Chemical Hygiene Plan

Instructions

Purpose

The purpose of the Occupational Health and Safety Administration's Laboratory Safety Standard is to ensure workers in non-production laboratories are informed of hazards of chemicals in their workplace and are protected from chemical exposure exceeding permissible levels (OSHA permissible exposure levels). The purpose of this document is to set forth minimum performance expectations for safe handling of hazardous chemicals, and the preparation and maintenance of chemical hygiene plans (CHP), and inventories for laboratories on campus as required by the regulation (29 CFR 1910.1450).

All labs are required to create and maintain a chemical hygiene plan. The Chemical Hygiene Plan shall include each of the following elements and shall indicate specific measures that the employer will take to ensure laboratory employee protection. The plan must be review and updated by the PI at least annually. This review shall be documented.

1. Standard operating procedures relevant to safety and health considerations to be followed when laboratory work involves the use of hazardous chemicals
2. Criteria that the Principal Investigator will use to determine and implement control measures to reduce employee exposure to hazardous chemicals including engineering controls, the use of personal protective equipment and hygiene practices; particular attention shall be given to the selection of control measures for chemicals that are known to be extremely hazardous
3. A requirement that fume hoods and other protective equipment are functioning properly and specific measures that shall be taken to ensure proper and adequate performance of such equipment
4. Provisions for information and training of lab personnel (*training must be completed and documented yearly*)
5. The circumstances under which a particular laboratory operation, procedure or activity shall require prior approval from the PI or the PI's designee before implementation;
6. Provisions for required medical consultation and medical examinations
7. Designation of personnel responsible for implementation of the Chemical Hygiene Plan including the assignment of a Chemical Hygiene Officer
8. Emergency Procedures for incidents involving chemicals
9. Provisions for additional employee protection for work with particularly hazardous substances. These include "select carcinogens," reproductive toxins and substances which have a high degree of acute toxicity. Specific consideration shall be given to the following provisions which shall be included where appropriate:

a. Establishment of designated work areas
b. Use of containment devices such as fume hoods or glove boxes
c. Procedures for safe removal of contaminated waste
d. Decontamination procedures

Chemical Hygiene Plan Template

Lab/Group:					
Principal Investigator (PI) Name:					
PI Contact Information					
Campus Address		**Campus Phone**		**24 Hour Emergency Contact Phone**	
Lab Supervisor/Manager Contact Information					
Lab Supervisor Name:					
Campus Address		**Campus Phone**		**24 Hour Emergency Contact Phone**	
Designated Laboratory Chemical Hygiene Officer (CHO)					
CHO Name:					
Campus Address		**Campus Phone**		**24 Hour Emergency Contact Phone**	
Lab locations covered by this plan					
Building Name		**Building #**		**Room Number(s)**	

Certification of Principal Investigator Review of Chemical Hygiene Plan and associated Standard Operating Procedures (to be completed at least annually):

I do hereby certify that I have reviewed and approved the contents of this Chemical Hygiene Plan and all associated standard operating procedures:

Print PI Name	PI Signature	Date of Review

Laboratory Worker Training Records:

Lab personnel must receive training specific to this plan and any hazards present in the lab. Include any hazard specific training records in this section.

All lab personnel must be trained on the contents of this plan and associated SOPs at least annually and whenever substantive changes are made to laboratory procedures. Record annual training participation using the following template:

Trainer Name	Trainer Signature	Trainee Name	Trainee Signature	Date of Training

Introduction

The Occupational Safety and Health Administration (OSHA) Laboratory Standard (29 CFR 1910.1450) requires all laboratories to have a *Chemical Hygiene Plan or CHP*.

The **purpose** of this CHP is to define work practices and procedures relevant to the work being conducted in the identified lab space(s) to help ensure that laboratory personnel are protected from hazards associated with the chemicals with which they work.

All lab personnel must be trained on the contents of this CHP, including relevant standard operating procedures (SOP) prior to beginning work in the laboratory and annually thereafter. A record of this training must be kept with the CHP (see training record template on preceding page).

Section 1: Lab Specific Standard Operating Procedures

29 CFR 1910.1450(e)(3)(i) requires that written standard operating procedures relevant to safety and health considerations be prepared and followed for all laboratory operations involving hazardous chemicals.

Written SOPs for the lab location listed above must be prepared and included in this section

Section 2: Control Measures

Lab personnel must be aware of the specific hazards of the chemicals and equipment with which they work and the controls measures used to protect against exposure. They must become acquainted with the properties of every chemical used and understand all terminology. The Merck Index and other reference books, Safety Data Sheets (SDS's), and compatibility charts are useful sources for finding hazard information. Coworkers, research advisors, EHS are also respected sources. Many hazards are outlined on the chemical container label. **All chemicals (including non-toxic chemicals) should be treated as though they were toxic.**

Engineering Controls – Lab Safety Equipment:

Engineering controls are designs or modifications to equipment, industrial plants, processes, or systems that reduce the risk of worker exposure to a hazard. They operate on a "hazard isolation principle", either by removing a hazardous workplace condition (such as through ventilation) or by placing a barrier between the worker and the hazard (such as through machine guards). These methods control hazards either at the source of the hazard or in transmission, rather than protecting the worker at the point of exposure to the hazard. Engineering controls offer a uniform standard of protection to all workers and function continuously without human supervision or intervention.

