

Office of the Vice President for Research
Environmental Health and Safety

Chemical Hygiene Plan

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Effective Date: circa 1991

Applies To: Employees, Faculty, Students, Others

For More Information contact: EHS, Chemical Health and Safety Manager at 860-486-3613

Table of Contents

[Foreword](#)

[Introduction](#)

[Summary](#)

- I. [Purpose](#)
- II. [Scope](#)
- III. [Policy Statement](#)
- IV. [Enforcement](#)
- V. [Definitions](#)
- VI. [Responsibilities](#)
- VII. [Procedures/Forms](#)
 - A. [Laboratory Safety Training](#)
 1. [Initial Safety Training](#)
 2. [Annual Refresher Training](#)
 3. [Laboratory Specific Training](#)
 - B. [Standard Operating Procedures](#)
 1. [General Rules](#)
 2. [Notification to EHS of Used/Empty/Disposed barcoded materials](#)
 3. [Personal Hygiene](#)
 4. [Personal Protective Equipment](#)
 5. [Housekeeping](#)
 6. [Laboratory Inspections](#)
 7. [Prior Approval](#)
 8. [Chemical Specific Safety Procedures](#)
 - C. [Records and Recordkeeping](#)
 - D. [Chemical Inventory Procedure](#)
 1. [Chemical Procurement](#)
 2. [Chemical Stockrooms/Storage](#)
 3. [Specific Chemical Incompatibilities and Instabilities](#)

4. [Peroxidizable Compounds](#)
5. [Laboratory Storage of Chemicals](#)
- E. [Medical Consultation/Examinations](#)

[Appendix A--Minimum Guidelines for Laboratory Health and Safety](#)

[Appendix B--Chemical Waste Disposal Manual](#)

Glossary of Terms

ANSI: American National Standards Institute

CFR: Code of Federal Regulations

DOT: U.S. Department of Transportation

EPA: U.S. Environmental Protection Agency

GHS: Globally Harmonized System of Classification and Labelling of Chemicals

NFPA: National Fire Protection Association

OSHA: Occupational Safety and Health Administration

PEL: Permissible Exposure Limits

SDS: Safety Data Sheets

TLV: Threshold Limit Values

Foreword

The University of Connecticut has many laboratories at its main campus, as well as laboratories at its regional campuses. Because the University employs people within these laboratories, the University is required to prepare a Chemical Hygiene Plan to be in compliance with ['The OSHA Laboratory Standard'](#) (29 CFR 1910.1450). Because Connecticut has its own OSHA– approved occupational safety and health plan, the State has adopted its own laboratory standard, which is as stringent as the Federal standard.

The OSHA Laboratory Standard was published as an amendment to 29 CFR 1910.1450, Subpart Z, and its title is 'Occupational Exposure to Hazardous Chemicals in Laboratories'. The effective date of the Standard was May 1, 1990, and the required written chemical hygiene plan was to be developed and implemented by January 31, 1991.

The OSHA Laboratory Standard supersedes all of Subpart Z of 29 CFR 1910, which includes the Hazard Communication Standard. However, some of the provisions of these standards are retained in the OSHA Laboratory Standard. These include the requirement for maintaining exposure limits below the Permissible Exposure Limits (PEL), information and training requirements, the use of Safety Data Sheets (SDS), labeling, and medical surveillance programs.

Introduction

This document serves as the Chemical Hygiene Plan for the University's laboratories, and was developed to meet the guidelines of 29 CFR 1910.1450, "Occupational Exposure to Hazardous Chemicals in Laboratories", a standard issued by the Occupational Safety and Health Administration (OSHA). This Chemical Hygiene Plan (CHP) will be accessible to all personnel of the University who are involved in any way with a laboratory activity, as well as to employee representatives, and State OSHA inspectors. Department-Specific Safety Manuals may also be appended to this document.

The Chemical Hygiene Plan places primary emphasis on engineering and administrative controls necessary to protect personnel from overexposure to hazardous substances in laboratories.

The University of Connecticut Chemical Hygiene Plan is comprised of the following elements:

- 1) Standard Operating Procedures.
- 2) Engineering Controls, Personal Protective Equipment, and Hygiene Practices.
- 3) Control Equipment Inspections and Review.
- 4) Safety Information and Training.
- 5) Special or Non--Routine Procedures.
- 6) Medical Surveillance Program/Environmental Monitoring.
- 7) Designated Chemical Hygiene Officer.
- 8) Safe Handling of Particularly Hazardous Substances.

Summary

The University of Connecticut laboratory practices will follow the National Research Council's general principles of Chemical Hygiene in Laboratories. They are as follows:

- 1) Minimize all chemical exposures.
- 2) Avoid underestimation of risk.
- 3) Provide adequate ventilation.
- 4) Institute a formal safety program.
- 5) Observe the Permissible Exposure Limits (PELs, U.S. Dept. of Labor, OSHA) and the Threshold Limit Values (TLVs, American Conference of Governmental Industrial Hygienists).

I. Purpose

UConn is committed to providing a healthy and safe work environment for the campus community. The UConn CHP establishes a formal written program for protecting laboratory personnel against health and safety hazards associated with hazardous chemicals in a laboratory setting. The CHP describes the proper use and handling procedures to be followed by faculty, staff, and all other personnel working with hazardous chemicals in laboratory settings.

II. Scope

The CHP applies to all laboratories that use, store, or handle hazardous chemicals and all personnel who work in these facilities. The information presented in the CHP represents best practices and provides a broad overview of the information necessary for the safe operation of laboratories that utilize hazardous chemicals. Laboratory use of hazardous chemicals is defined as handling or use of such chemicals in which lab specific procedures used do not simulate a production process, whose function is to produce commercial quantities of materials; and where protective laboratory practices and equipment are available and commonly used.

The University of Connecticut clearly meets the criteria established under OSHA 1910.1450, and is therefore subject to the requirements of the Laboratory Standard.

III. Policy Statement

As stated in the University's Health and Safety Policy, the University of Connecticut is committed to providing a healthful and safe environment for all activities under its jurisdiction and complying with federal and state health and safety standards. Faculty, staff and students all share responsibility for minimizing their exposure to hazardous chemical substances. This Chemical Hygiene Plan shall be implemented for all non-laboratory facilities at the University of Connecticut where hazardous chemicals are handled.

IV. Enforcement

Violations of this plan may result in appropriate disciplinary measures in accordance with University Laws and By-Laws, General Rules of Conduct for All University Employees, applicable collective bargaining agreements, and the University of Connecticut Student Conduct Code.

