SUNY Oswego Chemical Hygiene Plan

Program Update 2015

Prepared By:

EHS and Chemical Hygiene Committee

Approved By:

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I. Introduction

Definitions

<u>*EHS*</u>*: Environmental health and Safety*

<u>*CHP*</u>*: Chemical Hygiene Plan*

A. Purpose

The purpose of the Chemical Hygiene Plan at SUNY Oswego is to outline best practices and procedures that can be easily carried out by all persons in order to safely handle hazardous chemicals and materials. This document will serve to protect all persons dealing with hazardous materials here at SUNY Oswego, and keep them rightfully informed of the elements in their work and learning environment. Employees have the right to file a complaint with OSHA if they feel they are being exposed to unsafe or unhealthy work conditions and cannot be discharged, suspended, or otherwise disciplined by their employer for filing a complaint or exercising these rights.

The basis of our program will be to establish clear relationships and responsibilities among faculty, staff, students, personnel, visitors, vendors, and EHS. These roles will allow more clear communication and provide a solid basis for an ever-changing environment of research and learning. Our CHP will be a universal reference for handling hazardous materials, and eliminating risks when doing so.

At the State University of New York at Oswego we also hold sustainability in the highest regard. We strive to emphasize the importance of our environment when thinking about using and disposing of potentially hazardous materials as well. It is also a goal of the Chemical Hygiene Plan to reduce the amount of waste we produce to the most practical amount, and consider less hazardous options whenever possible.

B. Scope

The comprehensiveness of this Chemical Hygiene Plan will allow it to be a reference for all laboratories which handle hazardous materials, and those working within each lab. No one at SUNY Oswego is excluded from appropriate safety precautions, therefore all persons including faculty, staff, students, visitors, personnel, and vendors must abide.

II. Responsibilities

Definitions
CHO: Chemical Hygiene Officer, member of environmental health and safety who serves as the primary contact person in regards to the chemical hygiene plan and following its measures.

PI: Principle Investigator, faculty responsible for laboratory

SOP: Standard Operating Procedure; used in this context to outline proper safety measures when dealing with a hazardous material or chemical in the lab.

SDS: Safety Data Sheets; contain pertinent information regarding a chemical or mixture issued by the manufacturer and kept on file by all laboratories.

PPE: Personal Protective Equipment; used to protect persons from accidental exposure to chemicals. Examples: Laboratory coats, goggles, safety glasses, gloves.

A. SUNY Oswego

Through Support of our President, Provost, and the Dean of Liberal Arts and Sciences, the State University of New York at Oswego has an obligation to promote the best practices outlined in the Chemical Hygiene Plan. It is with the advocacy of our authority that we establish a culture in which our safety and respect in dealing with hazardous materials is seen on campus, and conveyed to those observing from outside our campus community. It is required by U.S. Department of Labor including 29 CFR 1910.1450 "Occupational Exposure to Hazardous Chemicals in Laboratories" (the "Laboratory Standard") that we provide a Chemical Hygiene Plan to provide awareness and means of mitigation for all risks associated with hazardous chemicals.

B. EHS/ Chemical Hygiene Officer

EHS is responsible for administering and overseeing institutional implementation of the Laboratory Safety Program. The Chemical Hygiene Officer (CHO) has primary responsibility for ensuring the implementation of all components of the CHP. In case of life safety matters or imminent danger to life or health, the Director of EHS or designee has the authority to order the cessation of the activity until the hazardous condition is abated. EHS provides technical guidance to personnel at all levels of responsibility on matters pertaining to laboratory use of hazardous materials. The CHO is a member of EHS and, with support from other EHS personnel, is responsible for:

1. Informing PIs/Laboratory Supervisors of all health and safety requirements and assisting with the selection of appropriate safety controls, including laboratory and other workplace practices, personal protective equipment, engineering controls, training, etc.;
2. Conducting periodic inspections and immediately taking steps to abate hazards that may pose a risk to life or safety upon discovery of such hazards;
3. Performing hazard assessments, upon request;
4. Helping to develop and implement appropriate chemical hygiene policies and practices;

