

Chapter 10: [Laser Safety](#)

## Laser Controlled Area Requirements

Product ID: 551 | Revision ID: 2217 | Date published: 16 November 2020 | Date effective: 16 November 2020

URL: <https://www-group.slac.stanford.edu/esh/eshmanual/references/laserReqControlledArea.pdf>

### 1 Purpose

The purpose of these requirements is to prevent untrained and unprotected personnel from entering areas where Class 3B and Class 4 laser radiation is present and to ensure that *qualified laser operators (QLOs)* can enter and exit areas safely, by warning them of the laser hazards present inside the area prior to entry and what the current operation mode and entry requirements are. They cover setting up *laser controlled areas (LCAs)*, which is a designation required when the maximum level of accessible laser radiation is Class 3B or Class 4. They apply to the *laser safety officer (LSO)*, *system laser safety officer (SLSO)*, and *laser facility program managers*.

For information on operating requirements for Class 3B and Class 4 lasers, see [Laser Safety: Class 3B and Class 4 Laser Operation Requirements](#).

### 2 Requirements

Class 3B and Class 4 laser operation may only take place inside an LCA. The LCA description will be given in the associated *lab-specific standard operating procedure (SOP)* or *job safety analysis (JSA)*.

An LCA must

- Allow both emergency entry and rapid exit. The emergency entry procedure, including a description of how the laser hazard is disabled, must be posted at the LCA entry. An emergency entry must automatically disable laser hazards via interlocks unless additional controls are in place, such as no unattended operation.
- Have a master controller located inside the LCA that permits laser light in the LCA above the *maximum permissible exposure (MPE)* level only when it is enabled and its input interlocks are satisfied. (Note for simple installations, the master controller and associated master key may be the laser power supply [one or more] and associated key[s].)
- Have a *master key* that enables the master controller operation. Removal of the master key will disable all Class 3B and Class 4 laser beams in the LCA and can be used for configuration control as part of an *administrative lockout procedure*. Access to the master key is restricted to QLOs. (See [Laser Safety: Class 3B and Class 4 Laser CoHE Requirements](#).)
- Have an illuminated warning sign, interfaced to the LCA master controller or engineered *laser safety system (LSS)*, to indicate when hazardous laser beams above the MPE may be present in the LCA. This LCA warning device must be installed at the LCA entry so it is visible prior to entry. It must also be installed inside the LCA, where it should be easily viewable to persons within.

- Have a minimum of one interlocked and one locked door to gain entry. An unauthorized access must trip the door interlock, which then disables the laser hazards. Access entry to the LCA through the locked door is restricted by key or coded access to QLOs. In some situations, though, the LCA entry may be unlocked if there is a guard posted at the entry. The means for restricted access must be specified in the lab-specific SOP or JSA.
- Be effectively light tight. If it is not light tight, an appropriate hazard analysis will be conducted by the LSO. Windows, doorways, and open portals will need curtains or covers to reduce laser radiation outside the LCA to levels below the MPE.
- Have an entryway with one of the following to ensure no laser hazard exists at the entryway during entry or exit:
  - A non-defeatable entry interlock that disables laser hazards in the LCA to be below the MPE during entry
  - A defeatable entry interlock that temporarily allows entry or exit without disabling laser hazards in the LCA, if barriers are in place to prevent a laser radiation hazard at the entry
  - Alternative controls such as a posted guard, if approved by the LSO, if interlocks are not feasible or inappropriate. Entryway must be configured such that no laser hazard exists at the entry point during an entry or exit (for example, with the use of overlapping laser curtains).
- For LCAs where there is a work area (for example, computer work station or optics preparation area) outside the *nominal hazard zone (NHZ)* an additional barrier must be implemented at the NHZ entryway to remind entering personnel to don laser eyewear protection during Class 3B or Class 4 laser operation. Engineered barriers are to be given priority over administrative barriers such as a sign. (An interlocked proximity sensor with an audible/visual alarm is one way to implement this NHZ entryway control.)
- Have a clearly marked and easily accessible EMERGENCY OFF button within the LCA that will reduce accessible laser light levels below the MPE
- Have an audible alarm during laser startup or activation (such as when a *laser safety shutter* is about to be opened) to notify personnel within the LCA. An emission delay (typically 10 to 15 seconds, during which the audible alarm sounds) following a request to start up the laser (for example, a request to open a laser safety shutter) is required before the laser beam energization occurs. If the LCA does not have such an audible alarm, then the lab-specific SOP or JSA must specify how verbal notification will be used instead. (See [Laser Safety: Class 3B and Class 4 Laser CoHE Requirements](#).)
- Have all interlock faults be latching. Reactivating the laser will be done manually. It is recommended that reactivating the laser following an interlock fault require authorization (for example, by using a radio-frequency identification [RFID] key or coded access) from a QLO. (See [Laser Safety: Class 3B and Class 4 Laser CoHE Requirements](#).)
- Have the following signs posted at the entryway location (templates for these are available on the [Laser Safety Program Site](#)):
  - Laser hazard warning sign, which gives the laser classification, laser parameters, and *optical density (OD)* requirements for laser eyewear
  - Contact information for responsible line management personnel and for phone within the LCA
  - Emergency entry procedure
  - LCA visitor policy, if visitors are permitted when Class 3B or Class 4 lasers are enabled (see [Laser Safety: Laser Controlled Area Visitor Requirements](#))