Verify that fume hoods and other protective equipment are functioning properly prior to beginning work with chemicals. Damaged equipment must be repaired or replaced – DO NOT USE damaged equipment.
To facilitate repair of damaged fume hoods, emergency shower, eyewashes, fire alarms or fire extinguishers contact Facility Operations Dispatch at 801-581-7221.

1. **Emergency Showers and Eyewashes**

Locations of emergency shower and eyewash units vary throughout University buildings. Familiarize yourself with these locations. These units should be flushed on a regular basis (weekly for eyewash units and monthly for showers). It is the responsibility of the Principal Investigator or their designee to ensure that units are flushed appropriately. Units are tested and inspected annually by EHS. In the event that an emergency shower or eyewash is used to flush chemicals from the body or eyes, call 911 to request emergency medical assistance and report to EHS as soon as possible.

If a unit is found to be in need of repair contact Facility Operations at 801-581-7221.

2. **Laboratory Ventilation**

Whenever possible chemicals should be handled in a properly functioning chemical fume hood. These hoods are designed to capture and remove potentially harmful materials from the work area. Proper use of the fume hood is critical. The following guidelines must be followed when using a fume hood:

a) Position the fume hood sash so that work is performed by extending the arms under or around the sash, placing the head in front of the sash and keeping the glass between the worker and the chemical source. The maximum opening is 18".
b) Avoid opening or closing the sash rapidly, swift arm or body movements in front of or inside the hood, or use of fans, window air conditioning units, etc. that may interfere with proper airflow into the hood.
c) Place all chemical sources, equipment and apparatus at least 6 inches behind the face of the hood.
d) Place equipment as far back in the hood as possible without blocking the rear baffle.
e) Separate and elevate equipment in the hood using blocks or racks so that air can flow easily around all apparatus.
f) Do not use large pieces of equipment in a hood. They tend to cause dead spaces in the airflow and reduce the efficiency of the hood.
g) If a large piece of equipment emits fumes or heat outside a fume hood then have a special purpose hood designed and installed to ventilate that particular device.
h) Do not modify fume hoods in any way.
i) Do not defeat fume hood airflow alarm systems.
j) Do not use the fume hood for storage. Only active experiments and apparatus should be in the fume hood.

EHS will test and inspect all fume hoods on an annual basis to verify proper airflow and functionality.

Chemical fume hoods may not provide adequate protection when using certain types of hazardous materials such as air reactive, highly toxic, or other high hazard compounds. Some material may require the use of a higher level of protective equipment such as a glove box. For more information about the use of these types of materials consult with the Principal Investigator or their designee, or EHS.

In the event a fume hood becomes non-functional or needs repair contact Facility Operations at 801-581-7221.

3. **Fire Alarms**

   Fire alarms are used to indicate mandatory building evacuation and as a notification to the fire department. Building evacuation may be needed in the event of: fires, chemical spills, gas leaks, and other hazards.

   Should the fire alarm sound, all personnel should take a moment to retrieve keys, cell phones, purse, wallets, jackets, etc. and then calmly evacuate the building, encouraging others to do the same, through the nearest exit.

   Some laboratory procedures may require additional steps in order to safely evacuate.

   List any lab specific shut down procedures that should be followed in an evacuation situation to avoid creation of additional hazards due to out of control processes:

   _____
   _____
   _____

4. **Fire Extinguishers**

   Fire extinguishers must be available, charged, and hung in an accessible location. Ensure the proper type of fire extinguisher is available in the area. Work with water or air reactive or pyrophoric materials require use of a class D fire extinguishing medium. Contact the fire systems shop at 801-581-7221 for assistance in determining the proper type of extinguisher for your area. If an extinguisher is discharged, report the incident to EHS at 801-581-6590 and contact the fire systems shop for replacement.

Administrative Controls

Administrative controls are work practices designed to reduce or eliminate hazards and risks.

1. **Chemical Inventory**

   All laboratories are required to have a chemical inventory in the online laboratory management system, accessed via the EHS website. Chemical inventories must be actively maintained an reviewed periodically for accuracy, review must be not less than annually.

2. **Food and Drink, etc.**

   Eating, drinking, applying cosmetics, etc. is not allowed in any laboratory on the University of Utah campus. Never smoke, eat, or drink in the laboratory. Laboratory refrigerators must not be used to store food or drink intended for human consumption. All laboratory refrigerators must be labeled with "No Food or Dink" stickers.

   List the location(s) in the building where food and drink can be stored and consumed (break rooms, kitchen facilities, etc.):

   _____
   _____
   _____

   Note: Chemicals, soiled lab coats, gloved hands, etc. are not allowed in areas where food and drink are consumed.

3. **Smoking**

   University of Utah is a tobacco free campus. Smoking is prohibited in all university facilities.

4. **Mouth Pipetting**

Mouth pipetting is not permitted under any circumstances.

5. **Personal Hygiene**
   Hands must be washed frequently throughout the day, before leaving the lab, after contact with any hazardous material, before eating, etc.

   Long hair must be pulled back and secured behind the head while working in the lab

6. **Situational Awareness**
   A good understanding of your surroundings is very important in a research laboratory. Be aware of your actions as well as those of your coworkers. Immediately warn your coworker if you see him/her doing something dangerous. Do not hesitate to ask your coworker, advisor, TA, and/or storeroom manager for guidance with using laboratory equipment or for advice on safety matters. Please respect the fact that others must use common laboratory equipment (i.e., balances, melting point apparatuses, hoods, etc.). Take appropriate care of this equipment and clean up common areas immediately.

