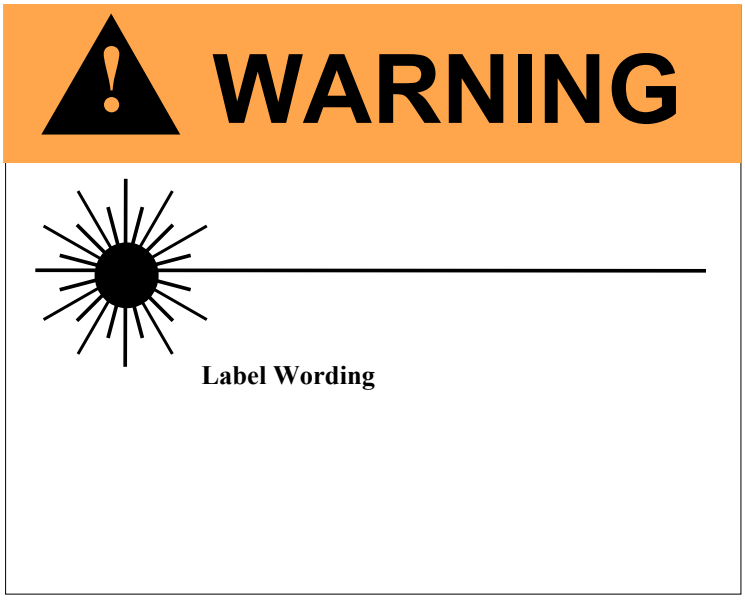

Figure 1g. Warning Awareness Label

Wording could indicate:

- Vertical Beams
- Polarizer Caution
- Barrier does not provide laser protection, cleanliness only
- Non-interlocked housing

