

SECTION 11600

LABORATORY EQUIPMENT

PART 1 – GENERAL

1.01 CODES AND STANDARDS

- A. Designs shall comply with the requirements of the following codes and standards:
 - 1. ANSI standards
 - 2. Local Codes
 - 3. Washington State Fire Prevention and Building Code
 - 4. NFPA standards 5. Current WISHA standards
- B. Where codes and standards do not exist or are unclear, design shall follow recommendations and guidelines set forth in the Pacific Lutheran University Laboratory Safety Manual and Chemical Hygiene Plan and/or other design guidelines established by the Office of Environmental Health and Safety (EH&S). Contact EH&S for more information at 253-535-7233.

1.02 CHEMICAL STORAGE CABINETS

- A. Chemical storage cabinets are used to store both solid and liquid chemicals such as flammables, solvents, acids, bases, toxics, and/or chemical wastes. For the purpose of this design standard, the term chemical storage cabinet is defined as both stand-alone cabinets, under counter cabinets, and fume hood base cabinets.
- B. Chemical storage cabinets are required when expected quantities will exceed limits within the Washington State fire code and NFPA or are recommended when quantities of any one hazard class of liquid chemicals exceed 10 gallons.

1.03 FUME HOOD BASE CABINETS

- A. Fume hood base cabinets can include storage for solvents, acids, bases, toxics, and chemical waste. Flammable liquids in excess of quantities identified in Section 1.02B (above) shall be stored in approved flammable liquid storage cabinets. "Flammable" fume hood base cabinets should be used for the storage

of volatile solvents, liquid toxics, noxious chemicals, and particularly hazardous substances such as acutely toxic, carcinogens, and reproductive toxins.

- B. Fume hood base cabinets shall be vented. The preferred method is to run the vent pipe along the inside of the fume hood superstructure (hidden) and vent behind the top baffle.
- C. Fume hood base cabinets can also be vented by running vent pipe through the fume hood counter top and behind the fume hood baffle. If this method of venting is used, then the vent pipe should be at least 6" above the fume hood countertop and chemically resistant sealant must be used around where the vent pipe comes out of the fume hood countertop.
- D. Fume hood base cabinets designated to store solvents shall be equipped with a flame arrestor in bung openings.

1.04 **VACUUM PUMP CABINETS**

- A. Due to the nature of vacuum pumps, all vacuum pumps or vacuum pump cabinets shall be vented.
- B. Vacuum pumps should be vented directly. If this is not feasible, then vacuum pump cabinets must be vented.
- C. The preferred method of venting vacuum pump cabinets is to vent directly. However, it is acceptable to vent vacuum pump cabinets directly into the fume hood.

1.05 **CORROSIVE STORAGE CABINETS**

- A. Corrosive storage cabinets are designed to store acids and bases (caustics). Corrosive storage cabinets can include stand-alone corrosive cabinets and fume hood base cabinets.
- B. Stand-alone corrosive storage cabinets do not have to be vented.
- C. Fume hood base cabinets used for corrosive storage shall be vented according to Section 1.03.1.
- D. Acid and base cabinets that are vented should be vented using separate vent pipe.
- E. Vent pipe shall be PVC or Poly-type tubing.

- F. Corrosive storage cabinets shall be made of or lined with a non-metallic liner such as polyethylene or polypropylene.

1.06 **FLAMMABLE LIQUID STORAGE CABINETS**

- A. For the purposes of this design standard, this section refers to stand-alone flammable liquid storage cabinets. Fume hood base cabinets designed to store volatile solvents should follow section 1.03.1.
- B. Stand-alone flammable liquid storage cabinets are not required to be vented, however, “bung caps” must be installed in bung holes of the cabinets (see NFPA 30).
- C. If stand-alone flammable liquid storage cabinets are vented, then the following must be met:
 - 1. A professional engineer shall design venting systems of storage cabinets.
 - 2. Make up air must be introduced in the top vent of the cabinet. This make up air must come from a fresh air independent source and cannot come from the room where the storage cabinet is located.
 - 3. Cabinets shall be vented from the bottom vent on the cabinet.
 - 4. Cabinet vent ports must be equipped with flame arrestors.
 - 5. Schedule 40 black steel pipe should be used for vent pipe.
 - 6. Manifolding should be avoided, but if necessary, the duct material for the rest of the entire manifold exhaust system must be a minimum of 18 gauge steel sheet metal.
 - 7. Venting of the cabinet must go directly outdoors.
 - 8. The airflow rate for venting should be 25 scfm for cabinets equipped with 2" connections and 40 scfm for cabinets with 4" connections.
 - 9. Mechanical exhaust ventilation should comply with NFPA 91.
 - 10. Fan material must be resistant to the anticipated material or vapors. The fan blade must be non-static and all fan parts must be grounded and bonded across the ant-vibration flex connections. The fan motor shall be UL listed, Class I, Division I, totally enclosed and explosion-proof.

- D. Contact EH&S at 253-535-7233 for more information if stand-alone flammable liquid storage cabinets are planned to be vented.

1.07 **BIOSAFETY CABINETS**

- A. Biosafety cabinets (BSCs) are primary safety devices that are used for containment when manipulating infectious and biohazardous materials, and to maintain aseptic conditions when using cell cultures.
- B. All BSC purchases must first be approved the Biosafety Officer, EH&S at 253-535-7233.
- C. Class II type A2 Biosafety Cabinets are the most commonly encountered cabinets on campus and fulfill most research needs. Exhaust from these cabinets can be recirculated into the room, or linked via a thimble or canopy connection to direct air outside. These cabinets are for particle containment only and must not be used with flammable or volatile chemicals or radioactive materials. Type B2 cabinets are 100% exhaust (no recirculation in the work area) that provide biological and some chemical containment.
- D. If possible, the BSC should be located in the laboratory away from air currents produced by ventilation inlets, opening/closing of the laboratory door(s), and away from areas of heavy traffic. An isolated tissue culture room is an ideal location.
- E. All BSCs must be certified by a contractor trained to National Sanitation Foundation Standard No. 49. BSC users must ensure that BSCs are certified on an annual basis. Contact the Biosafety Officer at 253-535-7233 for a list of available contractors that provide this service.