5. Having working knowledge of current health and safety rules and regulations, training, reporting requirements and standard operating procedures associated with regulated substances. Such knowledge may be supplemented and developed through research and training materials;
6. Providing technical guidance and investigation, as appropriate, for laboratory and other types of accidents and injuries;
7. Reviewing plans for installation of engineering controls and new facility construction/renovation, as requested;
8. Reviewing and evaluating the effectiveness of the CHP at least annually and updating it as appropriate; and
9. Providing management oversight and assistance with environmental compliance, transport and disposal of hazardous waste.
10. Providing support and periodic audits for the chemical inventory system.
11. Monitoring emergency safety showers and eyewashes by testing them on a weekly basis.
12. Working with Principle Investigator/Laboratory Instructor to ensure proper PPE is being used in handling hazardous materials.
13. Providing medical monitoring information to PI, Laboratory workers, and/or Medical professionals upon request.

C. Principle Investigator/Laboratory Instructor

Figure 1. Professor Sofia Windstam with a student in lab.

https://encryptedtbn0.gstatic.com/images?q=tbn:ANd9GcRigP7TMu43QTNOdBIk4ovxP9VIeQAOcbw2VHCmacnVkyeYmWbVaw

The PI/Laboratory Supervisor has responsibility for the health and safety of all personnel working in his or her laboratory who handle hazardous chemicals. The PI/Laboratory Supervisor may delegate safety duties, but remains responsible for ensuring that delegated safety duties are adequately performed**.** The PI/Laboratory Supervisor is responsible for:

1. Knowing all applicable health and safety rules and regulations, training and reporting requirements and standard operating procedures associated with chemical safety for regulated substances;

2. Identifying hazardous conditions or operations in the laboratory or other facility containing hazardous chemicals and determining safe procedures and controls, and implementing and enforcing standard safety procedures;

3. Providing prior-approval for the use of hazardous chemicals in the PI/Laboratory Supervisor's laboratory or other facility with hazardous chemicals;

4. Consulting with EHS and/or Departmental Safety Committee on use of higher risk materials, such as use of particularly hazardous substances, or conducting higher risk experimental procedures so that special safety precautions may be taken;

5. Maintaining an updated chemical inventory for the laboratory or facility;

6. Ensuring laboratory or other personnel under his/her supervision have access to and are familiar with the appropriate safety information such as SOPs or SDS sheets;

7. Training all laboratory or other personnel he/she supervises to work safely with hazardous materials. Training must include information of the location and availability of hazard information, as well as support for completing SOPs for all hazardous procedures;

8. Promptly notifying EHS should he/she become aware that work place engineering controls (e.g., fume hoods) and safety equipment (e.g., emergency showers/eyewashes, fire extinguishers, etc.) become non-operational;

9. Ensuring the availability of all appropriate personal protective equipment (PPE) (e.g., laboratory coats, gloves, eye protection, etc.) and ensuring the PPE is maintained in working order;

10. Conducting periodic self-inspections of laboratory or facility;

11. Promptly reporting of accidents and injuries that occur within the lab to EHS;

12. Informing facilities personnel, other non-laboratory personnel and any outside contractors of potential laboratory-related hazards when they are required to work in

the laboratory environment; and Identify and minimize potential hazards to provide a safe environment for repairs and renovations;

D. Laboratory Users (Students, Staff, Personnel)

Figure 2. Professor Diana Boyer with a student in lab.

http://oswegocountytoday.com/wp-content/uploads/2014/04/SUNY-Oswego-researcher-wins-NSF-grant-to-probe-mass-extinction-puzzle.jpg

All personnel in research or teaching laboratories that use, handle or store potentially hazardous chemicals are responsible for:

1. Reviewing and following requirements of the CHP and all appropriate Safety information;

2. Following all verbal and written laboratory safety rules, regulations, and standard operating procedures required for the tasks assigned;

3. Developing good personal chemical hygiene habits, including but not limited to, keeping the work areas safe and uncluttered;

4. Planning, reviewing and understanding the hazards of materials and processes in their laboratory research or other work procedures prior to conducting work; Gaining prior approval from the PI/Lab Supervisor for any change in procedure or risk of procedure;

5. Utilizing appropriate measures to control identified hazards, including consistent and proper use of engineering controls, personal protective equipment, and administrative controls;

6. Understanding the capabilities and limitations of PPE issued to them;

7. Immediately reporting all accidents and unsafe conditions inside the laboratory to the PI/Laboratory Supervisor;

8. Completing all required health, safety and environmental training;

9. Informing the PI/Laboratory Supervisor of any work modifications ordered by a physician as a result of medical surveillance, occupational injury or exposure; and

10. Having working knowledge of how to access SDS Sheets and SOPs for the chemicals in use or in the surrounding area;

11. Understanding the disposal procedure of hazardous waste and communicating with EHS/CHO to ensure that waste does not build up in the lab;

12. Write and upkeep SOPs for current research involving hazardous chemicals, and especially particularly hazardous chemicals. The purpose of SOPs is to make obvious potential hazards and how to mitigate them in everyday lab work.

13. When working autonomously or performing independent research or work:

    a. Reviewing the plan or scope of work for their proposed research with the PI/Laboratory Supervisor

    b. Providing appropriate oversight, training and safety information to laboratory or other personnel they supervise or direct.

E. Chemical Hygiene Committee

The chemical hygiene committee is formed to provide an alternate checks and balances system. This committee is comprised of faculty and staff who together have the ability to oversee the functionality of the Chemical Hygiene Plan, and work together to maintain that functionality.

1. Provide feedback when there is an aspect of the chemical hygiene plan that is not being executed properly.

2. Work with EHS/CHO to revise and review the Chemical Hygiene Plan on an annual basis.

3. Attend regular meetings and review research protocol if/when necessary.

III. Hazard Communication

Definitions

OSHA: Occupational Safety and Health Administration is a federal organization (part of the Department of Labor) that ensures safe and healthy working conditions for Americans by enforcing standards and providing workplace safety training.

PEL: Permissible Exposure Limit; is the legal limit of exposure to a given substance for an employee in the United States established by OSHA. A permissible exposure limit is usually given in units of parts per million (ppm) or milligrams per meter cubed (mg/m^3) and is almost always a time weighted average or a given rate of exposure over a period of time.

Carcinogen: Cancer causing agent.

PFC: Peroxide Forming Chemical; a class of compounds that have the ability to form shock-sensitive explosive peroxide crystals.

NIOSH: National Institute for Occupational Safety and Health; an organizational component of the Center for Disease Control and Prevention, charged with ensuring safety and health for all people in the workplace through research and prevention.

PHS: Particularly Hazardous Substance (PHS) are those ***chemicals*** *with special acute or chronic toxicity. The OSHA Laboratory Standard defines a PHS as being a select carcinogen, reproductive toxin, or having a high degree of acute toxicity.*

A. Location

At SUNY Oswego, it is expected that each laboratory keeps its own chemical inventory which may be accessed at any time by EHS if necessary. It is important to know the location of hazardous, and other chemicals in a time of emergency. Tools that are being implemented to assist us in readily providing location information for hazards are the barcode system, and hazardous chemical signage. It is expected that each laboratory Instructor or PI will cooperate and make it possible to access required information.

1. Lab signs have been posted already and will continue to be updated on an annual basis to ensure that all information is current.

   a. All lab signs are required to state at the very least the most hazardous substance found within the lab, its classification, and a primary and secondary contact person in case of emergency.