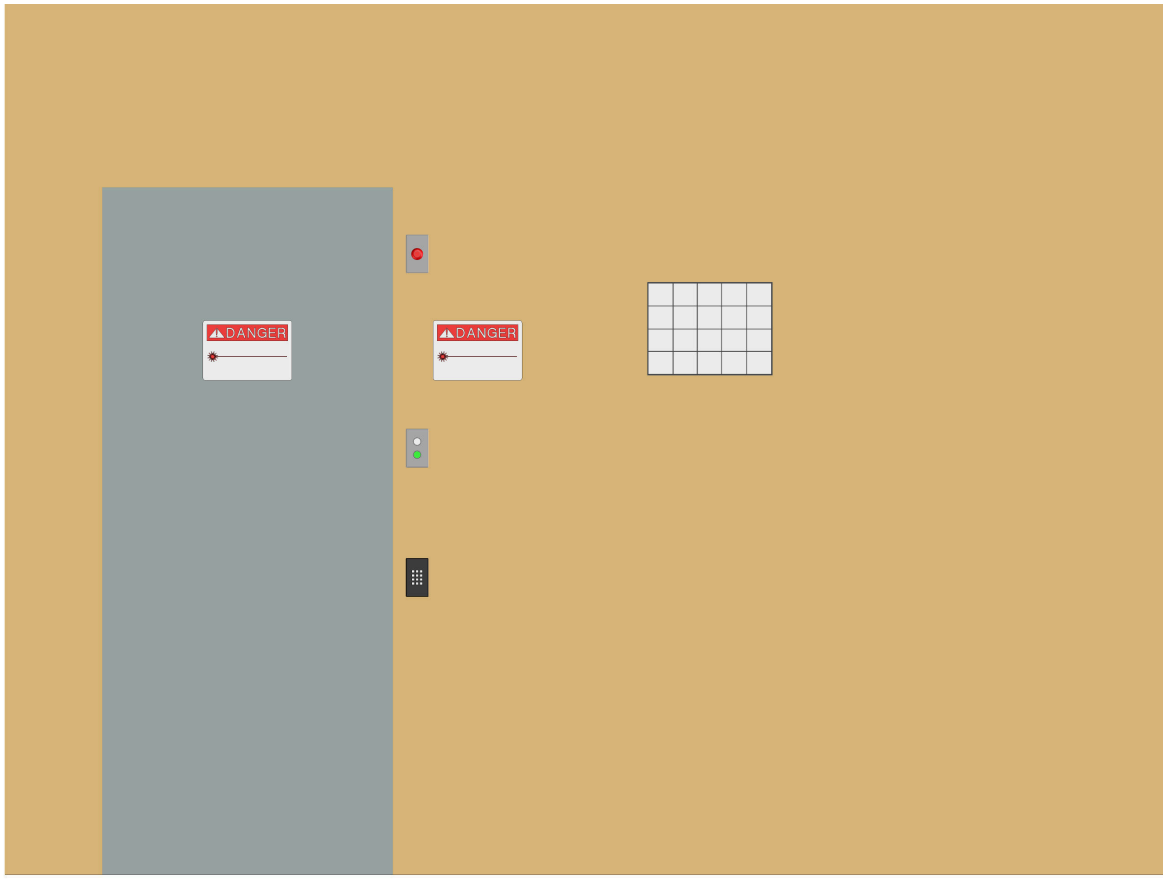

Figure 2a. Exterior of LCA Entryway Safety Controls for Class 4 Lasers Utilizing Entryway Interlocks

Elements of Figure 2a, LCA entrance

- Printed laser warning sign on door
- Illuminated laser area warning sign on side of door, near eye height, not over 2 m (6 ft) from the floor
- Eyewear holder (can be located either inside or outside of LCA or both locations
- Key pad for interlock by-pass or authorized user entry
- Door bell, intercom or permission-to-enter device
- Emergency entry device (unlocks door, may drop power or laser shutters), place out of random reach (or guarded to prevent random activation)