V. Definitions

29 CFR 1910.1450 - Code of Federal Regulations, Title 29, Section 1910.1450 – Occupational exposure to hazardous chemicals in laboratories. [OSHA Laboratory Standard](#)

ANSI Standard Z87.1 'Eye and Face Protection' - Sets forth criteria related to the description, general requirements, testing, marking, selection, care and use of protectors to minimize or prevent injuries, from such hazards as impact, non-ionizing radiation and chemical type injuries, in occupational and educational environments including, but not limited to, machinery operations, material welding and cutting, chemical handling, and assembly operations.

GHS - The GHS is an acronym for [The Globally Harmonized System of Classification and Labelling of Chemicals](#). The GHS is a system for standardizing and harmonizing the classification and labelling of chemicals. It is a logical and comprehensive approach to defining health, physical and environmental hazards of chemicals; creating classification processes that use available data on chemicals for comparison with the defined hazard criteria; and communicating hazard information, as well as protective measures, on labels and Safety Data Sheets (SDS).

NFPA 45 'Fire Protection for Laboratories'- This standard provides basic requirements to protect life and property through prevention and control of fires and explosions involving the use of chemicals in laboratory-scale operations. [NFPA 45](#) applies to laboratory buildings, laboratory units, and laboratory work areas whether located above or below grade in which chemicals, as defined, are handled or stored. Criteria cover laboratory unit hazard classification, design, and construction; fire and explosion hazard protection; ventilating systems and chemical fume hoods; chemical storage, handling, and waste disposal; flammable and combustible liquids; compressed and liquefied gases; operations; and hazard identification.

[OSHA Laboratory Safety Guidance](#) – This guidance document provides a general overview of the particular laboratory safety standards-related topic.

Carcinogen List - [National Toxicology Program Carcinogens](#). Call EHS for information on the International Agency for Research on Cancer (IARC) carcinogens.

Hazardous Chemical - OSHA defines a hazardous chemical as a substance for which there is statistically significant evidence, based on at least one scientific study, showing that harm may result from acute or chronic exposure to that chemical.

VI. Responsibilities

The University is obligated to ensure chemical health and safety at all levels in both teaching and research laboratories, including:

Vice President for Research (VPR) -- ultimately responsible for chemical safety on the campuses, and who, with the University administration, must provide the support for implementation and maintenance of a chemical hygiene program.

University Chemical Hygiene Committee (CHC) -- responsible for reviewing, recommending, and developing policies and procedures to establish safe work practices involving chemicals.

Chemical Hygiene Officers (CHO) – The [EHS Chemical Health and Safety Manager](#) serves as the University CHO and acts as the representative of the Vice President for Research. The University CHO is responsible for preparing, implementing, and maintaining the written *Chemical Hygiene Plan*.

Other CHO's must be designated by Unit Managers or Department Heads, and may be a second title for someone such as a Laboratory Director or a PI. Their assigned duties will be to ensure that the Chemical Hygiene Plan is being followed and to communicate non-compliant issues in departmental laboratories to EHS and the CHC.

Deans/Departments Heads -- responsible for establishing chemical safety committees within their respective departments/units, and for chemical hygiene in general within their departments.

Departmental Safety Committees/Building Safety Committees -- responsible for assisting the University Chemical Hygiene Officer in implementing this plan. These committees may develop additional policies or procedures with the intent to promote prudent work practices which are specific for their departments, and/or research area by developing a departmental or lab specific safety manual.

Principal Investigator (PI) – PIs are responsible for chemical hygiene in the laboratory/laboratories assigned to them. They must have up-to-date laboratory safety training and knowledge of the chemical inventory in their laboratory. This includes knowing the hazards and how to control exposures through the proper selection of laboratory techniques and engineering controls. The PI acts as the Chemical Hygiene Officer for their lab and will inform all personnel working in the laboratory of the hazards associated with the chemicals present, encourage safe analytical techniques, and detail

procedures for dealing with accidental spills as the default CHO. The PI should communicate with the parties mentioned above for assistance in monitoring engineering controls (ventilation, etc.), lab air quality, chemical waste disposal, chemical inventory maintenance, acquiring permission to obtain extremely hazardous substances, and understanding the legal requirements associated with all aspects of chemical usage in the laboratory.

Laboratory Personnel -- Laboratory personnel and other occupants are obligated to understand the chemical hygiene plan, maintain current laboratory safety training, and report any unsafe practices or conditions to any of the aforementioned parties. They should develop good laboratory habits in conducting any research involving the use of chemicals, and know the proper means of disposal of waste chemicals. With the PI, the laboratory worker is responsible for dating incoming chemicals, properly storing them, labeling containers holding chemicals or intermediates of reactions, communicating disposal/use of chemicals in the Chemical Inventory System (CIS), and informing visitors to the laboratory of the potential hazards within, and the associated rules. This information can be displayed using signs and symbols.

VII. Procedures/Forms

A. Laboratory Safety Training

The OSHA Laboratory Standard requires that training be provided to all individuals working in laboratories at the time of an employee's initial assignment to a work area where hazardous chemicals are present and prior to assignments involving new exposure situations. It is the responsibility of the University to ensure that each employee attend initial and refresher safety trainings provided by EHS and job-specific training provided by departments, principal investigators, laboratory supervisors or other qualified individuals. Failure of employees to attend required trainings prior to work in laboratories violates the [University Code of Conduct](#).

1. Initial Safety Training

EHS shall provide initial safety training for all new employees working in laboratories. It is the responsibility of departments, department heads, principal investigators, laboratory supervisors, and laboratory personnel to attend the [Laboratory Safety & Chemical Waste Management Training](#) prior to work in laboratories. Training records will be maintained by EHS. The training covers the following topics:

- The contents and location of the *OSHA Laboratory Standard*
- The location and details of the *Chemical Hygiene Plan*
- The permissible exposure limits for OSHA regulated substances or recommended exposure limits
- Signs and symptoms associated with exposures to hazardous chemicals used in the laboratory
- The location and availability of known reference material on the hazards, safe handling, storage and disposal of hazardous chemicals found in the laboratory
- Methods and observations that may be used to detect the presence or release of a hazardous chemical
- The physical and health hazards of chemicals in the work area
- Appropriate work practices, emergency procedures, and personal protective equipment to be used to protect employees from hazards in laboratories

2. Annual Refresher Training

Employees are required to take annual refresher training provided by EHS to ensure all employees are up-to-date with current federal and state regulations along with University policies and standards. The refresher training course is offered through EHS in both in-person and online formats. Training records will be maintained by EHS.

3. Laboratory-Specific Training

In addition to training provided by EHS, laboratory-specific training must be provided by departments, principal investigators or laboratory supervisors on the specific hazards of chemicals, equipment or operations unique to each laboratory.

