



Environmental Health and Safety

**ASU Laboratory Standard and Design Guide
Section: 5.0: Hazardous Materials Storage**



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Regulations, standards and references

Regulations

- Biosafety in Microbiological and Biomedical Laboratories — BMBL.
- International Fire Code — IFC.
- International Mechanical Code — IMC.
- National Fire Protection Association — NFPA — 2, Hydrogen Technologies Code.
- National Fire Protection Association — NFPA — 45, Standard on Fire Protection for Laboratories Using Chemicals.
- National Fire Protection Association — NFPA — 55, Compressed Gases and Cryogenic Fluids Code.
- National Fire Protection Association — NFPA — 56, Standard for Fire and Explosion Prevention During Cleaning and Purging of Flammable Gas Piping Systems.
- National Fire Protection Association — NFPA — 69, Standard on Explosion Prevention Systems.
- National Fire Protection Association — NFPA — 720, Standard for the Installation of Carbon Monoxide, CO, Detection and Warning Equipment.
- National Fire Protection Association — NFPA — 91, Standard for Exhaust Systems for Conveying of Vapors, Gases, Mist, and Particulate Solids.
- National Fire Protection Association — NFPA — 99, Health Care Facilities Code.
- National Sanitation Foundation — NSF — Standard 49.
- OSHA 29 CFR §1910.1450, Occupational Exposure to Hazardous Chemicals in Laboratories.

Any additional referenced code or standard included in the IFC or NFPA as identified.

Consensus standards and references

- ACGIH Industrial Ventilation Manual.
- ANSI/AIHA Z9.5 Laboratory Ventilation.
- ANSI/ASHRAE 110, Method of Testing Performance of Laboratory Fume.
- ANSI/ASHRAE 111, Practices for Measurement, Testing, Adjusting.



- ANSI/ASHRAE 41.2, Standard Method for Laboratory Air-Flow Measurement.
- ANSI/ASHRAE 41.3, Standard Method for Pressure Measurement.
- ANSI/ASHRAE 62, Ventilation for Acceptable Indoor Air Quality.
- Balancing of Building Heating, Ventilation, Air-Conditioning and Hoods.
- National Institutes of Health Design Requirements Manual for Biomedical Laboratories and Animal Research Facilities.
- National Research Council "Safe Handling of Radionuclides," International Atomic Energy Agency, Safety Series No. 1.
- Prudent Practices in the Laboratory, Committee on Prudent Practices for Handling, Storage and Disposal of Chemicals in Laboratories.
- Refrigeration Systems.

Scope

1. The requirements of this guide apply to all campus facilities, including leased properties in which hazardous materials are used, handled or stored. It covers the design, construction and installation of hazardous materials storage cabinets, including flammable liquid, corrosive material and toxic material storage cabinets. It applies to all ASU laboratory buildings, laboratory units and work areas where hazardous materials are used, handled or stored.
2. Environmental Health and Safety must review and approve deviations from the ASU Design Guidelines.
3. This document does not relinquish the owner or contractor from adhering to all applicable codes and standards for this project, requirements presented by EHS and the requirements outlined in the ASU Design Guidelines.

Approvals and listings

1. The purchase and installation of storage cabinets for flammable liquids and toxic materials shall be subject to review and approval of EHS.
2. Flammable liquid storage cabinets shall be listed by a Nationally Recognized Testing Laboratory such as Underwriters Laboratories, Factory Mutual or the state fire marshal.



- a. NRTL listing or EHS approval assures a minimum level of quality consistent with code requirements and good practice. A UL Listing is not required for corrosive or toxic material storage cabinets.

Design

1. Laboratories that store, use or handle flammable or combustible liquids shall have one or more flammable liquid storage cabinets.
2. Flammable liquid storage cabinets shall not store more than the required quantities identified of any flammable or combustible liquids following the IFC and referenced NFPA codes and standards.
3. Flammable liquid storage cabinets shall be conspicuously labeled with the warning "FLAMMABLE — KEEP FIRE AWAY" in red letters on a contrasting background. Doors shall be well-fitted, self-closing and equipped with a self-latching device.
4. When flammable or combustible liquids present multiple hazards, the storage requirements for each hazard shall be addressed. For example, acetic acid is a corrosive and combustible material. Therefore, if it is stored in a flammable cabinet with other flammable materials, it must be segregated — i.e., in secondary containment.
5. Laboratories that store, use or handle toxic liquids or solids shall have one or more approved and vented toxic material storage cabinets.
6. Where necessary, vented cabinets should be provided to store toxic materials, separated by hazard class. The vents shall be connected, preferably at the top of the cabinet, to a supply ventilation system and at the bottom of the cabinet to an exhaust ventilation system following the provisions of Section D of this chapter. The interior balance of the cabinet should be neutral to the outside. The cabinets should be compatible with the materials being stored.
7. Corrosive and toxic material storage cabinet shelving shall be constructed to prevent spillage of contents with tight-fitting joints, a welded or riveted liquid-tight bottom, a door sill of at least 2 inches and lockable cabinet doors that are self-closing and self-latching. Corrosive materials should not be stored in metal cabinets unless the construction materials are specifically treated as corrosion-resistant.