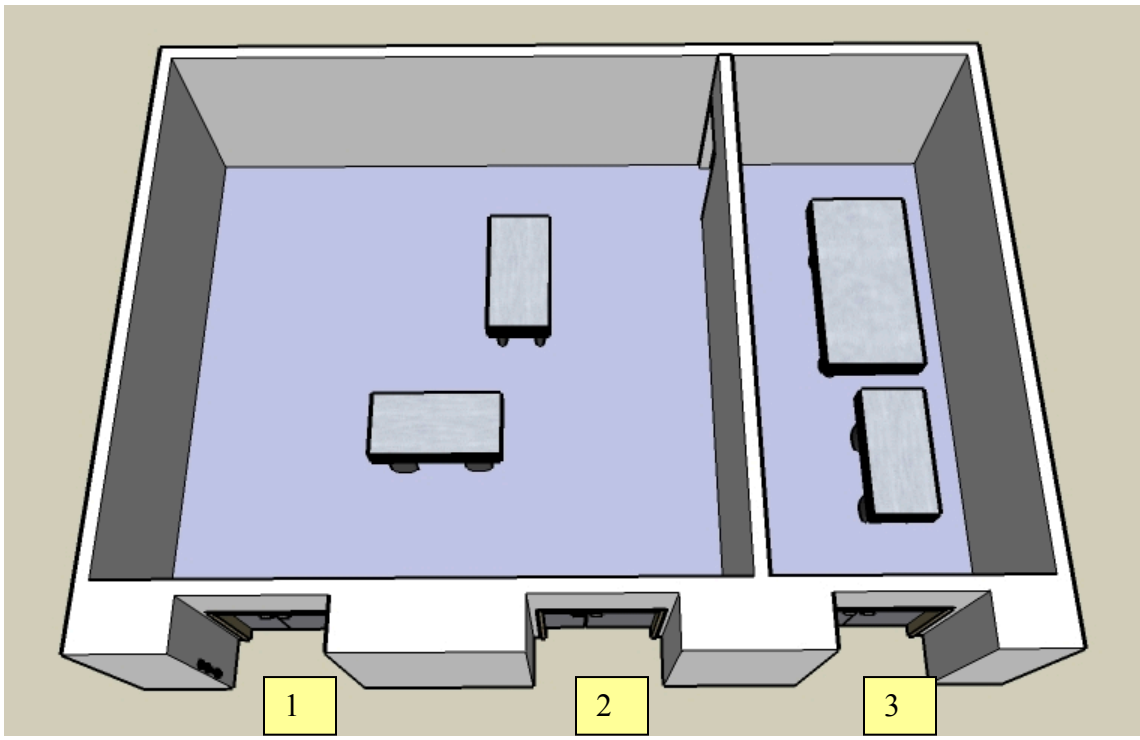

Figure 2b. LCA – Multi-Entry Points

— Laser protective eyewear can be stored outside or inside laser room. If inside, must be near entrance and beam exposure of personnel at or near entrance must be precluded.

— Door 1 is main entrance

— Door 2 is only for equipment movement, access control-lock door, remove outer door handle, non-defeatable interlock

— Door 3 separate lab

— Interconnecting door should be labeled “Emergency Exit Only” on both sides, can be non-defeatable interlock to laser system

— Illuminated area warning light should be eye height (less than 6 feet from the floor)

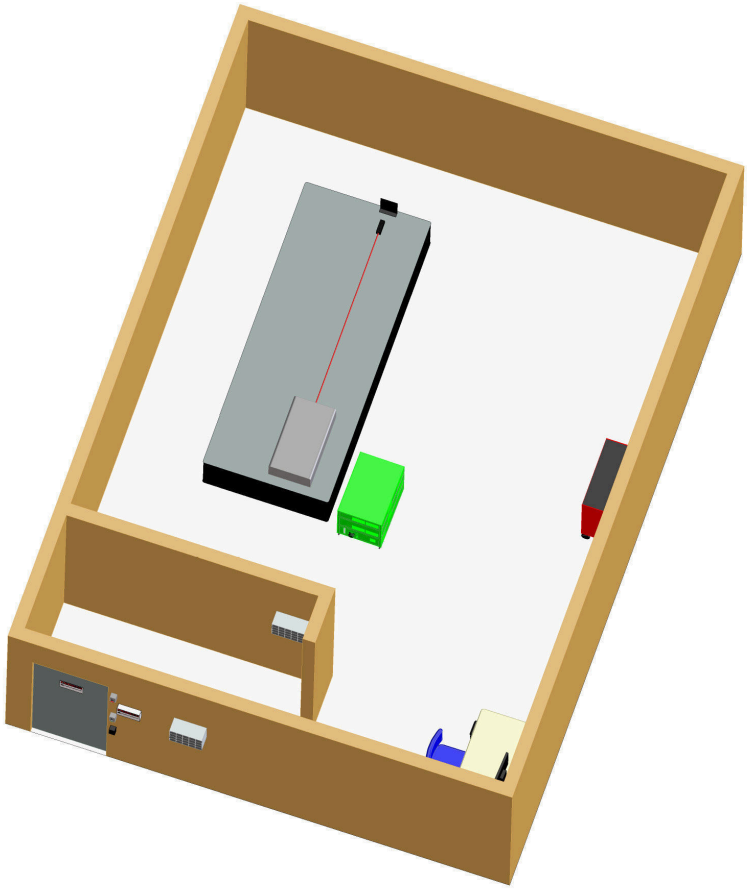

Figure 2c. LCA Entryway Safety Controls for Class 4 Laser Entryway Interlocks. Design also applicable for non-interlocked room.

Key features:

- Area warning sign on door
- Illuminated sign next to door indicating laser status
- Barrier inside room, protects individual upon entry, provides a location to put on PPE, (e.g., eyewear, clean room clothes). Prevents beams from exiting room. Great location for binder with SOP and notices—barrier not the common approach, usually door opens right into lab space.
- Care is needed to ensure beams are blocked and stay on optical table.
- Key pad or other by-pass device
- Laser protective eyewear holder, inside and out, either is acceptable
- Emergency entrance button
- Beam blocks end of beam path