Examples of laboratory-specific training include, but are not limited to:

- Use of cryogenic liquids
- Safety protocols for use of equipment that present health and physical hazards to employees (e.g. impact, cuts/penetration, harmful dusts/vapors, noise, etc.)
- Procedures using particularly hazardous chemicals (i.e. potentially explosive chemicals, pyrophoric chemicals, water-reactive chemicals, carcinogens, reproductive toxins, controlled substances, etc.)
- Emergency procedures for specific operations and equipment present in the lab

Laboratory-specific training must take place prior to employee use of the chemical, equipment or operation. Documentation of the training is recommended.

B. Standard Operating Procedures

1. General Rules

- a. PIs and Lab Managers must ensure students and employees do not work alone as defined in the [UConn Working Alone Policy](#), which states that working alone in an immediately hazardous environment is not permitted. Periodic hazard assessment of tasks, chemicals, and other potential hazards (energy, pressure systems) must be performed as stipulated in the "[Prior Approval](#)" section, and documented on the Workplace Hazard Assessment Form for Laboratories (WHA).

In situations where a worker knows he/she will be working alone, a periodic cross check should be maintained, either by phone calls or inter-laboratory personal checks.

- b. Unauthorized individuals are not allowed in laboratories. Access is limited to authorized University faculty, staff, students and visitors with legitimate reasons for being in such a laboratory. Authorized individuals must be properly trained, made aware of the hazards present in the lab, and provided appropriate personal protective equipment.
- c. Individuals under 18 years old are not allowed in laboratories that contain hazards unless they are University of Connecticut students or registered participants in a University-sanctioned project or program. Authorized

individuals under 18 years old must be supervised at all times while working in laboratories.

Note: Activities involving minors, who are not enrolled or accepted for enrollment in credit-granting courses at the University or who are not an employee of the University, must be sponsored by a unit within the University, be registered with the University's Minor Protection Coordinator, and meet University standards described in the [Policy for the Protection of Minors and Reporting of Child Abuse and Neglect](#). For more information, please visit: <http://minorprotection.uconn.edu>

- d. Pets are not allowed in laboratories, with some limited [exceptions](#) for police dogs and service animals (e.g. guide dogs). The only live vertebrate animals allowed in laboratories are those to be used in teaching and research and must be approved prior to entry by the [Institutional Animal Care and Use Committee \(IACUC\)](#).
- e. Wear appropriate personal protective equipment ([see PPE](#)) in the laboratory at all times. This also applies to visitors.
- f. When working with flammable chemicals, be certain that there are no sources of ignition nearby to cause a fire or explosion in the event of a vapor release or liquid spill.

For the chemicals they are working with, all personnel should know and constantly be aware of:

- *The chemical hazards as determined from the SDS and other appropriate references (see [UCONN Hazard Communication Policy](#)).*
- *The location and proper use of emergency equipment.*
- *Appropriate safeguards for using a chemical, including PPE.*
- *How and where to properly store the chemical when it is not in use.*
- *Proper personal hygiene practices.*
- *The proper methods of transporting chemicals within the facility.*
- *Appropriate procedures for emergencies, including evacuation routes, spill cleanup procedures and proper waste disposal.*

2. Notification to EHS of Used/Empty/Disposed barcoded materials

PI's or their designees are required to notify EHS when barcoded materials/containers have been removed from inventory.

3. Personal Hygiene

- a. Wash promptly whenever a chemical has come in contact with the skin.
- b. Avoid inhalation of chemicals; do not "sniff" to test chemicals.
- c. Do not use mouth suction to pipet anything; use suction bulbs or other engineered pipetting devices.
- d. Wash hands well with soap and water before leaving the laboratory; do not wash with solvents.
- e. Do not drink, eat, smoke, or apply cosmetics in the laboratory.
- f. Do not bring food, beverages, tobacco, or cosmetic products into chemical storage or use areas.

4. Personal Protective Equipment (PPE)

- a. Safety glasses or goggles are required in active lab areas where hazardous chemicals are used or stored. Eye protection must meet the requirements of the American National Standards Institute (ANSI) Z87.1. Face shields that protect the chin, neck, and ears must be worn by employees working with large quantities of hazardous chemicals or performing experiments with an increased likelihood of splashing or flying particles. Face shields must be used in conjunction with safety glasses or goggles.
- b. When working with corrosive liquids, wear gloves made of a material known to be resistant to permeation by the corrosive chemical. [Chemical resistance guidelines can be provided by EHS.](#)
- c. Proper laboratory attire includes laboratory coats over normal clothing which offers better protection against spills. Long pants are part of proper laboratory attire. Shorts should not be permitted. Proper attire must be documented when the PI is developing/reviewing the WHA form with laboratory personnel.
- d. When working with allergenic, sensitizing, or toxic chemicals, wear gloves made of a material known to be, or tested and found to be, resistant to permeation by the chemicals and tested for the absence of pin holes. [Contact EHS for chemical resistance guidelines \(486-3613\).](#)
- e. Always wear low-heeled shoes with fully covering uppers; shoes with open toes, or sandals are not permitted.

- f. Whenever exposure by inhalation is likely to exceed the threshold limits described in an SDS, use a fume hood. Consult with your supervisor before doing any such work, or [contact EHS](#).
- g. Carefully inspect all protective equipment before using. Do not use defective protective equipment.
- h. Respirators are not a normal part of PPE in a laboratory. Engineering controls are the preferred method of protection against inhalation hazards. Experiments with potential inhalation hazards shall be performed under an exhaust or fume hood. Notify EHS for an evaluation if it is determined that a respirator is required by the WHA.

5. Housekeeping

- a. Access to emergency equipment, showers, eyewashes, and exits should remain unobstructed at all times.
- b. All chemicals in original containers must be inventoried and labeled with the identity of the contents and any known hazards to users. New containers are inventoried and labeled by Central Stores in the Chemical Inventory Management System.
- c. Keep all work areas, especially laboratory benches, clear of clutter.
- d. Keep all aisles, hallways, and stairs clear of all chemicals.
- e. All chemicals should be placed in their assigned secure storage areas at the end of each workday.
- f. At the end of each workday, or if the lab is to be left unattended, the contents of all unlabeled containers should be labeled.
- g. Waste should be properly labeled and kept in the proper containers. Call EHS for removal and to have the item(s) removed from the Chemical Inventory System.
- h. Promptly clean up all spills; properly dispose of the spilled chemical and cleanup materials.