2. Implementation and maintenance of the barcode system will include ensuring every chemical in every workspace has a label. The barcode system will also require each lab to record the barcode of a bottle or vessel when it becomes empty, and notify the CHO. Regular audits of laboratory inventory will occur to keep records current, and account for any missing items.

B. Determination

It is the right of all persons working in a laboratory to know the hazardous substances contained within that room or facility. It is the responsibility of the PI or Laboratory Instructor to determine the hazardous substances that are present in their lab and which will be used in experimentation, according to those defined by OSHA.

Hazardous Substance

OSHA defines a hazardous material as any chemical that presents a physical hazard or a health hazard is considered a hazardous chemical. The definitions for physical and health hazards are:

- ***Physical hazard*** means a chemical for which there is scientifically valid evidence that it is a combustible liquid, a compressed gas, explosive, flammable, an organic peroxide, an oxidizer, pyrophoric, unstable (reactive) or water-reactive.
- ***Health hazard*** means a chemical for which there is statistically significant evidence based on at least one study conducted in accordance with established scientific principles that acute or chronic health effects may occur in exposed employees. The term "health hazard" includes chemicals which are carcinogens, toxic or highly toxic agents, reproductive toxins, irritants, corrosives, sensitizers, hepatotoxins, nephrotoxins, neurotoxins, agents which act on the hematopoietic system, and agents which damage the lungs, skin, eyes, or mucous membranes.

Physical Hazards	**Health Hazards**
Fire Hazards	***Systemic Effects***
Combustible liquid	Carcinogen
Flammable liquid	Toxic agent
Flammable aerosol	Highly toxic agent
Flammable gas	Corrosive
Flammable solid	Irritant
Oxidizer	Sensitizer
Pyrophoric	
	Target Organ Effects
Explosion Hazards	Hepatotoxin
Compressed gas	Nephrotoxin
Explosive	Neurotoxin
	Blood/hematopoietic toxin

Reactive Hazards	Respiratory toxin	These different types of hazards identified are presented in Table 1.
Organic peroxide	Reproductive toxin	
Unstable (reactive)	Cutaneous hazard	
Water-reactive	Eye hazard	

Table 1. Listed Hazard Categories

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http://web.princeton.edu/sites/ehs/labsafetymanual/sec7j.htm

1. Fire Hazards

A number of highly flammable substances are in common use in campus laboratories. *Combustible liquids* are those with a flash point at or above 100 degrees Fahrenheit. *Flammable liquids* include those chemicals that have a flashpoint of less than 100 degrees Fahrenheit. It should be mentioned that flash point was selected as the basis for classification of flammable and combustible liquids because it is directly related to a liquid's ability to generate vapor, i.e., its volatility. Since it is the vapor of the liquid, not the liquid itself that burns, vapor generation becomes the primary factor in determining the fire hazard. These materials must be stored in flammable storage cabinets if aggregate quantities of 10 gallons/room or more are stored in the lab. No more than 60 gallons should be stored inside a flammable cabinet at a time. *Flammable gases* include examples such as hydrogen and oxygen which could cause an explosion upon ignition.

Pyrophoric chemicals are a special classification of reactive materials that spontaneously combust when in contact with air and require laboratory-specific training. Particular attention should be given to preventing static electricity and sparks when handling flammable liquids.

2. Explosion Hazards

Compressed gases are the most common explosive hazard found at SUNY Oswego. It is important that compressed gasses are handled properly and carefully to ensure the safety of all persons here at SUNY Oswego. Each cylinder needs to be clearly labeled, and an indication must be obvious if the tank is “Full” or “Empty.” The compressed gas cylinder storage room is located on the ground floor of the Shineman Center in room G56. In storage, cylinders should be fixed to the wall. Empty cylinders should be stored away from full cylinders, and incompatible gases should be separated by a regulation divider (welding purposes) or 20 feet. Empty tanks should be called into EHS upon delivery to G56, and new tanks delivered from AirGas should be retrieved as soon as possible. Safe transport of gas cylinders will be outlined in Chapter 5 section J.