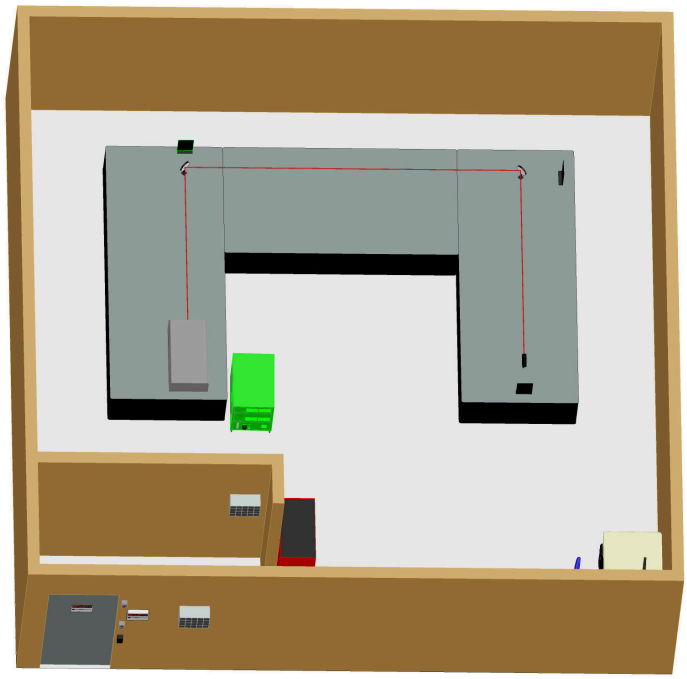

Figure 2d. LCA Entryway Safety Controls for Class 4 Lasers without Entryway Interlocks. Design also applicable for non-interlocked room.

Key features:

- Area warning sign on door
- Illuminated sign next to door indicating laser status (e.g., standby, operated, off)
- Maze (“Dog leg”) entry. Protects individual upon entry, provides a location to put on PPE (e.g., eyewear, clean room clothes). Great location for binder with SOP and notices.
- Barrier not the common approach, usually door opens right into lab space. Care is needed to make sure beams are blocked and stay on optical table.
- Notice laser set up has beams aimed away from entry
- Beam blocks at end of beam path and turning optics

Appendix A
Supplement to Section 1 – Laser Safety Programs

A1. Laser Facility

A1.1 General. The laser facility is a facility in which lasers are operated for any purpose. It is the responsibility of the laser facility management to have a laser safety program in place based on the types and uses of its operated lasers and laser systems.

The laser facility shall ensure that there is a mechanism in place (such as a designated individual or a committee) that is ultimately responsible for all phases of a laser project that requires LSO oversight.

A2. Laser Safety Officer (LSO)

A2.1 General. The LSO is an individual designated by the employer with the authority and responsibility to effect the knowledgeable evaluation and control of laser hazards and to monitor and enforce the control of such hazards. The LSO shall have authority to suspend, restrict, or terminate the operation of a laser system if he/she deems that laser hazard controls are inadequate. For the laser safety program to be effective, the LSO must have sufficient authority commensurate with the responsibility. In organizations that do not permit authority to reside with non-management personnel and the LSO is a non-management position, the management shall provide protocols and reporting structure to assure adequate enforcement authority.

The LSO may be designated from among such personnel as the radiation safety officer, industrial hygienist, safety engineer, laser specialist, laser operator or user. The LSO may be a part-time position when the workload for an LSO does not require a full-time effort. In some instances, the designation of an LSO may not be required. Operation and maintenance of Class 1, Class 1M, Class 2, Class 2M and Class 3R lasers and laser systems normally do not require the designation of an LSO. However, under some circumstances it may be desirable to designate an LSO, for example, if service is performed on a laser system having an embedded Class 3B, or Class 4 laser or laser system. In such instances, management may designate the service person requiring access to the embedded laser as the LSO. In any case, there shall be a designated LSO for all circumstances of operation, maintenance, and service of Class 3B and Class 4 lasers or laser systems.