6. Laboratory Inspections

EHS will conduct laboratory safety inspections to ensure compliance with federal and state laws and regulations, along with University's policies and standards. Priority will be given to laboratories using highly reactive, toxic or potentially-explosive substances. The EHS inspection procedure is outlined below:

- a. EHS will contact the principal investigator or supervisor of each laboratory in advance of each inspection.
- b. EHS will inspect the laboratory.
- c. A copy of the inspection report will be sent to the laboratory principal investigator or supervisor within 7 business days.
- d. The principal investigator or supervisor must take corrective action and respond to EHS within 21 days of receipt of the inspection report.
- e. Laboratories identified with unsafe conditions will be re-inspected by EHS. Re-inspections may be either announced or unannounced. If progress is unsatisfactory, a second inspection report will be sent to the principal investigator or supervisor and the department head.

Standards to achieve laboratory compliance are outlined in the [Laboratory Inspection Program](#). In addition to EHS inspections, routine self-inspections should be carried out by principal investigators, laboratory supervisors or laboratory personnel to confirm compliance and address safety-related issues.

7. Prior Approval

Insofar as possible, personnel should obtain prior approval to proceed with a laboratory task from their supervisor whenever:

- a. An unfamiliar laboratory procedure or test is to be carried out.
- b. It is likely that the toxic limit concentration could be exceeded or that other harm is likely.
- c. There is a change in a procedure or test, even if it is very similar to prior practices. "Change in a procedure or test" means:
 - *A substantial increase or decrease in the amount of one or more chemicals used.*
 - *A substitution or deletion of any of the chemicals in a procedure.*
 - *Any change or other condition under which the procedure is to be conducted.*
- d. There is a failure of any of the equipment used in the process, especially of safeguards such as fume hoods or clamped apparatus.

- e. There are unexpected results.
- f. Laboratory personnel, who become ill, suspect that they or others have been overexposed, or otherwise suspect a failure of any safeguards.

8. Chemical-Specific Safety Procedures

a. Procedures for Toxic Chemicals

The SDSs for many of the chemicals used in the laboratory will state recommended limits or OSHA mandated limits, or both, as guidelines for exposure. Typically limits are Threshold Limit Values (TLV), Permissible Exposure Limits (PEL), and action levels. When such limits are stated, they will be used to assist the chemical hygiene officer in determining the safety precautions, control measures and safety apparel that apply when working with toxic chemicals. The following are meant as guidelines only. When an overexposure is suspected, call EHS at (860) 486-3613 for possible air monitoring.

- When a TLV or PEL value is less than 100 milligrams per cubic meter of air, the chemical should be used in an operating fume hood, glove box, vacuum line, or similar device.
- If a TLV, PEL, or comparable value is not available for that substance, the animal or human median inhalation lethal concentration information, LC⁵⁰ should be reviewed if available. If that value is less than 2000 mg/m³ (when administered continuously for one hour or less), then the chemical should be used in an operating fume hood, glove box, vacuum line, or similar device, which is equipped with appropriate traps and/or scrubbers.
- Whenever laboratory handling of toxic substances with vapor pressures likely to exceed air concentrations limits, laboratory work with such liquids and solids should be conducted in a certified/approved fume hood, glove box, vacuum line, or similar device.

b. Procedures for Flammable Chemicals

In general, the flammability of a chemical is determined by its flashpoint, i.e. the lowest temperature at which an ignition source can cause the chemical to ignite momentarily under controlled conditions.

- Chemicals with a flash point below 200°F (93.3 °C) will be considered "fire-hazard chemicals".

- OSHA standards and the National Fire Protection Association (NFPA) guidelines on when a chemical is considered flammable apply to the use of flammable chemicals in the laboratory.

"Flammable and Combustible Liquids Code" and NFPA Manual 45, "Fire Protection for Laboratories Using Chemicals"

- Flammables must be stored in a flammable solvent storage area or in storage cabinets designed for flammable materials.
- Flammables must be used in vented hoods and away from sources of ignition; otherwise, additional precautions should be taken. In such cases, please contact the UConn Fire Department at (860) 486-4925.

c. Procedures for Reactive Chemicals

A reactive chemical is one that:

- Is described as such in the SDS,
- Is ranked by the NFPA as 3 or 4 for reactivity,
- Is identified by the Department of Transportation (DOT) as:
 - An oxidizer,
 - An organic peroxide, or
 - An explosive, Class A, B, or C,
- Fits the EPA definition of reactive in [40 CFR 261.23](#),
- Fits the OSHA definition of unstable in [29 CFR 1910.1450](#), or
- Is known or found to be reactive with other substances.

Procedure: *Handle reactive chemicals with all proper safety precautions, including segregation in storage.*

d. Procedures for Corrosive Chemicals and Contact-Hazard Chemicals

Corrosivity, allergenic, and sensitizer information is sometimes given in manufacturers' SDSs and on labels. Also, guidelines on which chemicals are corrosive can be found in other OSHA standards and in regulations promulgated by DOT in 49 CFR and the EPA in 40 CFR.

A corrosive chemical is one that:

- Fits the OSHA definition of corrosive in [29 CFR 1910.1200](#),
- Fits the EPA definition of corrosive in [40 CFR 261.22](#) (has a pH greater than 12.5 or less than 2.0), or
- Is known or found to be corrosive to living tissue.
- A contact-hazard chemical is an allergen or sensitizer that:
 - Is so identified or described in the SDS or on the label, or
 - Is so identified or described in the medical or industrial hygiene literature

Procedure: Handle corrosive chemicals with all proper safety precautions, including wearing safety goggles and/or face shield, gloves tested and known to be resistant to permeation or penetration, and a laboratory apron or laboratory coat.

e. Control Measures and Equipment

Chemical safety is achieved by continual awareness of chemical hazards and by keeping the chemical under control by using precautions, including engineering safeguards such as hoods. Laboratory personnel should be familiar with the precautions to be taken, including the use of engineering and other safeguards. Laboratory supervisors should be alert to detect the malfunction of engineering and other safeguards. All engineering safeguards and controls should be properly maintained, inspected on a regular basis, and never overloaded beyond their design limits. Contact EHS for evaluations, and Facilities Operations for maintenance/repair.

i) Ventilation

Laboratory ventilation should be sufficient such that no one is overexposed to chemical vapors. Work involving toxic chemicals that have low air concentration limits, or that have high vapor pressures, should always be done in a fume hood.

