Standard/Safe Operating Procedures for Setting up a Class 4 LASER or LASER System

Revision Date: September 21, 2021

Introduction

At SF State, the purchase and use of Class 3B and Class 4 lasers are subject to the Laser Safety Program overseen by the Non-ionizing Radiation Committee (NIRC) and a Laser Safety Officer (LSO). The Laser Safety Program follows the guidelines in the ANSI Z136 standards.

1. Class 4 LASERS

Class 4 lasers pose a higher risk of fire then the less powerful Class 3B lasers, because the directed Class 4 beam can cause combustible material to catch fire much more easily.

It is important to set up the equipment and workspace in a way that addresses the increased fire hazard inherent in the use of Class 4 lasers.

1.1 Laser Use Authorizations (LUAs)

The SF State Laser Safety Program requires the owner of Class 3B and Class 4 lasers to complete an application for an LUA that is then approved by the LSO and the Non-Ionizing Radiation Committee. Aside from training and approved safe work practices, the LUA also includes a drawing of the work area set up and provisions for access, exposure prevention and fire safety.

1.2 Fire Safety Considerations

Class 4 lasers pose both direct and indirect fire hazards. The indirect fire hazards are associated with the electrical equipment and other conditions in the room. The direct fire hazards are associated with the beam itself and the risk of the beam burning a material.

1. A suitable fire extinguisher must be present on the work area.
2. Barriers made of a non-combustible material, such as metal or fire-resistant mateirals must be installed to prevent the beam from leaving the control area.
3. Electrical cords and other equipment must be suitable for the current and amperage required by the equipment.
4. Conditions such as moisture, static electricity, and general housekeeping must be such that the risk of fire or electric shock is minimized.

1.3 Chemistry Laser Lab for New Science Building

The existing laser lab in Thornton Hall 810 will be moved to the new Science Building. This lab has two solid state Class 4 lasers. Each laser is used to analyze samples for chemistry research. Because of this, the fire and beam exposure hazards have already been addressed. Below is a list of precautions already in place and that are expected to continue in the new building.

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The laser lab is used for laser experiments and other optical engineering projects—building devices and tools for research. These are mechanical and electrical engineering projects. The hazardous materials used to support these activities include the following items. None of these are in the laser path.

- Small squirt bottles of reagent alcohol (less than 100 mL) and 1 small squirt bottle of ethanol (<25 mL)— for cleaning optics.
- Assorted commercial hardware store items: Several cans of WD-40; machine oil and grease, spray paint, epoxies, glues, compressed air, Teflon lubricants.
- 500 mL of isopropyl alcohol for cleaning prints from the resin printer

The lab includes a resin 3D printer for student projects. The printer uses plastic resins and the only use requirement is a well ventilated space. It is currently in the fume hood in TH 810. The fume hood is not in view of the current laser. A ventilated space or hood is included in the new space and the resin 3D printer will be installed there.

Notes: a. Currently, experiments are performed on <1mL of protein samples in water with salt.

b. There are no flammable, reactive or ignitable liquids used to operate this laser.

Standard Operating Precautions for the Laser Lab

1. Laser Use Authorization was approved with existing power supplies and electrical wiring.
2. The Class 4 beam is enclosed in a metal box along its path to the sample being analyzed.
3. Once set up, the beam does not have to be moved or adjusted during use.
4. Only the Principal Investigator may adjust the beam or beam path, not the other lab members or users. Adjusting the beam path requires the temporary removal of the box beam cover, then the cover is replaced.
5. The curtain barriers are manufactured and designed to be fire resistant and suitable for use with high-powered lasers.
    - These barriers meet or exceed the California Fire Code requirements for fire-resistant fabrics or materials
    - Testing documents are available and have been accepted by Fire Marshal inspectors
6. Combustible and flammable chemicals and products will be stored in a flammables storage cabinet meeting CFC and OSHA requirements.

7. Repairs or maintenance of Class 3 B or Class 4 lasers must be done by qualified factory certified technicians with temporary barriers or other safeguards in place as recommended by the manufacturer and to suit any special conditions.
8. In the unlikely event that a fire caused by the laser occurs, the new Science Building will have sprinklers or other fire suppression equipment, in addition to a fire extinguisher.

1.4 Other Future Laser Labs for New Science Building

1. Any new Class 3B or Class 4 lasers or laser systems to be used in the new building will undergo the same LUA approval process and be subject to the SF State Laser Safety Program.
2. Dr. Esquerra will submit a new LUA for LSO and NIRC approval when the new Science Building is ready for occupancy. The LSO and NIRC members will tour the new space and review the new lab diagram of the laser control area and its placement in the room.
3. Dye lasers are not used by the chemistry department. In the future, if a laser is acquired for the Science Building that requires a flammable, reactive, or combustible liquid to operate it, the LUA will address these hazards. The chemicals used will be added to the HMIS and stored appropriately.

1.5 Resin 3-D Printer Washing and Curing Machine

The printer uses plastic resins to make items for the lab. Prints occur about 1-2 times per week. The items printed out must be washed and cured before they can be used. About 500 mL of isopropyl alcohol (IPA) is used in the washing chamber. When this step is complete, the IPA is poured into a labeled glass container and stored in a flammable storage cabinet for re-use. The item is then cured using ultraviolet light until finished.

Creality 3D UW-01 Washing and Curing Machine 2 in 1 UV Curing Rotary Box Bucket for LCD/DLP/SLA Resin 3D Printer Models 7.42x6x7.8 inches Transparen Visiblet (Small)
Brand: Creality
67 ratings
| 4 answered questions
Amazon's Choice in 3D Printers by Creality
Price: $149.00 prime & FREE Returns
Coupon Save an extra $40.00 when you

One gallon of fresh IPA is stored in a flammables storage cabinet located in the lab away from the laser.