3. Reactivity Hazards

Reactive and explosive substances are materials that decompose under conditions of mechanical shock, elevated temperature, or chemical action, and release of large volumes of gases and heat. Some materials, such as *peroxide formers,* (ex. Ethyl ether, THF) may not be explosive, but may form explosive substances over time. These substances pose an immediate potential hazard and procedures which use them must be carefully reviewed. Peroxide formers must be monitored using peroxide strips every three months. These materials must also be stored in a separate flame-resistant storage cabinet or, in many cases, in laboratory grade refrigerator or freezer that are designed for flammable and reactive chemicals.

4. Health Hazards

OSHA uses the following definition for health hazards:

The term ‘health hazard’ includes chemicals which are carcinogens, toxic or highly toxic agents, reproductive toxins, irritants, corrosives, sensitizers, hepatotoxins, nephrotoxins, neurotoxins, agents which act on the hematopoietic systems, and agents which damage the lungs, skin, eyes, or mucous membranes.

5. Corrosive Substances

As a health hazard, corrosive substances cause destruction of, or alterations in, living tissue by chemical action at the site of contact.

Major classes of corrosive substances include:

- Strong acids – e.g., sulfuric, nitric, hydrochloric and hydrofluoric acids

- Strong bases – e.g., sodium hydroxide, potassium hydroxide and ammonium hydroxide
- Dehydrating agents – e.g., sulfuric acid, sodium hydroxide, phosphorus pentoxide and calcium oxide
- Oxidizing agents – e.g., hydrogen peroxide, chlorine and bromine.

6. Irritants

Irritants are defined as non-corrosive chemicals that cause reversible inflammatory effects on living tissue by chemical action at the site of contact. A wide variety of organic and inorganic compounds, including many chemicals that are in a powder or crystalline form, are irritants. The most common example of an irritant may be ordinary smoke which can irritate the nasal passages and respiratory system. Consequently, eye and skin contact with all laboratory chemicals should always be avoided. Symptoms of exposure can include reddening or discomfort of the skin and irritation to respiratory systems.

7. Sensitizers

A sensitizer (allergen) is a substance that causes exposed people to develop an allergic reaction in normal tissue after repeated exposure to the substance. Examples of sensitizers include diazomethane, chromium, nickel, formaldehyde, isocyanates, arylhydrazines, benzylic and allylic halides, and many phenol derivatives. Sensitizer exposure can lead to all of the symptoms associated with allergic reactions, or can increase an individual's existing allergies.

a. Hazardous Substances with Toxic Effects on Specific Organs

- Hepatotoxins – i.e., substances that produce liver damage, such as nitrosamines and carbon tetrachloride
- Nephrotoxins – i.e., agents causing damage to the kidneys, such as certain halogenated hydrocarbons
- Neurotoxins – i.e., substances which produce their primary toxic effects on the nervous system, such as mercury, acrylamide and carbon disulfide
- Agents which act on the hematopoietic system – e.g., carbon monoxide and cyanides which decrease hemoglobin function and deprive the body tissues of oxygen
- Agents which damage lung tissue – e.g., asbestos and silica.

Particularly Hazardous Substance

OSHA recognizes that some classes of chemical substances pose a greater health and safety risk than others. Substances that pose such significant threats to human health are classified as "particularly hazardous substances" (PHSs). The OSHA Laboratory Standard and OSHA regulation require that special provisions be established to prevent the harmful exposure of researchers to PHSs, including the establishment of designated areas for their use.

Particularly hazardous substances are divided into three primary types:

- **Carcinogens** – A carcinogen is a substance capable of causing cancer. Carcinogens are chronically toxic substances; that is, they cause damage after repeated or long-duration exposure, and their effects may become evident only after a long latency period.