Fume hoods should provide 80-100 linear feet per minute (fpm) of air flow across the face of the hood. EHS will evaluate hoods on request, and on a continuing scheduled basis. A green sticker indicates the hood is operating optimally. A yellow sticker indicates that the hood, while providing exhaust, may be either under - or over - performing. Use with caution - initiate a work order with Facilities Operations to optimize the performance. A red sticker indicates that the hood does not meet the criteria established for safe working conditions. Initiate a work order immediately. [Contact EHS at \(860\) 486-4927 to have a fume hood evaluated.](#)

Laboratory personnel should understand the following:

- A fume hood is a safety backup for condensers, traps, or other devices that collect vapors and fumes.
- The apparatus inside the hood should be placed on the floor of the hood at least six inches away from the front edge.
- Fume hood windows should be lowered at all times, except when necessary to raise them to adjust the apparatus that is inside the hood.
- The hood fan should be kept "on" whenever a chemical is inside the hood, whether or not any work is being done in the hood.

- Personnel should be aware of the steps to take in the event of a power (e.g., fume hood) or other utility (e.g., steam) failure based on laboratory specific procedures.
- Hoods should not be used as storage areas for chemicals, apparatus, or other materials.

ii) Flammable-Liquid Storage

If metal safety cans are used for fire-hazard chemicals, they should be used only as recommended by the manufacturer, including the following safety practice:

- Never disable the spring-loaded closure.
- Always keep the flame-arrestor screen in place; replace it if is punctured or damaged.

Cabinets designed for the storage of flammable materials should be properly used and maintained. Read and follow the manufacturer's information and also follow these safety practices:

- Store only compatible materials inside a cabinet.
- Do not store paper or cardboard or other combustible packaging material in a flammable-liquid storage cabinet.
- The manufacturer establishes quantity limits for various sizes of flammable-liquid storage cabinets; do not overload a cabinet.

iii) Eyewash Fountains and Safety Showers

It is desirable to have plumbed eyewashes and safety showers. These must be located so they can be reached from any point in the laboratory, within 10 seconds, or located within 100 feet. The 2009 ANSI standard recommends that the water should be “tepid”, in the range of 60-100°F.

Lab staff should check the functioning of eyewash fountains (weekly). Safety shower functionality will be evaluated by Facilities Operations on an annual basis.

It is the responsibility of the lab occupants to ensure that both eyewash stations and safety showers are functional in case of emergency. The proper functioning of eyewash stations and safety showers can be arranged by contacting [Facilities Operations](http://www.facilities.uconn.edu/wopolicy.html) at <http://www.facilities.uconn.edu/wopolicy.html>.

Ensure ready access to eyewash fountains and safety showers.

iv) Vapor Detection/Environmental Monitoring

Do not use odor as a means of determining if inhalation exposure limits are, or are not, being exceeded. Whenever there is reason to suspect that a toxic chemical inhalation limit might be exceeded, whether or not a suspicious odor is noticed, notify the PI and EHS. EHS will provide industrial hygiene consultation, as well as air monitoring and sample analysis, either upon request or as a result of its own assessment of air quality during a laboratory inspection.

v) Procedures for Carcinogens, Reproductive Toxins, Substances That Have A High Degree of Acute Toxicity

Follow the procedures described in this section when performing laboratory work with any select carcinogen, reproductive toxin, substance that has a high degree of acute toxicity, or a chemical whose toxic properties are unknown.

The following definitions will apply:

- *Carcinogen*: any substance defined as such in 29 CFR 1910.1450 and any other substance described as such in the applicable SDS.
- *Reproductive toxin*: any substance described as such in the applicable SDS.
- *Substance with a high degree of acute toxicity*: Any substance for which the LD50 data described in the applicable SDS cause the substance to be classified as a "highly toxic chemical" as defined in ANSI Z129.1.
- *Chemical whose toxic properties are unknown*: A chemical for which there is no known statistically significant study conducted in accordance with established scientific principles that establishes its toxicity.
- For the purposes of this Chemical Hygiene Plan, *hazardous chemicals* are those identified in categories 'a', 'b', 'c', and 'd'.
- *Designated area*: A hood, glove box, portion of a laboratory, or an entire laboratory room designated as the only area where work with quantities of the above chemicals in excess of the specified limit shall be conducted.

Designated areas shall be posted and their boundaries clearly marked. Only those persons trained to work with these hazardous chemicals will work in the designated area. All such persons should:

- Use the smallest amount of a chemical that is consistent with the requirements of the work to be done.
- Use High-Efficiency Particulate Air (HEPA) filters or high-efficiency scrubber systems to protect vacuum lines and pumps.
- Store chemicals or remove them from storage.
- Decontaminate a designated area when work is completed.
- Prepare wastes from work with these chemicals for waste disposal in accordance with specific disposal procedures consistent with the Resource Conservation and Recovery Act (RCRA) and as designated by EHS.
- If possible, store all hazardous chemicals in locked and enclosed spaces with a slight negative pressure compared to the rest of the building.
- Because the decontamination of jewelry may be difficult or impossible, do not wear jewelry when working in designated areas.
- Wear long-sleeved disposable clothing and gloves known to resist permeation by the chemicals to be used when working in designated areas.

C. Records and Recordkeeping

This section reviews the value of documenting an employer's compliance with the Laboratory Standard, which is required by [29 CFR 1910.20](#).

The Laboratory Standard requires that records of air concentration monitoring results, exposure assessments, medical consultations and examinations be maintained for at least 30 years and that they be accessible to personnel or their representatives. Air monitoring records are on file at EHS. Call EHS for the location of the medical records on file.

It is desirable to develop a system that retains documents related to the distribution and maintenance of safety data sheets, the safety training of personnel, and significant employee suggestions for many years, perhaps for the lifetime of the institution. For example, although not required by any regulation at this time, some employers use "SDS sign-off" records; for each hazardous chemical used or handled, personnel certify by dated signature that they have read the SDS and understand the content.

Specific records may be required in the event of lost work time resulting from an exposure or accident on the job. Use OSHA Form 300 to record lost workdays that occur. Contact your local OSHA office for details (CT OSHA office (860) 566-4550).

In addition to required records, reported exposures/complaints must be recorded regardless of the outcome of an exposure assessment. Other incidents or “near-miss” incidents must also be documented for future reference. All near miss events should be documented and reported to EHS and the CHC for official documentation and potential review. Examples include:

- **Major safety suggestions from personnel:** To improve laboratory safety, keep these records. A suggestion that is unusable today might be useful tomorrow. Even when a suggestion is clearly non workable, it should be taken seriously, examined, and recorded.
- **Near-miss reports:** A “near-miss” incident is an event or circumstance that did not; but could have caused physical harm or infrastructure damage. Laboratory personnel, who participate in or witness events that could have caused harm, must communicate the incident to EHS and the CHC so a report can be created. These reports are used to develop changes in procedures that will prevent a future more serious occurrence.
- **Building Repair and Infrastructure Maintenance records:** These records should be kept by Facilities Operations. These records are useful to suggest corrective actions and indicate that building infrastructure was, or was not, well maintained and kept in working condition. Repair and maintenance records of all other lab specific control systems should be centralized and maintained by departmental or unit laboratory personnel.