7. **Housekeeping**
   Proper housekeeping is critical to good chemical management. Laboratories must be maintained in a clean and orderly fashion.
   a) Wipe up all spills immediately.
   b) Maintain bench tops and hoods free from clutter and excessive equipment.
   c) Maintain chemical containers at least 4-6" from the edge of bench tops.
   d) Maintain exits, aisles and safety equipment free from all obstructions.
      Aisles within the laboratory must be 36 inches in clear width. Doors which are not in use but which are accessible from a corridor or adjacent room should be appropriately labeled if they are blocked on the interior of the room. Hallways and mechanical spaces are not to be used as storage areas. Work areas and floors are not to be used for excessive storage.

8. **Container Labeling**
   All containers not in immediate use (see below) must be labeled with the following:
   a) Full, common name of the chemical – do not use abbreviations, unfamiliar chemical formulas or nomenclature.
   b) Warning word associated with the chemical (caution, danger, flammable, corrosive, etc.), or appropriate GHS pictogram.
   c) Peroxide forming chemicals must be labeled with the date the container was received, the date the container was opened, and the date the container must be disposed.

   Chemical containers in immediate use: Chemical containers which are in use by the individual who filled them and which are intended to be used by the same individual, and which are continuously in the possession and control of the same individual do not require labeling. However, if the individual intend to leave the containers unattended for any amount of time they must be properly labeled.

   Care must be taken to not deface, remove, or obstruct the labels affixed to a container by the manufacturer.

9. **Horseplay**
   Horseplay, practical jokes, or other behavior that might startle, confuse, or distract other workers is not permitted.

10. **Drain Disposal of Chemicals**
    Drain disposal of hazardous chemicals is not permitted at the University of Utah. There are some situation where drain disposal is allowable – these situations must be reviewed and approved by EHS

before allowing any hazardous chemical to go down the drain.

11. Open flames

Use of open flames is highly discouraged. If the use of an open flame is required the following precautions must be in place:

a) The open flame must be properly secured as to prevent tipping
b) The open flames must be attended at all times
c) An appropriate fire extinguisher must be in close proximity
d) All tubing, piping, etc. used to connect the fuel source must be in good condition and leak tested prior to use.
e) Open flames are not permitted in areas where flammable liquids are present.
f) In some instances use of an open flame requires Fire Marshal approval, contact EHS at 801-581-6590 for more information.

12. Transfer of Chemicals

Never pour chemicals directly from storage containers into a reaction vessel. The use of an intermediate instrument such as a graduated cylinder, beaker, or pipette prevents unwanted chemical reactions, spills, or overfilling of vessels from occurring.

13. Non-Student Minors

Guidelines for non-student minors working in University of Utah Research Laboratories.
Note: These guidelines are not intended for minors that are enrolled as regular students at the university.

a) Minors wishing to work in a research labs on campus (science projects, outreach experiences, field trips, etc.) must complete University of Utah Risk & Insurance Management's liability waiver.
b) All minors must be provided with safety training specific to the activities they will be participating in within the lab. This should be provided by the PI/Instructor and must be documented in writing. Documentation of training must contain the following: Date of training, Name of trainer, Topics covered by the training, Name of minor, signatures of both the trainer and the minor participant(s). Training should also include a basic lab safety quiz that participants must pass with at least an 80% score.
c) The principal investigator/instructor/sponsor should discuss the following with the minor(s) and both should sign a statement stating that they understand the following guidelines:

    1. No minor shall be left unattended at any time within a lab space. Minors must be accompanied at all times by a responsible staff member.
    2. Minors must be provided with appropriate personal protective equipment, including, but not limited to, appropriate gloves (if they will be handling anything within the lab), lab coat and safety glasses. Minors must wear this personal protective equipment at all times while in the lab space. Shorts, sandals, etc. are not be permitted to be worn in the lab. Long pants, closed-toe shoes and shirts that cover the midriff must be worn at all times in the lab.
    3. Minors must be made aware of the hazards within the lab and areas where their access is restricted. This must be communicated to the minor prior to the start of their work as part of their training.
    4. Minors are not permitted to handle any biological agents/rDNA/sDNA, research animals, highly hazardous chemicals, or dangerous machinery without prior approval from EHS.

d) Copies of all documentation including, but not limited to, signed liability waiver, documentation of training, copies of completed quizzes, signed PI/instructor/sponsor statement(s), should be kept in the lab and it may be prudent to keep copies on file at the department level as well.