Venting hazardous material storage cabinets

1. According to NFPA 30, 6.3.4, The cabinet is not required to be vented for fire protection. However, the following shall apply:
 - a. If the lab is under renovation, then the new or existing flammable and combustible cabinets must be vented.



- b. If vented, the cabinet shall be vented outdoors or to the fume hood exhaust duct in a manner that will not compromise the specific performance of the cabinet.
 - c. In existing labs not under renovation, if the cabinet is not vented, the vent openings shall be sealed with the bungs supplied or with bungs specified by the manufacturer.
- 2. Combustible and flammable storage cabinets are used to store combustible and flammable liquids exceeding the maximum allowable quantity — MAQ — for laboratory occupancy or not stored in a specific type of container within the lab. These cabinets shall be designed following the current nationally recognized engineering standards, adopted International Fire Codes and the authority having jurisdiction.
 - Do not manifold vent piping from multiple cabinets.
 - Exhaust vent materials for hazardous material cabinets shall be compatible with the contents of the cabinets. Construction of the venting duct should be equal to the cabinet's rating.
 - For health and safety considerations — e.g., odor control and control of potentially hazardous vapors — the interior of a cabinet shall be ventilated. All toxic material storage cabinets shall be vented.
 - If a flammable liquid storage cabinet is ventilated, it shall not compromise the specified performance of the cabinet.
 - If the cabinet is not vented, it shall be sealed with the bungs supplied, including or specified by the manufacturer's requirements.
 - Piping, valves, fittings and related components intended for use with flammable and combustible liquids shall be designed and fabricated from suitable materials having adequate strength and durability to withstand the pressures, structural stresses and exposures to which they could be subjected. Such equipment shall follow the current nationally recognized engineering standards, adopted International Fire Codes and the authority having jurisdiction.
 - Under the fume hood storage units intended for hazardous materials — i.e., chemical, flammable liquids, gas, etc. — storage shall contain recessed flooring for spill retention, appropriate internal lining, and exhaust ventilated to maintain containment of materials. Such equipment shall follow the current nationally recognized engineering standards, adopted International Fire Codes and the authority having jurisdiction.
 - Vent materials for flammable liquid storage cabinets shall be resistant to high temperatures generated in a fire. Stainless steel, hard-soldered copper and carbon steel are appropriate vent materials for flammable storage cabinets,



provided the material is compatible with the intended service. The non-metallic duct is not to be used to vent flammable storage cabinets.

3. Corrosive cabinets store corrosive liquids capable of corroding steel at a rate of more than 0.250 inches per year at a test temperature of 55 degrees Celsius. These cabinets shall be designed following the current nationally recognized engineering standards, adopted International Fire Codes and the authority having jurisdiction. [According to NIH](#), the corrosive cabinet must be vented to the fume hood or the lab exhaust system as appropriate.
4. Gas cabinets shall store all flammable, corrosive, toxic and highly toxic compressed gas containers. These cabinets shall be designed following the current nationally recognized engineering standards, adopted International Fire Codes and the authority having jurisdiction. Gas cabinets will require a connection to an exhaust system. The manufacturer determines the local exhaust ventilation required to operate the cabinet. Refer to EHS guidelines for [Pressure vessels and compressed gas cylinders](#).

General installation requirements

1. Flammable liquid storage cabinets shall NOT be located near exit doorways, stairways or in a location that would impede leaving the area.
2. Flammable liquid storage cabinets shall NOT be wall-mounted. Good Practice Wall-mounted cabinets are not UL-Listed or EHS-approved. The mounting could breach the fire-resistive integrity of the cabinet.
3. Flammable liquid storage cabinets shall NOT be located near an open flame or ignition source. An open flame or other ignition source could start a fire or cause an explosion if an accident or natural disaster brought the ignition source and flammable liquids or vapors together.
4. One room shall not contain more than three flammable liquid storage cabinets unless those groups of three cabinets are separated from each other by not less than 100 feet (30 meters) — OR — if an automatic sprinkler system protects the building, the number of cabinets in any one group shall be increased to six.
5. Flammable and toxic/corrosive liquid storage cabinets shall be seismically anchored to prevent spillage of contents. Anchoring must not compromise the integrity of the fire rating, i.e., drilling holes through a free-standing cabinet.