A chemical is considered a carcinogen if it is included in any of the following carcinogen lists:

- OSHA-regulated carcinogens as listed in Subpart Z of the OSHA standards. The current list of substances that OSHA regulates as carcinogens or potential carcinogens follows:
    - asbestos
    - 4-Nitrobiphenyl
    - alpha-Naphthylamine
    - Methyl chloromethyl ether
    - 3,3'-Dichlorobenzidine (and its salts)
    - bis-Chloromethyl ether
    - beta-Naphthylamine
    - Benzidine
    - 4-Aminodiphenyl
    - Ethyleneimine
    - beta-Propiolactone
    - 2-Acetylaminofluorene
    - 4-Dimethylaminoazobenzene
    - N-Nitrosodimethylamine
    - Vinyl chloride
    - Inorganic arsenic
    - Cadmium
    - Benzene
    - Coke oven emissions
    - 1,2-dibromo-3-chloropropane
    - Acrylonitrile
    - Ethylene oxide
    - Formaldehyde
    - Methylenedianiline
    - 1,3-Butadiene
    - Methylene Chloride
- Under the category "known to be carcinogens" in the *Annual Report of Carcinogens* published by the National Toxicology Program (**NTP**) latest edition
- Group 1 ("carcinogenic to humans") of the International Agency for Research on Cancer (**IARC**), latest edition. Chemicals listed in Group 2A or 2B ("reasonably anticipated to be carcinogens") that cause

significant tumor incidence in experimental animals under specified conditions are also considered carcinogens under the OSHA Laboratory Standard.

- **Reproductive Toxins** – Reproductive toxins are substances that have adverse effects on various aspects of reproduction, including fertility, gestation, lactation, and general reproductive performance. When a pregnant woman is exposed to a chemical, the fetus may be exposed as well because the placenta is an extremely poor barrier to chemicals. Reproductive toxins can affect both men and women. Male reproductive toxins can in some cases lead to sterility.
- **Substances with a High Acute Toxicity** – High acute toxicity includes any chemical that falls within any of the following OSHA-defined categories:
  - A chemical with a median lethal dose (LD_{50}) of 50 mg or less per kg of body weight when administered orally to certain test populations.
  - A chemical with an LD_{50} of 200 mg less per kg of body weight when administered by continuous contact for 24 hours to certain test populations.
  - A chemical with a median lethal concentration (LC_{50}) in air of 200 parts per million (ppm) by volume or less of gas or vapor, or 2 mg per liter or less of mist, fume, or dust, when administered to certain test populations by continuous inhalation for one hour, provided such concentration and/or condition are likely to be encountered by humans when the chemical is used in any reasonably foreseeable manner.

Table 2. Lethal Dosage Overview

• OSHA Hazard Designation	Oral LD50 (rats, mg/kg)	Skin Contact LD50* (rabbits, mg/kg)	Inhalation LC50* (rats, ppm for 1 hr)
Highly toxic	<50	<200	<2000 ppm

Footnotes: *. LD**50**- value is the amount of a solid or liquid material that it takes to kill 50% of test animals (for example, mice or rats) in one dose.

*. LC**50**- The concentration of the chemical in air that will kill 50% of the test animals exposed to it. http://www.ehs.ucsb.edu/labsafety-chp/sec3/c/particularly-hazardous-substances

8. Nanomaterials

Nanomaterials include any materials or particles that have an external dimension in the nanoscale (~1 – 100 nm). Nanomaterials are both naturally occurring in the environment and intentionally produced. Intentionally produced nanomaterials are referred to as Engineered

Nanomaterials (ENMs). Materials whose properties do not differ significantly between their nanoscale and larger forms are generally excluded from ENMs. The most common types of ENMs are carbon based materials such as nanotubes, metals and metal oxides such as silver and zinc oxide, and quantum dots made of compounds such as zinc selenide (Table 3.1).