14. Reproductive Health and Pregnancy Safety

The following guidelines are provided for women who work in a laboratory environment and are pregnant, nursing, or are trying to become pregnant. It should be noted that the U.S. Supreme Court has determined that a pregnant employee has the right to determine whether or not she continues in her present work environment while pregnant regardless of the hazards that may be present.

a. The pregnant employee should start by listing all the hazards to which they might be exposed in the course of their own or a co-worker's work. Don't limit the list to chemical hazards only; many other hazards exist in the lab environment, such as radiation, biological materials, lifting of heavy objects, heat, fatigue, stress, etc.
b. Research the various materials used in the lab. Safety Data Sheets (SDS) are a good place to start your research but do not limit your research to one source. Additional, and often better, information on specific hazards can be found in a chemical dictionary, Prudent Practices in the Laboratory, the Centers for Disease Control website and others.
c. Discuss your list with your doctor or healthcare provider. In some cases it may be prudent to also discuss your concerns with an Occupational Medicine doctor – they have additional expertise in toxicology and other areas directly related to the work environment.
d. Discuss your list of concerns with your supervisor or Principal Investigator.
e. Discuss any recommendations made by your doctor with your supervisor.
f. Although it is not required, it is recommended that the supervisor attempt to accommodate the employee as much as possible. Labs have often made provisions where a person would temporarily have someone else carry out work with a particular agent or chemical. Ultimately it is the responsibility of the employee to determine whether or not they are willing to accept the risks associated with hazards in the laboratory.
g. Consult with Environmental Health and Safety (EHS) at 801-581-6590 to make sure that any steps taken to minimize the hazards are appropriate or if you have any questions.

15. Personal Items in the Lab

Use of personal items such as cell phones, headphones, ear buds, back packs, jackets, etc. in the lab is generally not permitted, if necessary their use should be extremely limited and only with PI approval. Use of these items increases the potential for transfer of hazardous materials to personal items, increasing the risk of exposure.

List any instances of PI approval for use of personal items in the lab:

_____

_____

16. Signage

All laboratories are required to have hazard warning signage. Complete the hazard warning signage questionnaire located on the EHS website: https://oehs.utah.edu/resource-center/forms/hazard-warning-signage-questionnaire. A sign will be delivered and posted.

17. Spill Kits

All University labs must have a spill kit appropriate for the chemicals present in the lab. Spill kits are available from EHS – order form is located on the EHS website: https://oehs.utah.edu/resource-center/forms/spillkitorderform

18. Working Alone

In general working alone is not recommended. Working alone conducting highly hazardous operations is not permitted. In situations where lab personnel may need to work alone the following guidelines must be followed:

a) The PI or their designee must be provided with a written scope of work for the proposed research.
b) The PI or their designee must approve all work that will be conducted alone and provide written authorization.
c) Lab personnel must notify and consult with the PI/designee, in advance, if they intend to deviate from their written scope or scale of work. PI/designee approval must be given in writing detailing the intended and approved changes before deviation or scale-up is allowed.
d) Lab personnel must prepare written SOPs and perform literature searches relevant to safety and health that are appropriate for their work and incorporate appropriate safety measures into prepared SOPs.
e) Lab personnel must update written SOPs when deviations or scale-up is approved by the PI.
f) Lab personnel must receive appropriate oversight, training and safety information from the PI/designee.
g) When working alone, lab personnel must notify someone outside the lab that they will be working in the lab alone and make arrangements for the outside contact to contact them at regular intervals to check on them. The outside contact should be made aware of the nature of the work and the hazards involved.

19. Minimization of Hazardous Waste

Minimizing wastes also minimizes safety hazards. Utilize the following guidelines to reduce hazardous waste:

a) Scale reactions to minimize the amount of required materials
b) Substitute less hazardous materials whenever possible
c) Periodically inspect the inventory of chemicals and dispose of unwanted or unusable items
d) Purchase only the quantity needed. Before ordering from an outside vendor, check your supplies and refer to your chemical inventory.
e) Eliminate or reduce the use of: chromic acid cleaning solutions, heavy metals, and halogenated solvents if possible

20. Drying Ethers

An acceptable means of drying ethers is the use of sodium/benzophenone. In the past, a common laboratory method for drying ethers has been distillation from lithium aluminum hydride (LAH). LAH is a serious fire hazard and should not be used to dry ethers. It decomposes at ~125 °C which can be easily reached at a flask's surface in a heating mantle. The decomposition products of LAH can be quite explosive, especially when combined with CO_2. Therefore, use a Class D (Metal-X) fire extinguishing medium for fires involving LAH. Do not use CO_2 or bicarbonate powder extinguishers for these types of fires.

21. Mercury

Use of mercury containing devices on campus is not permitted without EHS approval. To request approval for use of a mercury containing devices visit the EHS website: https://oehs.utah.edu/mercury-containing-device-review-request

Consult EHS for assistance in finding mercury substitutes.

22. Perchloric Acid

Perchloric acid heated above ambient temperature will give off vapors that can condense and form explosive perchlorates. When heating perchloric acid above ambient temperature, a perchloric acid laboratory chemical hood with a wash down system or a local scrubbing or trapping system **must** be used. Consult EHS before performing these operations.

23. Peroxidizable Compounds

Peroxidizable compounds present considerable hazards within the laboratory. Commonly used solvents such as ether, dioxane, and THF can form explosive peroxides after exposure to air. Hazards associated with peroxidizable compounds can be minimized in several ways. Some peroxide formers are provided with a label on which the initial date opened should be written. Store peroxide formers in an obvious location where they will not be forgotten and where they are readily accessible to EHS. Peroxide formers should be checked for peroxides every six months after opening. Peroxide formers should also be checked prior to performing distillations or evaporations. Concentrations of <100 ppm are generally acceptable, except for planned solvent evaporation experiments. Concentrations >100ppm should be disposed of through EHS chemical waste management.