D. Chemical Inventory Procedure

A chemical inventory system is a crucial part of any laboratory safety program. Subsequent to, and in conjunction with, the chemical inventorying practices in the Department of Chemistry, the University committed to implementing a campus wide chemical inventory management system in 2014. The purpose of implementing the chemical inventory management system is to promote uniformity on how chemicals are received at the University and standardize inventory practices. Chemical shipments will be received at Central Stores for systematic inventorying. At Central Stores, chemical shipments will be unpacked, added as an item to a lab specific inventory, assigned a unique barcode and delivered to the appropriate destination.

1. Chemical Procurement

When placing an order for any chemical to be shipped to UConn, SDS information on proper handling, storage, and disposal must be obtained by the supplier in either electronic or in paper form. This information shall be made readily accessible to all potential handlers and users. It is the responsibility of the PI of the laboratory in which the chemical is to be used to ensure that these conditions are met, including any training. It is the policy of the University that procurement of

chemicals will be done on a minimum quantity basis; large quantity discounts should not be an incentive in purchasing chemicals that are not used extensively. All chemical containers accepted by the University must meet the new GHS labelling requirements under OSHA's Hazard Communication standard. The chemical inventory management system will be maintained by Central Stores and EHS.

2. Chemical Stockrooms/Storage

EHS suggests following the general storage patterns shown in figures 1 and 2. In addition, other storage suggestions are as follows:

- Avoid chemical storage (even temporary) on the floor.
- Avoid storage of chemicals on top shelves.
- Avoid storage of chemicals above eye level.
- Make sure shelf assemblies are firmly secured to walls. Avoid island shelf assemblies.
- Ideally, shelving assemblies would be of wood construction.
- Avoid metal adjustable shelf supports and clips.
- Store acids in a dedicated acid cabinet. Store nitric acid in that same cabinet only if isolated from the other acids. Store both inorganic and some organic acids in the acid cabinet.
- Store flammables in a dedicated flammables cabinet in each lab unless prohibited by space restrictions.
- Store severe poisons in a dedicated poisons cabinet.

The following figures represent diagrams of shelf storage patterns segregating chemicals.

Fig 1. Suggested Shelf Storage Pattern -- Inorganics

		shelf
<p>ACID STORAGE CABINET</p> <p>Acids (best stored in dedicated cabinets)</p> <p>EXCEPT NITRIC ACID - STORE NITRIC ACID AWAY FROM OTHER ACIDS unless your acid cabinet provides a separate compartment for Nitric Acid.</p> <p>Do not store chemicals on the floor</p>	<p>Sulfur, Phosphorous, Arsenic, Phosphorous Pentoxide</p>	<p>Arsenates, Cyanides, Cyanates</p> <p>(STORE AWAY FROM ANY WATER)</p> <p>1</p>
	<p>Halides, Sulfates, Sulfites, Thiosulfates, Phosphates, Halogens, Acetates</p>	<p>Sulfides, Selenides, Phosphides, Carbides, Nitrides</p> <p>2</p>
	<p>Amides, Nitrates*, Nitrites, Azides</p> <p>* AMMONIUM NITRATE ideally should be stored separately</p>	<p>Borates, Chromates, Manganates, Permanganates</p> <p>3</p>
	<p>Metals And Hydrides</p> <p>(STORE AWAY FROM ANY WATER AND STORE FLAMMABLE SOLIDS IN A FLAMMABLES CABINET)</p>	<p>Chlorates, Perchlorates, Chlorites, Perchloric Acid, Peroxides, Hypochlorites, Hydrogen Peroxide</p> <p>4</p>
	<p>Hydroxides, Oxides, Silicates, Carbonates, Carbon</p>	<p>Miscellaneous</p> <p>5</p>

Fig 2. Suggested Shelf Storage Pattern -- Organics

		shelf
Alcohols, Glycols, Amines, Amides, Imines, Imides STORE FLAMMABLES IN A DEDICATED CABINET	Phenols, Cresols	1
Hydrocarbons, Esters, Aldehydes STORE FLAMMABLES IN A DEDICATED CABINET	Peroxides, Azides, Hydroperoxides	2
Ethers, Ketones, Halogenated Hydrocarbons, Ethylene Oxide STORE FLAMMABLES IN A DEDICATED CABINET	Acids, Anhydrides, Peracids STORE CERTAIN ORGANIC ACIDS IN AN ACID CABINET	3
Epoxy Compounds, Isocyanates	Miscellaneous	4
Sulfides, Polysulfides, Etc.	Miscellaneous	5

POISON STORAGE CABINET
Toxic Substances
STORE SEVERE POISONS IN A POISON CABINET

FLAMMABLE STORAGE CABINET	shelf
FLAMMABLE Alcohols, Glycols, etc.	1
FLAMMABLE Hydrocarbons, Esters, etc.	2
FLAMMABLE Ethers, Ketones, etc.	3

Do not store chemicals on the floor

3. Specific Chemical Incompatibilities and Instabilities

The following chemical reagents must be dated and handled according to prescribed storage conditions, and disposed of after use:

Chemical	Keep Out of Contact With
Acetic Acid	Nitric acid, peroxides, permanganates, ethylene glycol, hydroxyl compounds, perchloric acid, or chromic acid
Acetone	Concentrated sulfuric and nitric acid
Acetylene	Bromine, chlorine, fluorine, copper, silver, mercury and their compounds
Alkali Metals	Carbon tetrachloride, carbon dioxide, water, halogens
Alkaline Metals (powdered aluminum or magnesium)	Carbon tetrachloride, or other chlorinated hydrocarbons, halogens, carbon dioxide
Ammonia, Anhydrous	Mercury, hydrogen fluoride, calcium hypochlorite, chlorine, bromine
Ammonium Nitrate	Acids, flammable liquids, metal powders, sulfur, chlorates, any finely divided organic or combustible substance
Aniline	Nitric acid and hydrogen peroxide
Bromine, Chlorine	Ammonia, petroleum gases, hydrogen, sodium, benzene, finely divided metals
Carbon, activated	Calcium hypochlorite and all oxidizing agents
Chlorates	Ammonium salts, acids, metal powders, sulfur, and finely divided organic or combustible substances
Chlorine dioxide	Ammonia, methane, phosphine, hydrogen sulphide
Chromic acid	Glacial acetic acid, camphor, glycerin, naphthalene, turpentine, lower molecular weight alcohols, and many flammable liquids
Copper	Acetylene and hydrogen peroxide

