2 This policy should be read in conjunction with [Policy number 796](#) – Fires and incidents involving hazardous materials.

Appendix 1 - Warning label - hazard symbol





LFB image ID: 377302

- Triangle 200mm x 200mm.
- Sign 305mm x 254mm.
- Other sizes also manufactured.

Class 1		CLASS 1 LASER PRODUCT
Class 2		LASER RADIATION DO NOT STARE INTO BEAM CLASS 2 LASER PRODUCT
Class 2M		LASER RADIATION DO NOT STARE INTO BEAM OR VIEW DIRECTLY WITH OPTICAL INSTRUMENTS CLASS 2M LASER PRODUCT
Class 3B		LASER RADIATION AVOID EXPOSURE TO BEAM CLASS 3B LASER PRODUCT
Class 4		LASER RADIATION AVOID EYE OR SKIN EXPOSURE TO DIRECT OR SCATTERED RADIATION CLASS 4 LASER PRODUCT

Typical warnings associated with laser classes, NB class 3R is the same as class 3B.

DESIGNATED AREA

CLASS 4 LASER HAZARD


NO UNAUTHORISED ENTRY

The Laser Safety Officer is:

The emergency contacts are:

1) _____

2) _____



PERMIT-TO-WORK REQUIRED

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Appendix 2 – Key point summary – Lasers and their associated hazards

Information on task or event

- On site contingency plans.
- Local knowledge of LASER installations (7,2(d)s).
- Class of LASER involved.
- Cryogenic materials used/involved.
- Power supply.
- What is the LASER used for?
- Persons involved.

Information about Resources

- Attend main entrance or pre-determined RVP and liaise with responsible person.
- HMEPO.
- SA.

Information about Risk and Benefit

- Risk assess benefit of rescue.
- Electric shock - from direct contact, standing in water, jets directed onto live equipment and conduction.
- Residual charges - may be present.
- Cryogenic material – cold burns.

Gathering and thinking

Objectives

- Save life.
- Isolate LASER.
- Protect property - If firefighting can not commence due to live power supplies, protect the surrounding risk, where safe to do so, with appropriate firefighting media.

Communicating

- Brief crews of hazards associated with LASERs, cryogenics, high voltages, oxygen deficient atmospheres.
- Brief crews to heed warning signs/lights.
- Obtain specialist advice from on site responsible person, HMEPO or SA.

Controlling

- Personnel should not enter the area/room containing the laser and associated equipment if it is not directly involved in the incident or absolutely necessary to do so.
- Personnel are to enter any room directing their vision away from any beam towards the floor.
- Appoint safety officer to control access to the area.

Plan

- Incidents at facilities that do not involve the laser installation should be dealt with using the appropriate operational procedures.
- When possible shut down the LASER before entering the room.
- Ensure close liaison with the site 'responsible person' and/or the laser operator/technician is maintained during the incident.
- Locate and identify the emergency controls.
- Crews not to move hastily into screened areas/rooms that may contain the laser installation.
- Early use of breathing apparatus (BA) may be advised (fumes etc).
- If deemed necessary to immediately enter the area/room containing the laser installation the emergency isolation switch must be operated and crews must proceed with caution.
- Secure a water supply if a fire is likely to be tackled by the use of water or foam and assess whether any additional resources are required, such as firefighting foam.

Document history

Assessments

An equality, sustainability or health, safety and welfare impact assessment and/or a risk assessment was last completed on:

EIA	26/09/20	SDIA	27/08/20	HSWIA	09/09/20	RA	27/09/20
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Audit trail

Listed below is a brief audit trail, detailing amendments made to this policy/procedure.

Page/para nos.	Brief description of change	Date
Page 4 para 2.5 Page 8 Page 5, 7, 9 Throughout	"or the beam of a class 2 or 2M laser is viewed for prolonged periods" added. Section on LASER pointers added Explanatory text added to bottom of table Pictures given LFB image library id numbers Policy number 527 reference amended to PN796 Re-formatted.	07/12/2012
Page 9	'Subjects list' table - template updated.	13/01/2015
Throughout	Minor amendments made to content, paragraphs 3.5 and 3.6 and appendix 2 – new style key point summary added.	27/11/2015
Throughout Page 9	This policy has been reviewed as current with changes made to department and team names to reflect the abolition of the London Fire and Emergency Planning Authority; now replaced with the London Fire Commissioner. Assessments dates updated.	06/11/2018
Page 2, Para 2.2	Updated from WM to StnO/SubO in line with Role to Rank changes.	29/11/2019
Page 3, Para 3.7	Reviewed as current, new paragraph 3.7, action to take by firefighters in the event of a laser pointer directed towards the eye and impact assessment dates updated.	30/09/2021
Throughout	Reviewed as current, no changes made.	12/10/2023

Subject list

You can find this policy under the following subjects.

Fire hazards	Operational procedures
Incident Management	Incident Type
Mobile Data Terminals (MDT)	Lasers
Hazards	Hazardous Materials Incidents
Generic Hazards	Firefighting -Special ground procedures

Freedom of Information Act exemptions

This policy/procedure has been securely marked due to:

Considered by: (responsible work team)	FOIA exemption	Security marking classification