24. Mal-odorous Compounds

Precautions should be taken when working with mal-odorous compounds. ALWAYS notify personnel in surrounding areas and labs BEFORE using mal-odorous compounds. Always use mal-odorous compounds in a properly functioning laboratory chemical hood. Minimize the quantity of material and time the container is open. Maintain the chemical and contaminated material in a sealed container. Always use mal-odorous compounds in a properly functioning laboratory chemical hood. Keep lab windows and doors closed to maintain proper laboratory chemical fume hood air flow.

25. Chemical Storage

a) Segregation of Chemicals

Stored chemicals must be segregated according to hazard class to avoid unwanted reactions. Recommended hazard classes for chemical separation include: acid, base, flammable, oxidizer, and reactive.

Physical separation (separate cabinets, storage containers, etc.) is the preferred method of storage.

b) Flammable liquid storage

All flammable liquids in excess of 10 accumulative gallons in a single lab space must be stored in a flammable storage cabinet.

Flammable materials must be stored in appropriate, labeled containers, in safety cans or Department of Transportation (DOT) approved containers. If in a substantial amount, waste solvents should be stored in polyethylene containers. Waste halogenated solvents may not be stored in metal safety cans due to corrosion.

c) Cold storage of flammable materials

Flammable materials must be stored in a rated flammable storage refrigerator. Flammable materials must NOT be stored in household type refrigerators due to potential to create an explosive atmosphere inside the refrigerator which can be ignited by the electrical circuits present. Flammable materials must not be stored in cold rooms un less the cold room is rated for storage of flammable materials.

d) Chemical containers

Chemical containers must be compatible with the materials being stored. For example, hydrofluoric acid must not be stored in glass and some oxidizers should not be stored in plastic containers.

All chemical containers must have lids in place at all times except when actively using the container.

e) Volatile substances

Volatile substances must be stored in an appropriate storage cabinet (such as the under fume hood cabinets present in many labs).

26. Unwanted Materials Disposal

a) Laboratory Management System (LMS)

The University's online LMS is used to facilitate disposal of unwanted materials from campus laboratories. Users of the LMS must be registered and complete user training prior to having access granted. For assistance setting up an LMS account contact EHS.

Access to LMS is via the EHS website: https://oehs.utah.edu/topics/lab-management-system

b) Container Labeling

Containers used for disposal of unwanted materials generated in the lab must be labeled with the words "unwanted material". There should not be variations to this primary wording and the word "Waste" should not be used. After pickup, EHS will make the final determination whether the unwanted material is reusable, recyclable, or a hazardous waste.

Unwanted materials container labels can be downloaded and printed from https://oehs.utah.edu/resource-center/forms or printed from the LMS. These labels must be affixed to the container as soon as material begins to accumulate in the container. At a minimum, the label will detail the contents of the container, communicate the hazard associated with the container, give an accurate description of the contents of the container, and give the accumulation start date (The date when the first unwanted material is discarded into the container).

c) Container Compatibility

Container used for disposal of unwanted materials must be compatible with the materials being placed in them. For assistance with identifying appropriate containers contact EHS

d) Accumulation Management

A laboratory must not accumulate or store declared unwanted materials for periods of time greater than 12 months or in quantities in excess of 55 gallons. Lab personnel are responsible to monitor accumulation limitations for declared unwanted materials.

e) Disposal Request

Disposal requests are initiated by lab personnel via the LMS. EHS will pick up unwanted materials within 10 days of request. Lab personnel must ensure that the pickup request is initiated at least 1 month prior to the 12 month accumulation expiration date.

Prior to disposal ensure that the container must be properly labeled and prepared. The container must:

1. Have the LMS generated label attached.
2. Be in good condition with no structural issues to the body or lid.
3. Lid must be securely affixed.
4. Be compatible with chemicals eg. No corrosive material in a ferrous metal container or Hydrofluoric acid in glass container.
5. Be free of dried chemicals or contamination on the exterior surfaces.
6. Be closed at all times except when adding or removing or consolidating unwanted materials or when venting is necessary for safety reasons.
7. Be stored in secondary container.

27. Exposure Assessment

OSHA a list of specific chemicals (https://www.osha.gov/SLTC/carcinogens/standards.html) which require an initial exposure assessment prior to use. EHS must conduct an exposure assessment prior to use of these chemicals in the lab. Any exposure above the established limits may require additional protective procedures and/or medical surveillance.

28. Lab Closure or Relocation

In the event a laboratory is moved or closed the Lab closure/Relocation Checklist must be completed and a final inspection scheduled with EHS. The checklist can be found on the EHS website: http://tiny.cc/b5g27y

Once the checklist is completed contact EHS at 801-581-6590 to schedule a final walk through inspection with an EHS specialist.

