

## Appendix 9. Laser control measures: designated laser areas

### A9.1 Containment of the laser hazard

- A9.1.1 The designated laser area (DLA) must present a robust physical boundary capable of adequately containing the laser radiation generated within it, thereby protecting those outside the boundary from hazardous exposure to laser radiation.
- A9.1.2 Any parts of the DLA boundary through which it is reasonably foreseeable that class 3B or class 4 laser radiation could pass (e.g. gaps in doors, windows), and which could then reasonably present a laser hazard to a person outside the DLA must be covered during laser use.
- A9.1.3 Illuminated warning signs must be displayed at every point of entry to the DLA.
- A9.1.4 The warning signs should take the form of clearly visible lights or a monitor screen giving the status of the laser(s) inside. STFC currently operates two versions of warning signs; one of these formats must be adopted.
- a. If coloured lights are used, then they can either conform to a 'traffic light system' of red/amber/green e.g.
    - (i) A red colour; implying 'restricted access: laser ON' i.e. that a high hazard laser within the DLA is energised and the beam has been released;
    - (ii) An Amber colour; implying 'restricted access: laser ON' but that the high hazard laser within the DLA exists only within a small, specific zone within the DLA (such as the focal point of a beamline).
    - (iii) A green colour; implying 'SAFE to enter'. This is the default colour to show that the monitor and/or lights are active and that no laser protective eyewear is required.
  - b. Alternatively, a red colour lamp stating 'Laser On' implying that a high hazard laser within the DLA is energised and the beam has, or has the potential to be, released. If the lamp is not lit, it implies that it is 'SAFE to enter'.
- A9.1.5 If practicable the laser laboratory should have a high level of illumination.
- A9.1.6 Windows should be kept to a minimum and may need to be covered or protected. Preferably, the covering should be a rigid fixed panel.
- A9.1.7 Walls, ceilings and fittings should be painted with a light coloured matt paint to enhance illumination and minimise specular reflections. Reflecting surfaces such as the use of glass-fronted cupboards should be avoided.

## A9.2 Access

- A9.2.1 Lasers inside a designated laser area (DLA) must be linked into the external interlock chain provided within the DLA, either using the remote interlock connector on the laser or an external safety shutter (see A7.4 Control of Access).
- A9.2.2 Where lasers within a designated laser area (DLA) are operated with all high hazard beams fully enclosed at all times, including during service (or servicing takes place off-site), there is no requirement for a room interlock system to be provided or for the laser to be connected to one where it is provided.
- A9.2.3 Where lasers within a designated laser area are predominantly operated with all high hazard beams fully enclosed, but occasionally operated with the enclosure open or removed for the purposes of alignment or adjustment, then the room interlock system may be adapted to provide an override facility. This should operate such that the room interlock system can be overridden when the high hazard beams are enclosed and enabled when the enclosure is open or removed. The override should be key (rather than code) operated where possible and its status should be clearly indicated.
- A9.2.4 Where the use of overrides is absolutely essential on technical grounds there must be a detailed written justification that demonstrates why the override is required. In general, if access into and out of an area is necessary when enclosures may be removed or open, then the room interlock system can be used to control beam hazards through the use of one or more shutters.
- A9.2.5 If their use is justified, interlock overrides at access doors are only permitted under the following circumstances:
- Overrides that can be operated only from within the DLA must be located near the door. Controls must be installed to prevent the escape of hazardous levels of laser radiation when the door is opened.
  - Overrides that can be operated from outside the DLA must be of a coded or key operated type with access restricted to authorised personnel. Secondary screening (e.g. labyrinth) within the DLA must ensure that the laser hazard zone does not extend outside the door when it is opened. Exceptionally, where space does not permit a labyrinth entrance, then during activities (e.g. beam alignment) when a beam could emerge through the open door:
    - (i) a warning light should be placed adjacent to the door to indicate the laser hazard status;
    - (ii) a prominent temporary warning sign should be placed near or on the outside of the door during alignment;
    - (iii) the door should be locked but with a key for emergency access (e.g. a knob to lock the door on the inside and a key behind a break glass cover on the outside).
- A9.2.6 Access doors, both those at the DLA boundary and any within the DLA that divide laser hazard areas from one another or that separate laser hazard from hazard-free areas, should be self-closing.

