University of Massachusetts Lowell
Learning with Purpose

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Laser Lab Facility Policy

Laser facilities at UMass Lowell must be registered per Massachusetts Department of Public Health regulations as well as the UML Radiation Safety Office. A full hazard analysis will be performed before the laser is deemed operable.

Radiation Safety must be involved with the process of lab design as well as meeting with the Principal Investigator before the lab can be commissioned.

GUIDANCE FOR FACILITIES DESIGN AND BUILD

Class 3b and 4 Laser Facility Requirements - open beam laser systems

Open beam refers to laser systems that are not enclosed within a protective housing that is interlocked for laser safety purposes.

Class 3b and 4 Laser Facility Design **Requirements**:

- The room must be light tight. If the room has windows or doors with windows they must be fully blocked with permanently attached light tight laser curtains or otherwise permanently blocked. Doors must also be light tight, i.e. a strip at the bottom of the door similar to weather stripping.

- Facility at a minimum must have access control, such as a locked door with limited key access, card access, or combination lock.

- A lighted laser sign outside each entryway to the laser controlled area is required. The lighted sign should be interlocked to the laser system. The lighted sign needs to be eye height at the outside door. For information on lit laser signs contact UML Radiation Safety.

- An area for signage needs to be provided on all entrance ways into the lab.

- A mechanism for eyewear storage needs to be provided at all entries to the lab.

- Lab must have adequate power supplies available to avoid extension cord use and/or daisy chaining with multiple power strips.

- There must be an inner barrier to the laser light such as a laser curtain around the laser table or a blocking barrier, screen, curtains, etc. at the entryway. Curtains must be appropriate to the laser system. A non-defeatable interlock or defeatable interlock may be used in place of the inner barriers. See details regarding entryway safety controls.

- Emergency power shutdown. A red mushroom type button must be easily accessible in an emergency.

If lab is using toxic gasses, chemicals, or lasers are used for cutting or burning :

- Ventilation must be supplied (such as toxic gas cabinets or snorkels). If hazardous chemicals will be used a chemical fume hood must be available. Consult UML EHS for appropriate equipment.

Class 3b and 4 Laser Facility Design **Recommendations**:

- Walls should be painted a non-reflective color such as a matte black. There should be no reflective materials in the lab such as corner protectors on walls.
- Curtains need to be hung without blocking emergency sprinklers. UML Safety Office can provide guidance.
- Emergency lighting should be evaluated with guidance from the UML Safety Office.
- Deviations can be made with prior approval from the Radiation Safety Office.

Next Pages:
Guidance for Lab Owner (PI)

The following is for Principle Investigator (PI)

Entryway Safety Controls (ANSI Z136.1) one of the three below must be used.

Non-Defeatable (non-override) Area or Entryway Safety Controls

Safety latches, entryway or area interlocks (e.g., electrical switches, pressure sensitive floor mats, infrared detectors) shall be used to deactivate the laser or reduce the output to levels below the MPE in the event of an unexpected entry.

Defeatable Area or Entryway Safety Controls

Defeatable safety latches, entryway or area interlocks shall be used if non-defeatable controls limit the intended use of the laser. These safety controls may be overridden to allow access if it is clearly evident that there is no laser hazard at the point of entry. The authorized personnel requiring entry must be adequately trained and provided with adequate personal protective equipment.

Procedural Area or Entryway Safety Controls

Where safety latches or interlocks are not feasible or are inappropriate, the following shall apply:

a. All authorized personnel shall be adequately trained and adequate personal protective equipment shall be provided upon entry.

b. A door, blocking barrier, screen, curtains, etc. shall be used to block or attenuate the laser radiation at the entryway. The level of laser radiation at the exterior of these shall not exceed the MPE.

c. At the entryway there shall be a visible or audible signal indicating that the laser is operating at class 4 levels.

