

APPENDIX 11
EH&S DESIGN GUIDELINES FOR CHEMICAL USE AREAS
 Appendix to UCB Construction Standards

Guidelines communicate general safety requirements to administrators, architects, contractors, and laboratory staff but each laboratory or shop chemical use area requires individual interpretation. See also EH&S Guidelines for Laboratory Construction and Renovation Projects.

CHEMICAL INVENTORY EVALUATION

Chemical inventories must be submitted to EH&S to determine exactly which of the following guidelines apply. The chemical inventory must be submitted electronically in the approved excel spreadsheet format, unless advised otherwise. A copy of the chemical inventory template showing the contents required is included below. The chemical inventory template may be downloaded at <http://ehs.colorado.edu/publication.html> by selecting Chemical Inventory Template for Projects.

EH&S Design Guidelines for Chemical Use Areas							
How to complete this form:							
1. Use complete chemical names, no abbreviations or chemical formulas.							
2. Container Size must be a number. The units (g, ml, L..etc) are put in the Units of Measure Column.							
3. Units of Measure contains the units used to measure the chemical amount. (grams, milliliters, Liters, etc)							
4. # Containers is the number of containers of that size of that chemical located in the same location.							
5. Location: put where the chemical is stored, if in a flammable or corrosive cabinet, in a hood, in refrigerator, on a shelf...etc							
When the chemical inventory is complete send via email to Melinda.Hodges@colorado.edu							
Example:						Location	
Chemical Name	Concentration	Container Size	Units of Measure	# Containers	Flammable/ Corrosive Storage Cabinet ?	Hood ?	Other ?
acetone		1	Liter	1	Flammable cabinet		
Hydrofluoric acid	10 N	750	ml	2	Corrosive cabinet		

LIQUID/ SOLID CHEMICAL STORAGE- NFPA 30, 45, 99, 2000 UFC and UCB Standard Section 15852

Proper chemical storage must be provided for hazardous chemicals used, stored, and generated in addition to hazardous waste that may be generated. Storage must be planned to allow for segregation of acids, bases, flammables and organics, oxidizers, reactives and so on. Storage space underneath sinks, generally should not be used for the storage of hazardous chemicals.

Chemical storage cabinets must be UL listed for the materials that they will contain and must comply with the applicable requirements of NFPA 30, 45 and 99 (see UCB Standard Section 15852, Special Exhaust Systems). Cabinets should be clearly labeled to identify the class of chemicals inside e.g., Flammable- Fire Keep.

Flammable storage must be provided to store Class I, II, and III flammable and combustible liquids. (Examples of Class I: acetaldehyde, acetone, methanol; Class II: acetic anhydride, dibutylamine, hydrazine; Class III: acetophenone, benzaldehyde, cyclohexanol, formic acid.)

Each flammable storage cabinet may not exceed a capacity of 120 gallons (NFPA 30, 4.3 Design, construction, and Capacity of Storage Cabinets; Uniform Fire Code 7902.5.9.2 Liquid Storage Cabinets, Quantities).

All stand-alone flammable cabinets must have self-closing doors. (2000 Uniform Fire Code 7902.5.9.3 Liquid Storage Cabinets, Construction)

Flammable storage cabinets do not have to be vented, however, proper ventilation improves air quality in the workplace and increases the longevity of the cabinet. If a cabinet is not vented, the vent openings must be sealed closed with the bungs supplied. If a chemical cabinet is to be vented, it must be vented following the requirements of UCB Standard 15852-Special Exhaust Systems. Ventilation of chemical cabinets must be approved by Facilities Management and performed by an authorized contractor.

Proper storage is also required for corrosive acids and bases. Lined metal corrosive cabinets are available, however all-plastic corrosive cabinets are more resistant to the deteriorating effects of these chemicals.

A number of solid compounds, if not flammable or corrosive, may not need to be stored in an approved cabinet. However, certain reactive, toxic, or highly odorous materials may require special storage in ventilated cabinets.

GAS STORAGE- NFPA 45, 2000 UFC; UCB Standard Section 15852

All gas cylinders need to be properly secured, whether they are stored in a gas cabinet, in a fume hood or out in open laboratory space. All gas cylinders need to have status tags and gas-identifying labels attached.

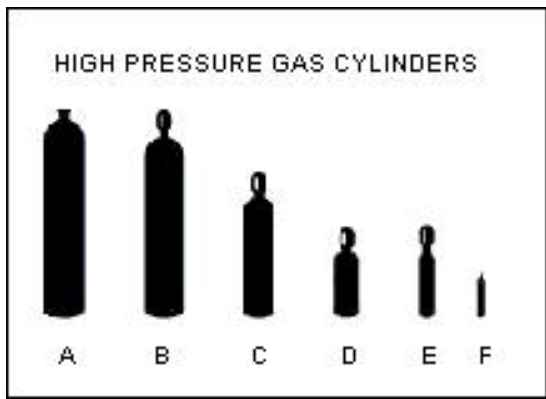
Continuously mechanically ventilated gas cabinets are required for the storage of cylinders of all gases that are greater than lecture bottle size and have an NFPA Health Hazard Rating of 3 or 4. Lecture bottles of these gases must be used and stored inside a chemical fume hood (NFPA 45 8.1.4.2 Special Ventilation Requirements of Gas Cylinders). (Examples of NFPA Health Hazard Rating 4: arsine, chlorine, hydrogen fluoride, phosgene; NFPA Health Hazard Rating 3: ammonia, carbon monoxide.)