If necessary, a Deputy Laser Safety Officer (DLSO) or Back up Laser Safety Officer (BLSO) shall be appointed by management or the LSO. The DLSO/BLSO shall perform the functions of the LSO when the latter is not available. For institutions with multiple divisions, plant locations and multi-shifts, a system of DLSOs may be required to carry out the duties of the LSO at those locations or during the shifts.

A2.2 LSO Specific Duties and Responsibilities.

a) **Safety Program.** The LSO shall establish and maintain adequate policies and procedures for the control of laser hazards. These policies and procedures shall comply with applicable requirements, including federal, state and local regulations.

b) **Classification.** The LSO shall classify, or verify classifications of lasers and laser systems used under the LSO's jurisdiction. Classifications shall be consistent with classifications listed in Section 3 of this standard.

c) **Hazard Evaluation.** The LSO shall be responsible for hazard evaluation of laser work areas. Hazard evaluation shall be conducted in accordance with Section 3 of this standard.

d) **Control Measures.** The LSO shall be responsible for assuring that the prescribed control measures are implemented and maintained in effect. This includes avoiding unnecessary or duplicate controls and recommending or approving substitute or alternate control measures when the primary ones are not feasible or practical.

e) **Procedure Approvals.** The LSO should approve Class 3B and shall approve Class 4 SOPs, and other procedures that may be part of the requirements for administrative and procedural controls.

f) **Protective Equipment.** The LSO shall recommend or approve PPE, including eyewear, clothing, barriers and screens, as may be required to assure personnel safety. The LSO shall assure that protective equipment is audited periodically to assure proper working order.

g) **Environmental and Facility Safety Signs and Equipment Labels.** The LSO shall review the wording on area signs and equipment labels.

h) **Facility and Equipment.** The LSO shall review Class 3B and Class 4 laser installations, facilities and laser equipment prior to use. This also applies to modification of existing facilities or equipment.

i) **Training.** The LSO shall assure that adequate safety education and training are provided to laser personnel that are potentially exposed to laser radiation exceeding the MPE. The LSO should make available adequate safety education and training to personnel working with or around lasers that do not produce exposures that exceed the MPE. The frequency of refresher training shall be considered on the basis of the total hazard evaluation criteria presented in Section 3.

j) **Approval of Alignment Eyewear.** The LSO on a case-by-case basis should review the need and use of alignment eyewear by the laser user. Alternate means of viewing the beam such as CCD and web cameras should be considered before allowing the use of alignment eyewear.

k) **Medical Surveillance.** The LSO shall determine the personnel categories for medical surveillance (see Section 6).

l) **Records.** The LSO shall assure that the necessary records required by applicable federal, state and local regulations are maintained. The LSO shall also submit to the appropriate medical officer the individuals' names that are obtained in accordance with A4.1(c) and A4.1(d), and shall assure that the appropriate records are maintained indicating that applicable medical examinations have been scheduled and performed. Other records documenting the maintenance of the safety program, such as training records, audits, and SOP approvals, shall be maintained.

m) **Audits, Surveys and Inspections.** The LSO shall periodically audit or survey by inspection for the presence and functionality of the laser safety features and control measures required for each Class 3B and Class 4 laser or laser system in the laser facilities. The LSO shall accompany regulatory agency inspectors (such as OSHA, FDA/CDRH, state or local agencies) reviewing the laser safety program or investigating an incident and document any discrepancies or issues noted. The LSO shall assure that corrective action is taken where required.

n) **Accidents.** The LSO should develop a plan to respond to notifications of incidents of actual or suspected exposure to potentially harmful laser radiation. The plan should include the provision of medical assistance for the potentially exposed individual, investigation of the incident and the documentation and reporting of the investigation results.

o) **Approval of Laser Systems Operations.** Approval of Class 3B and Class 4 lasers and laser systems for operation shall be given only if the LSO is satisfied that laser hazard control measures are adequate. This includes all required SOPs for Class 3B and 4 laser systems. The procedures should include adequate consideration of safety from non-beam hazards.