Area Requirements

Class 3b and 4 Laser Controlled Area Requirements for **Open** Beams:

- Appropriate protective eyewear shall be available to anyone upon entering the laser controlled area. Laser protective eyewear must be worn whenever a hazardous condition could exist.
- There shall be written standard operating procedures (SOPs) for all class 4 laser systems. Class 3b laser systems should also have written SOPs.
- All entrances to the laser controlled area are posted with the appropriate warning sign and area warning device (“Laser in Use” sign or equivalent.
- Path of the laser light is well defined and controlled.
- Hazardous beams are terminated using a beam stops made of non-flammable material. All light levels in excess of the MPE must be confined to the laser table.
- Use only diffusely reflecting materials in or near the beam path.
- Secure the laser beam path above or below eye level.

Class 3b and 4 Laser Facility Requirements - **fully enclosed** laser systems

A fully enclosed laser system is a laser which is contained within a protective housing. The protective housing must be in place in order to work under these less restrictive laser facility requirements. When the protective housing is removed a temporary laser controlled area must be established (see below).

For a laser system to be considered fully enclosed and exempted from the class 3b and 4 open beam facility requirements it must meet the three following criteria.

1. The enclosed laser system must not emit light which is in excess of the MPE.
2. The enclosure must be secured from unauthorized or unintentional removal.
3. The laser system must be reclassified by the Radiation Safety Office and labeled with the laser safety classification.

Facility Design Requirements (Fully enclosed lasers):

- Access control, such as a locked door with limited key access, card access, or combination lock.
- Accommodations for a temporary laser controlled area.

Laser controlled area requirements under normal operating conditions

- The system must not be operated without the protective housing unless a temporary laser controlled area has been established.

Laser controlled area requirements when enclosure has been removed

This might be done during service, repair or alignment.

- A temporary laser controlled are must be established.

Engineering Controls

Protective housing – this fully encloses the laser light so that the use cannot be exposed above the MPE. If the laser is not to fully enclosed the laser safety officer must do a full laser hazard evaluation. A class 1 laser system has protective housing and the housing is interlocked so when open the laser cannot be energized.

Alternate to Protective housing – A laser may be operated without protective housing provided the following conditions have been met:

- A laser controlled area has been established (see requirements of a laser controlled area below)
- Appropriate laser protection eyewear is available.
- Barriers, shrouds, curtains, and beam stops should be used with class 3b and must be used with class 4 lasers to prevent light from escaping from the laser table.

- Permanently attached beam stops or attenuators must be used with class 3b and class 4 lasers when the beam is not in use, such as when the laser is warming up.

- Administrative and Procedural controls are followed (i.e. there must be written operational procedures kept in an area where laser operator have access).

- All individuals who operate the system are trained in laser safety.

Laser Controlled Area – The Laser Safety Officer must do a hazard analysis and nominal hazard zone (NHZ) determination of all class 3b and 4 laser controlled areas.

Class 3b and 4 laser controlled area requirements (indoors only):

- Only a person who has been trained in the operation of the laser system and laser safety may operate the laser.
- Posted with appropriate warning signs
- Operated such that the beam path is well defined.
- Be under the direct supervision of someone knowledgeable in laser safety.
- Located in an area so access is limited and requires approval.
- All potentially hazardous beams are terminated with an appropriate material.
- Use only diffusely reflecting materials in or near the beam path (where feasible).
- Provide those in the laser controlled area with the appropriate protective eyewear.
- Have the laser secured such that the exposed beam path is above or below eye level while seated or standing.
- Have all windows, doors, open portals, etc. be either covered or restricted in such a way as to reduce the transmitted light below the MPE.
- Store in a manner as to prevent unauthorized use.

Additional requirements for a class 4 laser controlled area

Any person who is not trained in laser safety must first be approved by the Lab supervisor, be informed of the degree of hazard and avoidance procedures, and all protective measures have been taken to provide a safe environment, before entering the class 4 laser controlled area.

Entryway controls must include one of the following:

- Non-defeatable entryway safety control (i.e. door interlock) to reduce the laser light below the MPE.

- Defeatable entryway safety control to reduce the laser light below the MPE. Allowed provided those entering have been trained and have protective eyewear.

- Procedural entryway controls are allowed if those entering have been trained, have protective eyewear, an inner barrier to the laser light, and a lighted laser warning sign outside the entryway.