Chemical	Keep Out of Contact With
Cyanides	Acids and alkalines
Flammable liquids	Ammonium nitrate, chromic acid, hydrogen peroxide, sodium peroxide, nitric acid and the halogens
Hydrocarbons (propane, benzene, gasoline)	Fluorine, chlorine, bromine, sodium peroxide and chromic acid
Hydrofluoric Acid	Ammonia(aqueous or anhydrous)
Hydrogen Peroxide	Most metals and their salts, alcohols, organic substances, any flammable substances
Hydrogen Sulfide	Oxidizing gases, fuming nitric acid
Iodine	Acetylene, ammonia, hydrogen
Mercury	Acetylene, ammonia
Nitric Acid	Acetic acid, hydrogen sulfide, flammable (concentrated) liquids and gases, chromic acid, aniline
Oxygen	Oils, grease, hydrogen, flammable liquids, solids and gases
Oxalic acid	Silver, mercury
Perchloric Acid	Acetic anhydride, bismuth and its alloys, alcohols, paper, wood, and other organic materials
Phosphorus Pentoxide	Water
Potassium Chlorate	Sulfuric and other acids, any organic material
Potassium Permanganate	Sulfuric acid, glycerine, ethylene glycol
Silver	Acetylene, ammonia compounds, oxalic acid, tartaric acid
Sodium Peroxide	Ethyl or methyl alcohol, glacial acetic acid, carbon disulfide, glycerine, ethylene glycol, ethyl acetate
Sulfuric Acid	Potassium chlorate, potassium perchlorate, potassium permanganate

4. Peroxidizable Compounds

Peroxidizable compounds tend to absorb and react with oxygen from the air to form unstable peroxides. **Table 1** lists specific chemicals in this category. Pay attention to the following details regarding these compounds:

- Date and CIS barcode all peroxidizable compounds when received and when opened.
- Eliminate compounds in Group A three months after opening, and Group B compounds one year after opening.
- Inspect all containers of undetermined age prior to opening, and, if it appears old or in bad condition, do not attempt to open.
- Order less than a six month supply of these chemicals.
- Store these materials separately from oxidizers and mineral acids.

Table 1 -- Peroxidizable compounds

Group A - Eliminate 3 months after Opening	
Isopropyl ether	
Divinyl acetylene	Butadiene
Vinylidene chloride	Vinyl pyridine
Potassium metal	Tetrafluoroethylene
Sodium metal	Chloroprene

Group B –Eliminate One Year After Opening	
Diethyl ether	<i>Shock/heat-sensitive compounds</i> Ammonium perchlorate
Dicyclopentadiene	Dibenzoyl peroxide
Tetrahydrofuran	Ammonium permanganate
Diacetylene	Anhydrous perchloric acid
Dioxane	Dinitrobenzene (ortho)
Methyl acetylene	Butyl Hydroperoxide
Decahydronaphthalene (Decalin)	Ethyl methyl ketone peroxide
Tetrahydronaphthalene (Tetralin)	Butyl perbenzoate
Ethylene glycol dimethyl ether	Ethyl nitrate
Vinyl ethers	Butyl peroxyacetate, tert
Acetamethyl methacrylate	Hydroxylamine
Chlorotrifluoroethylene	Peroxyacetic acid
Styrene	1Chloro2,4dinitrobenzene
Vinyl acetylene	Picric acid
Acrylic acid	Cumene hydroperoxide
Vinyl acetate	Trinitrobenzene
Acrylonitrile	Diacetyl peroxide
Vinyl chloride	Trinitrotoluene

5. Laboratory storage of chemicals

When individual laboratories require their own chemical storage area, amounts permitted should be as small as practical. The PI should inspect and review such storage areas periodically to remove any old and never-used chemicals. Exposure to heat and direct sunlight should be avoided.

E. Medical Consultation/Examination

All University laboratory personnel who work with hazardous chemicals will be provided the opportunity to receive medical attention and follow-up examinations by, or under the supervision of, a licensed physician. This medical consultation will be provided at no cost to the individual and will be provided to the individual under the following circumstances:

- Whenever an individual develops signs or symptoms associated with a hazardous chemical to which the individual may have been overexposed in the lab.
- Where monitoring reveals an exposure level routinely above the action level or Permissible Exposure Limit for an OSHA-regulated substance.
- Whenever an event such as a spill, leak, or explosion takes place in the workplace and results in the likelihood of an overexposure.
- At the request of the Chemical Hygiene Officer.

In the event of an unexpected chemical exposure or overexposure:

- 1) Emergency: call 911 for immediate help.
- 2) Non-emergency: To assess what action should be taken, contact the person who directly supervises the laboratory where the situation occurred.
- 3) For the Storrs campus, consider evaluation by [UConn Occupation Health Center Urgent Care](#) at 1 Royce Circle, Storrs, CT (860) 487-9300, or other nearby urgent care facility.
- 4) Follow-up by calling EHS at (860) 486-3613.

Appendices

<u>Appendix A</u>	Minimum Guidelines for Laboratory Health and Safety
<u>Appendix B</u>	Chemical Waste Disposal Manual

Appendix A

Minimum Guidelines for Laboratory Safety

A. Safety Practices

1. Pipetting is done only with mechanical pipetting devices. Mouth pipetting is prohibited.
2. Laboratory doors should be kept closed to minimize the spread of chemical vapors, disease organisms, or fugitive emissions (smoke) in case of an accident.
3. To help comply with state and federal "Laboratory Standard" regulations, a person should be assigned by the department to act as a Chemical Hygiene officer for the completion of necessary activities. These activities include the following:
 - An inventory of all hazardous chemicals being used and/or stored in each laboratory or facility, with approximate quantities on hand should be kept on file in the department.
 - A file of Safety Data Sheets (SDS) for each hazardous chemical in the department should be assembled. The file is available at all times for employees to review.
 - The University Chemical Hygiene Plan must be available to all employees.
 - Labels indicating the name of the material and warning of the health and/or physical hazards are attached to all containers of hazardous materials.
 - Appropriate warning signs are posted in proper locations, including the emergency information notice posted at the entrance of each lab.
 - Informational meetings are conducted with all employees; those working with hazardous chemicals are given at least basic and simple training which addresses the specific chemicals used and associated hazards, as well as the use of safety equipment in each work place. Specific hazardous chemical training is conducted for new personnel and for all personnel any time a new hazardous chemical is introduced into the workplace.
 - Written records are kept of the training outline and format and a list of personnel receiving the training is on file in the department.
 - The above items are updated as new personnel are hired, new chemicals are purchased, laboratory methods are changed, etc.
4. All laboratory experiments must be evaluated for their potential risk by the PI and must incorporate appropriate engineering control. For more information [contact EHS](#).
 - Fume hoods and biological safety cabinets are used only for procedures and not for routine storage.
 - Airflow to fume hoods and biological safety cabinets must be free from obstruction at all times.

