Section 12

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**CONTROL MEASURES FOR BEAM HAZARDS**

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ANSI Z136.1-2007 requires control measures be devised to reduce the possibility of exposure of the eyes and the skin to hazardous levels of laser radiation and to other hazards associated with the operation of laser devices during operation and maintenance.

The types of control measures are engineering, administrative, and procedural controls. Engineering controls are safety features that are incorporated into the laser equipment. Administrative controls are policies that control and restrict access to laser radiation and include training requirements, audits, and authorized/approved users. Procedural controls assure safe operation of hazardous laser radiation and include SOP’s for alignment, operation, and emergency as well as protocols for use of protective eyewear.

Control measures for beam hazards include the following:

* Laser Controlled Area.
* Eye protection.
* Barriers, shrouds, beam stops, etc.
* Administrative and procedural controls.
* Education and training.

The hierarchy of controls listed in the order of effectiveness are:

**Substitute** a low power laser for a high power one, if feasible. The minimum laser radiation for the application should be used. The higher the power, the more controls are needed.

**Engineering controls** such as enclosures, interlocks, and beam stops, are very effective at eliminating hazards (if not defeated). Most engineering controls are in place.

**Personal protection,** especially eyewear, is effective when it is (1) the correct eyewear and (2) worn at the appropriate times.

**Administrative controls,** such as warning signs, training, and SOPs are reminders to laser operators and are unfortunately not as effective as engineering controls since they are often ignored or forgotten.

The LSO shall have the authority to monitor and enforce the control of laser hazards and conduct surveillance of the appropriate control measures.

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**Laser Controls**

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| Class 3B and Class 4 Requirements | Comments |
| Appropriate laser warning labels shall be affixed in a conspicuous place on the housing. | Labels are usually affixed by the manufacturer. |
| A master switch, operated by a key or a coded access, shall be provided. | Only authorized persons should have access to the key or code. |
| A protective housing shall be provided.  | This applies to the housing of the laser, not the beam. |
| Interlocks on removable parts of housings shall be provided (or require a tool to remove). If the beam is totally enclosed, the enclosure shall be interlocked. | Interlocks need to be tested and results documented on a 6-month basis.  |
| When the entire beam is not fully enclosed, the Nominal Hazard Zone shall be established by the LSO. | If the beam is totally enclosed, then determination of the NHZ is not required.  |
| The LSO shall require approved written standard operating, and maintenance procedures.  | No laser operators on campus are authorized to do service on lasers. |
| Alignment shall be performed to ensure that the eye is not exposed to laser radiation which exceeds the MPE. | * Orient the beam so that it is not directed toward any door.
* Orient the beam so that it is not directed upward during alignment or operation.
* Locate the beam path so that it is not at eye level for person standing or sitting.
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| Training shall be provided for operators, maintenance, and service personnel. | No laser operators on campus are authorized to perform service on lasers. |

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**CONTROL MEASURES FOR BEAM HAZARDS**

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**Control Measures for Laser Controlled Areas**

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| Class 3B and Class 4 Requirements | Comments |
| Restricted to properly trained individuals, provided with appropriate protective equipment, and following all applicable controls | Only Authorized Laser Users shall operate the lasers. |
| Designed to allow rapid ingress/egress during emergencies. | The area should be free of clutter in case of fire or other emergencies. |
| Designed with one of the following:* Non-defeatable area/entryway safety controls
* Defeatable area/entryway safety controls
* Procedural area/entryway safety controls
 | Interlocks on entry ways are one way of meeting this requirement for open-beam systems. Some prefer to add a warning light which informs persons entering of the status of laser use. |
| Equipped with a “panic button” which deactivates the laser. | Should be easily accessible |
| Posted with appropriate warning signs at the entryway. |  |
| Operated by trained and authorized persons. Unattended use shall not be permitted. |  |
| Under the direct supervision of an individual knowledgeable in laser safety. | This is the Approved laser user’s responsibility. |
| Located such that access by spectators is limited. | Spectators include non-authorized/untrained people. |
| Provided with a permanently attached beam stop or attenuator. | Beam stop should be made of non-reflective material. |
| Have appropriate eye protection for all individuals within the area. |  |
| Have the laser positioned such that the beam is not at eye level with a person seated or standing. | The laser should be secured so that it does not move if bumped. |
| Have all windows and doorways covered or restricted so that laser radiation above the MPE cannot exit the area. | Materials used as a barrier for Class 3B and Class 4 lasers must be fires retardant. |
| Require storage or disabling of the laser when not in use. | Removal of the key is easiest way to do this. |

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**CONTROL MEASURES FOR BEAM HAZARDS**

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**Viewing Windows, Display Screens, and Collecting Optics**

In order to adequately address additional protection requirement, it is sometimes necessary to utilize protective devices such as viewing windows, display screens, and laser barriers.

All viewing windows and diffuse (reflective or transmitted) display screens as an integral part of a laser or laser system shall incorporate a suitable means (such as interlocks and attenuators) to maintain the laser radiation at the viewing point at or below the applicable MPE.

All collecting optics (such as lenses, telescopes, and microscopes) that integrate the use of a laser or laser system shall incorporate suitable means (such as interlocks and filters) to maintain the laser radiation transmitted through the collecting optics to levels at or below the applicable MPE.