Continuously mechanically ventilated, sprinklered gas cabinets are required for all cylinders larger than lecture bottle size that contain pyrophoric gases (NFPA 45 8.1.4.3 Special Ventilation Requirements of Gas Cylinders).

All gas cabinets must comply with 2000 Uniform Fire Code 8003.1.3.2 and UCB Standard Section 15852. Compatibility of the gases and other chemicals being vented must be taken into account when determining the proper ventilation materials, mixing distance, etc. Ventilation of gas cabinets must be approved by Facilities Management and performed by an authorized contractor.

The maximum allowable amount of flammable gases in any one area is determined by the square footage of the area, the types and concentrations of gas being used and stored, and whether or not the gases are stored in gas cabinets. The chart and table below show some common high pressure gas cylinders, their dimensions, average capacity at STP and average internal volume (water volume). Using NFPA 45 and 2000 UFC 8001.15A as guidelines, UCB has determined that the maximum allowable amount of flammable gases stored outside of flammable gas cabinets is 0.012 cu ft (internal volume)/ ft² area. This equates to about four full size cylinders per 500 ft² area. The maximum allowable amount may be doubled if the gases are stored in ventilated flammable gas cabinets.

Cylinder	Cylinder Dimensions	Avg Capacity @ STP		Avg Internal Volume	
		Liters	Cu Ft	Liters	Cu Ft
A	9" x 55"	8657	346.28	48.7	1.72
B	9" x 51"	5005	200.2	43.8	1.54
C	7" x 32"	1677	67.08	15.7	0.55
D	7" x 18"	1107	44.28	6.7	0.24
E	4" x 16"	450	18	2.3	0.08
F	2" x 12"	52	2.08	0.44	0.16



GAS DETECTING SYSTEMS - NFPA 55

A gas detecting system is required when a cylinder larger than lecture bottle size containing a gas with a Health Hazard Rating of 4 is being used or stored in the laboratory (NFPA 55, Chapter 3 Toxic Gases).

A gas detecting system may also be required if a cylinder larger than lecture bottle size containing a gas with a Health Hazard Rating of 3 has been approved by EH&S to be stored outside of a gas cabinet.

EH&S will determine if a gas detecting system is required based on gas types, volumes, concentrations, toxicity, physiological warning properties and how the gases are to be used.

LABORATORY FUME HOODS - UCB Standard Section 11610, 15852, 15400 Division 12, 15, 16.

General laboratory fume hoods are required where there is potential for harmful exposures to hazardous chemicals that are being used or generated in the laboratory. The type of fume hood required will be determined by EH&S after evaluating the chemical inventory and the use of certain chemicals.

A special corrosive fume hood may be required if highly corrosive chemicals are being used in high concentrations or being heated (Example: hydrofluoric acid). If hydrofluoric acid is being used in the laboratory, the EH&S Questionnaire for Use of Hydrogen Fluoride Gas and Hydrofluoric Acid must be filled out and submitted to EH&S. This form may be downloaded from the EH&S website at <http://ehs.colorado.edu/publications.asp> by selecting Requirements for Use of Hydrogen Fluoride Gas and Hydrofluoric Acid.

A perchloric acid fume hood may be required if perchloric acid is being used or stored in concentrations greater than 72.5%. In addition, if perchloric acid is being heated or evaporated into the atmosphere or fume hood without a vapor capture/scrubber system in place a perchloric acid hood may be required.

When a new fume hood is installed, proper chemical storage cabinets should be located underneath. If adequate chemical storage is already available in the laboratory, the storage underneath may be approved for non-chemical storage, for example for vacuum pumps.

All fume hoods must be selected, installed and ventilated following UCB Standard Section 11610 and all its related sections: Section 15852 – Special Exhaust Systems, Division 12, Division 15, Division 16, and 15400 Series sections. Installation of fume hoods must be approved by Facilities Management and performed by an authorized contractor.

FLAMMABLE-PROOF REFRIGERATORS/FREEZERS - NFPA 45

Flammable-proof refrigerators/freezers are required for cold storage of any Class I flammable liquids (Examples: ethyl alcohol, methanol, acetone and hexane).

Flammable-proof refrigerators/freezers must meet the requirements of NFPA 45 9.2.2 Refrigeration and Cooling Equipment and National Electrical Code.

Flammable-proof refrigerators/freezers must be prominently marked to indicate they meet the requirements for safe storage of flammable liquids.

EYEWASH and SAFETY SHOWERS – ANSI Standard Z358.1-1998, UCB Standard 12349, 15440

The purpose of eyewashes and safety showers is to provide immediate relief to any laboratory occupant/user that may have been contaminated by chemicals. In order to effectively provide this care, the eyewashes and showers need to be immediately accessible. The closer to the chemical sources the better the coverage. EH&S may deem it necessary to have multiple eyewashes in one laboratory if the chemicals used in the laboratory present significant hazards. Selection, location and installation of eyewashes and safety showers must comply with ANSI Standard Z358.1-1998, UCB Standard 15440, and UCB Standard 12349.

Eyewashes are required inside laboratories which use or store chemicals that present an eye hazard. Eye/face wash units shall be in locations that require no more than 10 seconds to reach, within the same room as the hazard. The eye/face wash must be on the same floor level as the hazard, and the path of travel shall be free of doors and other obstructions that could hinder access to immediate use of the equipment. Where strong acids or caustics are used, the eye/face wash must be immediately adjacent (within 10 feet) to the hazardous chemical use.

Safety showers are required to be located near laboratories that use hazardous chemicals. Showers shall be in accessible locations that require no more than 10 second to reach and on the same floor level as the hazard. The path of travel shall be free of obstructions that could hinder access to immediate use of the equipment