## A9.3 Layout

- A9.3.1 The layout of the facility should take account of the need to undertake alignment and other adjustment work.
- A9.3.2 High hazard laser beams that are likely to be exposed during alignment or adjustment should point away from and not towards the DLA entrance.

A9.3.3 If more than one high hazard laser is operated within the same DLA, consideration will need to be given to how alignment or other open beam work can temporarily be carried out on one system without putting the operators of other systems at risk. The risk assessment for the open beam work must consider the risks to others who may be in the DLA and should lead to the selection of effective control measures. Options that should be considered include:

- whether it is reasonably practicable to carry out open beam work with non-hazardous or low hazard beams
- where it is essential to carry out open beam work with high hazard beams, there is a legal requirement to demarcate the area, restrict access and display warning signs
- where it is essential to carry out open beam work with high hazard beams, it may be feasible to temporarily prevent access to the entire DLA by those not involved in the work with the open beams. It would not be acceptable to require all working in the area to wear laser protective eyewear
- where it is essential to carry out open beam work with high hazard beams, the use of curtains or temporary screens together with appropriate warning signals may be used to temporarily restrict access to the immediate vicinity of the installation with open beams
- the positioning of curtains and screens must be arranged so that it is not necessary for those not involved in the open beam work to move through an area in order to gain access to their own work area. It should be possible to independently access each potential hazard area from a 'safe area'
- curtains/screens and warning signs together with local supervision should normally be sufficient to restrict access to the hazardous area, but consideration could be given to supplementing these measures with pressure pads or light beams to detect intrusion into the area and terminate the laser beam
- the standing orders must include specific requirements for the open beam work including any arrangements for restriction of access and any procedures to be followed for work within the hazardous area, including the specification for any laser protective eyewear that is required.
- See also appendix 11 for information on additional marking of laser safety eyewear to avoid wrong selection.
- If there is likely to be a requirement for entry or exit from the hazard area during open beam work the arrangements for this must also be detailed in the standing orders

A9.3.4 SHE Group must be consulted about the provision of suitable fire fighting equipment and adequate means of escape from the DLA.

A9.3.5 Any areas within the DLA in which non-laser (or low hazard / low risk laser) activities take place, such as computer work, clean rooms or sample preparation rooms, must be partitioned off from those where high hazard open beams may be in use. It should not be necessary to pass through the hazard area in order to enter or exit these areas. The use of chairs in a DLA, if essential, must be restricted to screened off areas where there are no hazardous beams.

- A9.3.6 As stated in A9.3.5, there should normally be a safe route to and from any work area where there is no laser hazard. Exceptionally there may be one or more small rooms or areas off a DLA with no other access route. In these cases, the additional rooms must form part of the DLA and should be subject to the same restrictions when a high hazard laser beam is exposed. However, additional controls are required to ensure that nobody working in such an area is inadvertently overlooked prior to generating a hazardous exposed beam:
- i. warning signals must be installed in each area to give warning when a hazardous situation is about to be created (this should include an audible warning) and a distinguishable warning when the hazardous situation exists
  - ii. a means of terminating hazardous emission must be provided in each area
  - iii. the standing orders must require a search to be made of all areas prior to releasing a hazardous beam

A9.3.7 If, in addition to emergency stop buttons, emergency laser-off buttons are provided in the DLA, they must be colour coded with a clearly visible black on yellow laser hazard triangle on a red background. Operation of an emergency laser-off button must immediately terminate accessible laser radiation from high hazard lasers in the DLA. This could be achieved, for example, by breaking the laser external interlock circuit or closure of laser safety shutters positioned in the proximity of the laser apertures, as described in A7.5.2.25.

#### **A9.4 Administrative controls**

A9.4.1 Standing orders must be readily available within the DLA.

A9.4.2 Visitors

- Visitors may enter a DLA provided there are no open hazardous beams. This could be either because:
  - all beams are fully enclosed
  - beams have been attenuated to non-hazardous levels
  - there are no beams present
- If there are genuine reasons for a visitor to enter a DLA whilst hazardous open beams are present (for example as part of training in a particular procedure), they should be subject to the same controls as anyone routinely working in the area.
- A maximum numbers of visitors should be established and consideration given to the need for additional persons to be present to help supervise the visitors.