5. Working Alone is addressed in the [UConn Working Alone Policy](#) and details that lab occupants are not permitted to work alone in an immediately hazardous environment.
6. Work surfaces are decontaminated as needed and when a work process is completed. All spills are cleaned up immediately.
7. All contaminated materials are decontaminated before washing, reuse, or disposal. If infectious agents or organisms containing recombinant DNA molecules are present in the laboratory, an autoclave is available in the same building.
8. Containers for hazardous waste are available and must be clearly marked.
9. A clearly marked and puncture resistant container is used for broken glass, and other glass sharp waste. A separate, puncture resistant, tamper proof and leak proof container is used for syringes and metal sharps. All syringes and metal sharps are collected by the division of EHS.
10. The creation of aerosols is avoided. This necessitates the use of appropriately designed centrifuges, blenders, sonicators, and neat working practices.
11. Eye and/or face protection is worn at all times where there are corrosives, hot liquids, or other eye irritants, or where there is a possibility of flying materials.
12. Closed toe footwear must be worn at all times in the laboratory.
13. Laboratory coats or protective aprons should be worn at all times as dictated by the WHA form on record with EHS and posted in the laboratory.
14. Laboratory coats are not worn into food areas or outside of the building where the laboratory is located. If infectious organisms are involved, protective clothing is not worn outside of the laboratory.
15. Other protective clothing (such as gloves and rubber aprons) and equipment (such as explosion shield) are used where appropriate. Gloves are worn when handling experimental animals, corrosive chemicals, and when skin contact with infectious agents or organisms containing recombinant DNA molecules could occur.
16. Only persons who have received formal training in the nature of the hazards and have the consent of the laboratory supervisor are allowed to enter the laboratory. Such [training](#) is available through EHS.

17. Areas of unique hazards (biological, radiological, etc.) in any laboratory are required to be separate and demarcated from any general lab experimental areas.
18. All accidents and hazardous spills are reported in writing to the laboratory supervisor, and to EHS.
19. Medical evaluation, treatment, and surveillance are available for each laboratory individual as appropriate under the University's Chemical Hygiene Program.
20. An appropriate departmental and/or laboratory specific safety manual should be developed as an addendum to the University Chemical Hygiene Plan and communicated to all laboratory personnel by the PI. The PI will advise personnel of the hazards and the recommended practices and procedures specific to that department.

B. General Health Practices in Laboratories

- Eating and drinking are prohibited.
- Smoking or the applying of cosmetics is prohibited.
- The storage of personal effects, food, and beverages is prohibited.
- Tubing attached to faucets should not be extended below the sink rim. Failure to do so could create a potential cross-connection or backflow into the water supply.
- Hands are washed after working with hazardous material and before working with uncontaminated material or leaving the laboratory.
- All areas are designed for easy cleaning and are kept clean and uncluttered. Storage space is sufficient. Spaces between equipment are accessible for cleaning.
- Bench tops and work surfaces are smooth and easily cleanable, impervious to water, and resistant to chemicals and moderate heat.
- Researchers are not allowed to ride on elevators when cryogenic liquids are being delivered to laboratories by outside vendors.

C. Physical Safety

- All exit doors are appropriately marked and unobstructed.
- Aisles are unobstructed.
- There are no tripping hazards.
- All equipment is in good repair.
- Eye wash and safety shower access is unobstructed.
- Circuit breaker panels must be accessible.
- Heavy objects are stored below a level of five feet from the floor unless secured.
- All shelving and cabinets are secured to prevent tipping.

D. Safety Equipment

- Spill kits should be available in case of hazardous liquid spills.
- An appropriate first aid kit is available.
- Non-breakable, leak-proof, and closed containers are used for transporting hazardous materials outside of the laboratory.
- All belts, pulleys, fans, and other moving parts are guarded.
- Catch trays are used where appropriate.
- Vacuum equipment is trapped or filtered.
- If hypodermic needles are used, they are of the locking or integral type. They should be disposed of in approved sharps containers, not in regular trash.

E. Chemical Storage

- All gas cylinders are secured, away from heat sources, and capped if not in use.
- Incompatible chemicals are stored separately. All chemicals are stored by hazard categories rather than alphabetically. See the Chemical Hygiene Plan.
- Flammable liquid quantities exceeding more than one gallon must be kept in approved safety cans. No more than 10 gallons of flammable liquid can be stored outside of rated flammable storage cabinets. Flammable liquid storage must comply with the fire code program overseen by the UConn Fire Marshal.
- Peroxide-forming chemicals are dated when received and when in the laboratory.
- Peroxide-forming chemicals should be disposed of within one year of purchase and within six months of opening.
- All containers are securely closed when not in use.
- All containers are correctly labeled.
- Chemical storage areas are adequately ventilated.
- Flammable liquid storage areas are free of ignition sources.
- All refrigeration equipment is labeled to indicate the suitability or unsuitability for the storage of flammable liquids.
- Flammable storage cabinets do not need to be vented.

F. Electrical Safety

- Electrical equipment is correctly grounded.
- An over temperature shut-off device is provided for unattended heating equipment.
- Electrical cords are undamaged and of sufficient capacity.
- Multiple plug-ins and extension cords are to be avoided, and not to be used in place of permanent wiring. Extension cords are not to be in areas of traffic.

G. Building and Infrastructure Repair

Use the [Facilities Management/Work Order Control](#) (Ext. 3113) for repair and maintenance of certain safety items. *The repair of laboratory specific equipment is the responsibility of the PI or department overseeing the lab.*

- Circuit breaker panels are correctly labeled.
- Electrical outlets are correctly wired and grounded and are in good repair.
- Ground fault interruption is provided at electrical outlets where needed.
- Approved eyewash stations are installed where corrosives, hot liquids, or other eye irritating materials are stored or used.
- Approved safety showers are installed within 100 feet of each area where corrosives or flammable liquids are stored or used.
- Walls, floors, and ceilings are in good repair.
- Sufficient fresh air is provided and building air movement is from areas of lesser hazard to areas of greater hazard.
- Plumbing backflow prevention devices are provided where needed.
- Chemical fume hoods, biological safety cabinets, and autoclaves are operational and certified.

Appendix B
Chemical Waste Disposal Manual

[Chemical Waste Disposal Manual](#)