- Have a Core Laser Safety Practices poster displayed (available on the [Laser Safety Program Site](#))
- Have the following signs/procedures (or equivalent) posted at the laser control panel location for changing operation modes (templates for these are available on the [Laser Safety Program Site](#)):
  - All laser labs that have both Class 1 and Class 4 operation modes must post the Setting Class 1 (Laser Enclosed) Operation Mode procedure
  - All laser labs that have a Class 4 operation mode must post the Setting or Changing Class 4 Operation Mode procedure
  - All LCLS hutches that have LCAs must post the Hutch Search Procedure to Set Class 4 Laser Operation

*Note* SLSOs may modify the template procedures, with the approval of the LSO. SLSOs must review these procedures as part of on-the-job training.

## 2.1 Recommendations

An LCA should

- Have a Class 1 operation mode, where beams are enabled but fully enclosed in an approved, engineered *Class 1 enclosure*. Laser eyewear protection would not be required in this mode. Unattended operation should not be permitted in this mode unless the associated removable panel covers are interlocked or secured by administrative configuration control locks.
- Use partitions or laser curtains to allow regions inside the LCA to be outside of NHZ. Outside the NHZ no accessible Class 3B or Class 4 laser beams are present and laser eyewear protection is not required. This can be useful to accommodate a computer workstation, an optics preparation area, and an entryway area where laser eyewear is stored and put on. (If such areas are set up, an additional barrier must be implemented at the NHZ entryway to remind entering personnel to don laser eyewear protection during Class 3B or Class 4 laser operation. See Section 2.)
- Have normal entry and exit not challenge interlocks. Where practical, *engineering controls* rather than *administrative controls* should be used for this.
- Have emergency lighting installed
- Have ambient lighting capable of providing at least 500 lux
- Have a phone inside the LCA

## 3 Forms

The following are signs to be posted at the LCA that are described in these requirements (templates for these are available on the [Laser Safety Program Site](#) [SharePoint]):

- Laser hazard warning sign
- Emergency entry procedure
- LCA visitor policy
- Core Laser Safety Practices poster

## 4 Recordkeeping

The following recordkeeping requirements apply for these requirements:

- None

## 5 References

[SLAC Environment, Safety, and Health Manual](#) (SLAC-I-720-0A29Z-001)

- [Chapter 10, “Laser Safety”](#)
  - [Laser Safety: Class 3B and Class 4 Laser Operation Requirements](#) (SLAC-I-730-0A05S-004)
  - [Laser Safety: Class 3B and Class 4 Laser CoHE Requirements](#) (SLAC-I-730-0A05S-005)
  - [Laser Safety: Laser Controlled Area Visitor Requirements](#) (SLAC-I-730-0A05S-011)
  - [Laser Safety Program Site](#) (SharePoint)