29. Compressed Gas Cylinders

a) Receiving and Storage

1. Arrange a return agreement with supplier prior to purchase.
2. Ensure laboratory door placard is current each time gases are received. (Contact EHS for updated labels for door placards)
3. Cylinder contents must be clearly labeled. Color code does not constitute adequate labeling
4. Valve caps shall be in place any time that the cylinder is not connected to a regulator.
5. Always transport cylinders with valve caps securely in place.
6. Do not accept cylinders which are damaged, not clearly labeled, or do not have a valve protection cap.
7. Keep oxygen cylinders a minimum of twenty feet from flammable gas cylinders or combustible materials. If this cannot be done, separation by a non-combustible barrier at least 5 feet high having a fire rating of at least one-half hour is required.
8. Components used for other gases and purposes must never be interchanged.
9. Cylinders, upon filling, should have a current hydrostatic test date (normally less than 5 years old for steel and 3 years old for aluminum) engraved on the cylinder.
10. All gas cylinders shall be secured in an upright position with upper and lower restraints in racks, holders, or clamping devices. The lower restraint may be exempted only if impractical. When cylinders are grouped together, they should be individually secured and conspicuously labeled on the neck area.
11. Do not place cylinders near heat, sparks, or flames or where they might become part of an electrical circuit.
12. Do not store cylinders in exit or egress routes.
13. Store cylinders in a well ventilated area.

b) Handling and Use

1. Wear sturdy shoes (no open-toed, sandals, etc.) when engaging in moving or transporting cylinders.
2. Use a cylinder cart and secure cylinders with a chain during transport.
3. Only Compressed Gas Association (CGA) fittings and components are permitted for use with gas cylinders. Only use regulators approved for the type of gas in the cylinder. Do not use adapters to interchange regulators.
4. Gas lines must be labeled. Color-coding is not allowed.
5. Gas lines must be appropriate for the type of gas. Hydrogen gas must be piped in stainless steel piping.
6. Contents of the cylinder must be visibly labeled as installed including hazard class (i.e., poison, flammable, inert, etc.). The label facing the wall is not acceptable.
7. Ensure all connections are tight via leak testing. Cylinders, connections, and hoses should be checked regularly for leaks. Use a flammable gas leak detector (for flammable gases only), soapy water, or a 50% glycerin-water solution and look for bubbles. At or below freezing temperatures, the glycerin solution should be used.

8. When the gas to be used is a flammable oxidizing or highly toxic gas, the system should be checked first for leaks with an inert gas (helium or nitrogen) before introducing the hazardous gas.
9. Leak tests must be witnessed by a third party (e.g., lab/department safety officer, EHS representative, safety committee representative, etc.) and logged.
10. When a special wrench is required to open a cylinder or manifold valve, the wrench shall be left in place on the valve stem when in use; this precaution is taken so the gas supply can be shut off quickly in case of an emergency. Nothing shall be placed on top of or near a cylinder that may damage the safety device or interfere with the quick closing of the valve.
11. Open cylinder valves slowly and away from the direction of people (including yourself). Never force a gas cylinder valve. If the valve cannot be opened by the wheel or small wrench provided, the cylinder should be returned; do not attempt to repair a cylinder valve or regulator yourself.
12. No attempt shall be made to transfer gases from one cylinder to another, to refill cylinders, or to mix gases in a cylinder in the laboratory.
13. Keep cylinder valves, regulators, couplings, hoses, and apparatus clean and free of oil and grease.
14. Compressed gases must not be used to clean your skin or clothing.
15. Never heat cylinders to raise internal pressure.
16. Use flashback connectors and reverse-flow check valves to prevent flashback when using oxy-fuel systems.
17. Regulators must be removed when moving cylinders, when work is completed, and when cylinders are empty.
18. Do not use copper (>65%) connectors or tubing with acetylene. Acetylene can form explosive compounds with copper, silver, and mercury.
19. Always leave at least 30 psi minimum pressure in all *Empty* cylinders.
20. Label all cylinders when "Empty". All cylinders are to be considered full unless labeled as empty by the user. Empty cylinders must be returned to the supplier and not accumulated.
21. Do not leave an empty cylinder attached to a pressurized system.
22. Use of lecture bottles is highly discouraged if other cylinders are available. Lecture bottles are very difficult to dispose of and they use universal threads and valves (some of which are interchangeable), thus increasing the potential for unintentional mixing. If lecture bottles are used, label all associated equipment with the gas name to prevent unintentional mixing.

1. **The above identified administrative controls is not an exhaustive list. Each lab is unique and may need administrative controls in addition to those listed above. List additional administrative controls specific to the lab:**

_____
_____
_____
_____
_____

Personal Protective Equipment

Personal Protective Equipment (PPE) is the last line of defense against chemical exposure hazards in the lab. PPE must be provided by the PI at no cost to the employee and must be appropriate for the hazards present in the lab.

1. **Minimum PPE**: All lab personnel are required to wear the following as minimum personal protective equipment (PPE) **<u>at all times</u>** when in the laboratory (even when not working directly with hazardous materials or operations):

a) Closed shoes,
b) Long pants (no skirts or shorts),
c) Fully fastened lab coat,
d) Eye protection (safety glasses at all times, safety goggles when working with liquids),
e) And, Gloves as appropriate (gloves should be worn at all times when handling chemicals, but not when updating lab notebooks, keyboarding, etc.)