1.08 **COMPRESSED GAS CYLINDER RESTRAINTS**

- A. As per code, compressed gas cylinders must be restrained. The use of fixed gas cylinder restraints is preferred over portable restraints (i.e., vice-style fastened to tables).
- B. The use of chains to secure cylinders is preferred over the use of nylon (or other combustible) strapping.

1.09 **TOXIC GASES**

- A. Laboratories and research areas intending to use toxic gases, as defined by Washington State Fire Code, Section 3701.1, will comply with Section 3704, including storage and toxic gas monitoring requirements. All renovations and

new construction projects for laboratories and other areas planning to use toxic gases must contact EH&S at 253-535-7233 early in the design process to ensure appropriate engineering and administrative controls are put in place as part of the design project.

1.10 USE OF LIQUID NITROGEN, HELIUM, OR OTHER CRYOGENS

- A. In areas where liquid nitrogen, helium, or other cryogenics will be used in large quantities, laboratory size and ventilation shall be assessed for oxygen displacement. The use of local oxygen monitoring alarms is required in poorly ventilated areas, or in special cases like environmental chambers.

1.11 FLAMMABLE LIQUID STORAGE IN REFRIGERATORS

- A. Newly constructed laboratories or retrofits intending to store flammable liquids in refrigerators shall include provisions for the purchase/use of refrigerators rated for the storage of flammable liquids as part of the design project.

1.12 LASERS

- A. Contact EH&S early in the design process so the appropriate safety features may be included. Laboratories using Class 3b and 4 lasers will meet the requirements outlined in ANSI Standard Z136.1 and Z136.5, and the Pacific Lutheran University Laser Safety Manual. The Laser Safety Officer will review all Class 3b and 4 lab layouts, safety features, warning lights and signs, and safety interlock systems.
- B. Homebuilt lasers, commercially available equipment that has been modified, and home built laser systems and equipment requires review and classification by the Laser Safety Officer. This equipment cannot be provided to, sold to, or operated by persons not involved with the modifications unless the equipment is certified to meet FDA regulations (21CFR1040 Subchapter J). Contact the Laser Safety Officer at EH&S for assistance.
- C. Laser beams may not leave the confines of the lab where the laser is located unless approved by the Laser Safety Officer.
- D. Contact the Laser Safety Officer at 253-535-7233 for more information.

1.13 RADIATION PRODUCING EQUIPMENT

- A. Use of radiation producing equipment (x-ray, accelerator/implanter, transmission electron microscope, etc.) requires a permit from EH&S. Contact the Radiation Safety Officer at EH&S at 253-535-7233 for additional information and assistance.

1.14 ANIMAL ROOMS

- A. Obtain approval from the Institutional Animal Care and Use Committee regarding all plans, specifications, and use of animal rooms.
- B. There must not be any recirculation of exhaust air, and directional air flow is recommended.
- C. A hand washing sink should ideally be located within the animal room, or minimally within the animal facility

1.15 MAGNET REQUIREMENTS

- A. Contact EH&S early in the design process so the appropriate safety features may be included. In general, room temperature and cryogenic/superconducting magnets need to be located so that the magnetic field does not exceed 5 gauss outside the confines of the laboratory (i.e., spaces on all six sides of the lab need to be assessed). If fields exceed 5 gauss outside the laboratory, and shielding is not possible, the occupants of those spaces need to be informed and mutual agreement must be reached.
- B. Magnetic field warning signs are required at the 5 gauss line. Sample signs are available from EH&S. Additional warning signs are required at the entrances to spaces where magnetic fields strengths can create projectile hazards should magnetic items enter that space.
- C. Cryogenically cooled magnet systems have the potential to quench causing the release of large amounts of nitrogen and/or helium gas. This can quickly create oxygen deficient areas which can be immediately dangerous to life and health. The venting of these gases and the control of potentially dangerous area shall be considered in the laboratory design (see also Section 1.11 above).
- D. Time varying magnetic fields can present different exposure hazards to humans and need to be evaluated on a case by case basis.
- E. Contact the Non-ionizing Radiation Safety Officer at 253-535-7233 for more information.

1.16 CHEMICAL WASTE STORAGE

- A. Facilities are not required to collect chemical waste in a central storage area. Those Facilities that choose to collect waste in a central room for the building must meet the following facility requirements:

- B. Emergency communications (a telephone) must be present.
- C. Appropriate fire alarm systems must be installed.
- D. Fire protection (typically sprinklers and handheld extinguishers) must be present.
- E. The room must have spill containment (secondary containment or bermed areas).
- F. There needs to be sufficient aisle space.
- G. There needs to be sufficient space to segregate chemical wastes by hazard classes.
- H. There is a strong recommendation that spill control equipment be present.
- I. The area needs to be secured (i.e., have a lock) and a security alarm is strongly recommended.
- J. Appropriate signage must be provided (i.e., no smoking, hazardous waste).

1.17 **CHEMICAL SECURITY CABINETS**

- A. In areas where controlled substances, radioactive stocks, highly toxic or highly valuable chemicals will be used and/or stored, the provisions for a locked storage cabinet should be given consideration. Such a locked storage cabinet could include a separate cabinet or retrofit to existing cabinetry.

END OF SECTION