A3. Laser Safety Committee

A3.1 Membership of Laser Safety Committee. The membership of the Laser Safety Committee may include members with expertise in laser technology or in the assessment of laser hazards. Management may be included in the membership. Examples of members include, but are not limited to the following: technical management, LSO and/or representatives of the safety/industrial hygiene organization, physician, education department member, engineer/scientist and user representative.

A3.2 Policies and Practices. The committee shall establish and maintain adequate policies and practices for the evaluation and control of laser hazards, including recommendations for appropriate laser safety training programs and materials.

A3.3 Standards. The committee shall maintain an awareness of all applicable new or revised laser safety standards.

A3.4 Deputy Laser Safety Officer (DLSO). At the discretion of the LSO or management a DLSO may be designated. This person may also be known as the laser safety supervisor. This individual can be responsible for laser safety for a division, building or individual laser use area. The responsibility of this person is similar to the LSO or supervisor. They are responsible for day-to-day laser safety operation and should have training commensurate to their duties.

A3.5 Deputy Laser Safety Officer Committee. At the discretion of the LSO or management, a DLSO committee may be created. The goal of such a committee is to ensure that consistent polices are followed throughout an organization and for continued education of the DLSO(s). Policies and procedures should mirror those of the Laser Safety Committee.

A4. Other Personnel Responsibilities

A4.1 Laser Supervisor/Laser Safety Supervisor. The supervisor (work area leader, group leader, and foreman) of individuals working with or having the potential for exposure to greater than Class 1 laser radiation, should have a basic overall knowledge of laser safety requirements for the lasers under his or her authority.

The following should be considered a minimal set of responsibilities for the Laser Supervisor:

a) The supervisor shall be responsible for the issuance of appropriate instructions and training materials on laser hazards and their control for all personnel who may work with lasers that are operated within the supervisor's jurisdiction.

b) The supervisor shall not permit the operation of a laser unless there is adequate control of laser hazards to employees, visitors, and the general public.

c) The supervisor shall submit to the LSO the names of individuals scheduled to work with lasers and shall submit information as requested by the LSO for scheduling medical surveillance and completion of training.

d) When the supervisor knows of, or suspects, an accident resulting from a laser operated under his or her authority, the supervisor shall immediately upon becoming aware of the suspected laser incident implement the institution's accident responsibility plan and ensure it includes notification of the LSO.

e) If necessary, the supervisor shall assist in obtaining appropriate medical attention for any employee involved in a laser accident.

f) The supervisor shall not permit operation of a new or modified Class 3B or Class 4 laser under his or her authority without the approval of the LSO.

g) The supervisor shall submit plans for Class 3B and Class 4 laser installations or modifications of such installations to the LSO for review.

h) For Class 3B and Class 4 lasers and laser systems, the supervisor shall be familiar with the SOPs and ensure that they are provided to users of such lasers.

A4.2 Responsibility of Employees Working with Lasers. Employees working with lasers or laser systems shall have, where applicable, the following minimal responsibilities.

a) An employee shall not energize or work with or near a laser unless authorized to do so by the supervisor for that laser.

b) An employee shall comply with safety rules and procedures prescribed by the supervisor and the LSO. The employee shall be familiar with all applicable operating procedures.

c) When an employee operating a laser knows or suspects that an accident has occurred involving that laser, or a laser operated by any other employee, and that such accident has caused an injury or could potentially have caused an injury, he or she shall immediately inform the supervisor. If the supervisor is not available, the employee shall notify the LSO.

A4.3 Other Personnel. Anyone involved in purchasing a laser or laser system should contact the LSO. Such personnel may also include, but is not limited to, purchasing, accounting, and building management as may be applicable.

A4.4 Responsibility of Additional Safety Professionals. Environmental Health & Safety (EH&S) Professionals provide guidance in handling and establishing controls for laser-associated hazards such as:

- Laser dyes and other toxic chemicals
- Ventilation requirements for laser targets and toxic materials
- Hazardous gases
- Electrical hazards
- Seismic hazards

Appendix B
Sample Forms