2. **Additional PPE:** Additional PPE may be required when working in the lab. A PPE hazard assessment must be conducted for all labs. The assessment form is located on the EHS website: https://d2vxd53ymoe6ju.cloudfront.net/wp-content/uploads/sites/4/20190325124856/PPE-Hazard-assessment-form.pdf. EHS personnel are available to assist with the hazard assessment, contact EHS at 801-5841-6590. A copy of the assessment should be included in the SOP section of this plan (Section 1). Individual standard operating procedures in this must reference any PPE use above the minimum required.
3. **Other PPE considerations:**
    a) Eye Protection: Prescription glasses are not sufficient protective eyewear. Prescription glasses may be equipped with protective safety lenses to protect against impact but are inadequate to protect against chemical splashing. Safety goggles must be worn over prescription eyewear or whenever wearing contact lenses. Contact lenses must be removed when using an eyewash to flush after a chemical exposure. Some processes may also require use of eyewear to protect from exposure to optical light hazards. Refer to the appropriate SOP.
    b) Face Protection: In some instances a full face shield will be required, refer to the PPE hazard assessment and/or appropriate SOP.
    c) Hand Protection: Always wear protective gloves when working with chemical hazards. Consult the glove manufacturer's recommendations, or contact EHS, for assistance in determining appropriate glove selection. Gloves must be removed and hands washed prior to handling water/utility/door handles, or other surfaces likely to be touched with bare hands, to avoid contamination. Disposable gloves may not be re-used, even if holes or tears are not present. Check gloves for leaks prior to use.
    d) Broken Glassware/Glassware Under Strain
    Always wear leather gloves when working with either broken glassware and/or glassware that is under strain (e.g., pressure vessels, tubing being inserted into stoppers, etc.). Note: Leather gloves do not provide protection from chemicals. Uncontaminated broken glassware should go into a broken glass container.
    e) When working with temperature extremes (hot OR cold) utilize appropriate insulated gloves. Note: Insulated gloves do not provide protection from chemicals.

Section 4: Training

All individuals working in laboratories that may be exposed to hazardous chemicals must be apprised of the hazards of chemicals present in their work area. THIS INFORMATION AND TRAINING ON THESE TOPICS MUST BE PROVIDED BEFORE INITIAL ASSIGNMENT, BEFORE NEW EXPOSURE SITUATIONS, AND ANY TIME PROCEDURAL CHANGES ARE MADE IN THE LAB. Equipment necessary for the safe handling of hazardous substances must also be provided.

Information

Laboratory workers shall be informed of the location and availability of the following:

- This Chemical Hygiene Plan.
- Reference materials on chemical safety, including Safety Data Sheets (SDS).
- Permissible exposure limits (PEL) for OSHA regulated substances, or if there is no applicable

OSHA standard, the recommended exposure limits or threshold limit value (TLV) may be provided.
- Signs and symptoms associated with exposure to the hazardous chemicals found in the lab.

Training

Training for those working in labs includes:

- The information provided in this Chemical Hygiene Plan
- All lab workers must have yearly chemical hygiene training. Environmental Health and Safety provides classroom and online Basic Chemical Hygiene Training, or the PI can provide that training. This does not include lab specific procedures – the PI/Designee must provide to all lab personnel

  All training must be documented and included in the training records section at the beginning of this plan.

Training for using EHS' Lab Management System (LMS) for unwanted material pickups, requesting containers and managing a labs chemical inventory is found on the EHS website www.oehs.utah.edu. This training is required prior to using the LMS.

List lab specific provisions for information and training of lab personnel

Section 5: Prior Approval Circumstances

Any work involving the use of certain hazardous chemicals with animals must be registered with, and approved by, EHS. For details on which chemicals require approval visit the EHS website: https://oehs.utah.edu/resource-center/forms/application-for-the-use-of-hazardous-chemicals-in-animal-protocols. Documentation of registration and approval must be included in the SOP section of this document.

Working alone, is generally not permitted in the laboratory (See relevant information in administrative controls section).

New experiments are not permitted without PI, or their designee, review and approval. All new experiments must undergo a risk assessment to identify appropriate hazard control measures and ensure identified controls are in place prior to beginning the experiment.

Experiment scale-up: scaling up an experiment can be extremely hazardous. All scale up must be reviewed and approved by the PI. The review and approval of the scale must be documented in writing in an updated SOP or lab notebook.

List all circumstances under which a particular laboratory operation, procedure or activity shall require prior approval from the PI or the PI's designee before implementation

Section 6: Medical Surveillance

Work with some equipment and/or chemicals may require medical surveillance.

For assistance in determining what/if medical surveillance is required contact EHS.

List any required medical surveillance and provisions for required medical consultation and medical examinations.

Section 7: Emergency Procedures

General Emergency Procedures are outline in the Campus Emergency Response Guide Flipchart (available from University Emergency Management or EHS). This flipchart must be posted in all labs on campus.

In addition to the general procedures, labs should identify specific emergency procedures for operations within the lab.

List lab specific emergency procedures:

1. **Injuries:**
   a) Get medical attention immediately. If life threatening, call 911
   b) Answer all operator questions thoroughly and completely. Inform the operator of any hazardous materials involved in the incident.
   c) Send someone to meet emergency response personnel.

2. **Chemical Exposure (Skin/Eye)**
   a) Upon skin or eye contact with chemicals, flush the exposed area with water for 15 minutes.
   b) Remove contaminated clothing immediately. If modesty is a concern, cover with clean apparel, towels, blankets, etc., and minimize personnel in affected area.

3. **Incident and Injury Reporting**
   To report an injury to an employee, complete the Worker's First Report of Injury form found on the HR website: https://www.hr.utah.edu/forms/lib/E1.pdf. Submit the completed form to the HR absence management team.

   To report an injury to a student, complete the Risk Management Incident Report Form:

https://riskmanagement.utah.edu/intranet/forms/incident-accident-report.php

All incidents/injuries must also be reported to EHS. Injuries must be reported as soon as possible after the injury by calling 801-581-6590. Reports may also be filed via the EHS website: https://oehs.utah.edu/incidentnear-miss-report

4. **Chemical Spills**
   a) **Personal safety**
   Wear appropriate personal protection (gloves, boots, goggles, respirator, etc.) as needed. Spill kits must be present in all Labs. Personnel must be trained in proper spill response and familiar with the location and content of the lab's spill kit.
   b) **Containment of the spill**
   For solvents, be sure to eliminate potential sources of ignition. Close lab doors and windows to enable laboratory chemical hood exhaust to ventilate the area. Gently place absorbent pads on the spill. Cover the spilled material with an appropriate absorbent material (consult SDS or SOP) Allow absorbent to absorb the spill.
   c) **Cleanup**
   Collect spent absorbent materials in an appropriate container for disposal. Place the spill absorbent into a plastic bag or other appropriate container. Seal and label the container. Consult EHS for disposal information.
   d) **Large Spills or Releases**
   For large spills or releases inside a lab, evacuate and secure the area, and call EHS. For spills or releases impacting more than a single lab, or for extremely toxic material spills or releases, evacuate the building by activating the fire alarm pull box, call EHS.
   e) **Mercury Spills and Cleanup**
   Mercury spill cleanup methods are determined by the quantity of mercury spilled. Small spills can be managed by using a mercury sponge or by aspirating mercury droplets into a suction flask. If aspirating the mercury, the mercury can be transferred to another container for disposal. For large quantity spills or where the spill has contaminated a large area, quarantine the area to prevent further contamination (shoes, equipment, etc.). Contact EHS to coordinate the mercury clean up. DO NOT use sulfur to coat the mercury or use nitric acid to dissolve the mercury, since either method will greatly complicate disposal. Contaminated materials used to clean up the mercury spill should be collected and sealed in a bag. To dispose of the cleanup materials or a container of mercury, follow the instructions for chemical waste disposal described in the University of Utah LMS quick start guide.
   f) **Fire**
   In the event of a large fire, the building should be evacuated by activating the fire alarm at the pull station. Pull stations are located throughout University buildings, primarily near exits. The fire alarm pull will set off continuous buzzers throughout the building, signal occupants to leave the building, and notify emergency response personnel.

   Laboratory personnel may attempt to extinguish small fires if:
   1. Personal safety is not in jeopardy
   2. Personnel are properly trained concerning firefighting equipment and its appropriate use
   3. Appropriate firefighting equipment is available

   If the fire grows or becomes unmanageable, activate the nearest fire alarm pull. Meet the fire department to direct them to the affected area.

Section 8: Particularly Hazardous Substances

Particular hazardous substances include select carcinogens, genotoxins, reproductive toxins and substances which have a high degree of acute toxicity (LD50 ≤50mg/kg). The following guidelines

apply to the use of these substances:

a. Use the smallest amount of material possible.
b. Do not wear jewelry when working with particularly hazardous substances.
c. Establishment of designated work areas. This may be a fume hood, glove box, portion of a laboratory, or an entire laboratory room.
d. Access to designated areas must be restricted to properly trained lab personnel.
e. Prior to working with any particularly hazardous substance lab personnel must be trained in the specific hazard associate with the substance, the required control methods, and the signs and symptoms of exposure to the substance.
f. Work with any particularly hazardous substance must not be performed outside the designated area.
g. Work with a particularly hazardous substance must be conducted in an appropriate containment device such as a fume hood or glove box.
h. In line High-efficiency particulate air (HEPA) filters or high-efficiency scrubber systems must be in place to protect vacuum lines and pumps.
i. Decontaminate designated areas, and equipment, periodically while, and after, using the substance and before any other work is permitted in the designated area.
j. Remove all protective apparel and place in an appropriately labeled disposal container for disposal as unwanted materials.
k. Compressed gas cylinders containing particularly hazardous substances should (and may be required to) be contained within a ventilated gas cabinet
l. Specific SOPs and emergency response procedures must be developed for each particularly hazardous substance used and detailed in the SOP and emergency procedures section of this plan respectively.
m. Special precautions to avoid release and exposure to particularly hazardous substances must be utilized. For example, volatile substances must be kept cool and contained, compressed gas systems must have properly functioning valves, check valves, regulators, containment which can withstand pressure buildup, and appropriate piping. Dispersive solids must be kept in closed containers, used in places with minimum air currents, and appropriate contact materials should be used to avoid static charging.

List all particularly hazardous substances used in the lab as well as provisions for additional employee protection for work with these substances

Resources

- EHS website

www.oehs.utah.edu

- Chemical Hygiene Training Record

https://d2vxd53ymoe6ju.cloudfront.net/wp-content/uploads/sites/4/20170403112726/Chem-Hyg-Training-Log-Blank.pdf

- Prudent Practices in the Laboratory

https://www.ncbi.nlm.nih.gov/books/NBK55861/

- OSHA 29 CFR 1910 Subpart Z – Toxic and Hazardous Substances

https://www.osha.gov/SLTC/carcinogens/standards.html

- SOP Template

Need to post on EHS website