The increasing use of nanomaterials in research labs warrants consideration of the hazards they may pose. As is the case with many new technologies, the health effects of nanomaterials have not been thoroughly investigated. Consequently, the uncertainty surrounding the toxicity of nanomaterials merits a cautious approach when working with them. Nanomaterials that can be inhaled, ingested or can penetrate skin indicate a potential for exposure and present the possibility of potential health effects.

Nanomaterials can be categorized by the potential risk of exposure they pose to personnel based on the physical state of the materials and the conditions in which they are used (Table 3). In general, the risk of exposure is lowest when nanomaterials are bound in a solid matrix with little potential to create airborne dust or when in a non-volatile liquid suspension. Whenever possible, select engineered nanomaterials bound in a substrate or matrix or in water-based liquid suspensions or gels. The risk of exposure increases when nanomaterials are used as fine powders or are suspended in volatile solvents or gases. The parent compound of the nanomaterial should also be taken into consideration when evaluating the potential hazards associated with exposure (e.g., a highly toxic compound such as cadmium should be anticipated to be at least as toxic and possibly more toxic when used as a nanomaterial).

For further information see the National Institute of Occupational Safety & Health's (NIOSH) "Safe Practices for Working with Engineered Nanomaterials in Research Laboratories" (http://www.cdc.gov/niosh/docs/2012-147/pdfs/2012-147.pdf

Table 3. Nanomaterial Risk Categories

Category 1 Lower Exposure Potential	**Material State** • No potential for airborne release (when handling) • Solid: Bound in a substrate or matrix • Liquid: Water-based liquid suspensions or	**Type of Use** Non-destructive handling of solid engineering nanoparticle composites or nanoparticles permanently bonded to a substrate

	gels • Gas: No potential for release into air (when handling) • No thermal or mechanical stress	
Category 2 Moderate Exposure Potential	**Material State** • Moderate potential for airborne release (when handling) • Solid: Powders or Pellets • Liquid: Solvent-based liquid suspensions or gels • Thermal or mechanical stress induced	**Type of Use** Pouring, heating, or mixing liquid suspensions (ex. Stirring or pipetting), or operations with high degree of agitation involved Weighing or transferring powders or pellets Changing bedding out of laboratory animal cages
Category 3 Higher Exposure Potential	**Material State** • High potential for airborne release (when handling) • Solid: Powders or Pellets with extreme potential for release into air • Gas: Suspended in gas	**Type of Use** Generating or manipulating nanomaterials in gas phase or in aerosol form Furnace operations Cleaning reactors Changing filter elements Cleaning dust collection systems used to capture nanomaterials High speed abrading / grinding nanocomposite materials

https://ucla.app.box.com/ehs-chemical-hygiene-plan

IV.Controls

Safety controls are the first line of defense in a laboratory setting against exposure to hazardous chemicals. Exposure means to either ingest, inhale, inject or absorb. Of these four routes of exposure, the most likely to occur is inhalation.

Whenever possible, it is the goal of this Chemical Hygiene Plan to eliminate all routes of exposure to a hazardous chemical. Three types of controls will be outlined to make the lab the safest place possible. This document will describe engineering controls, administrative controls, and protective equipment as protection against hazards.

A. Engineering Controls

Engineering controls are what we consider to be “built in” controls. These installed controls are designed to try and eliminate hazardous conditions in the lab when hazards are present. These controls require little to no extra procedure to be followed by the end user, except monitoring and observing control functionality. Examples of engineering controls are ventilation systems, flammable storage areas, and secondary containments.

1. Ventilation Systems

Laboratories should not be part of the recirculated air system in a building. They should be completely ventilated to the outdoors. The air inside a laboratory should also be set at a negative pressure to prevent the spreading of fumes from that laboratory to outside rooms or areas. At SUNY Oswego, our Shineman Center is designed to hold a specific air pressure with lab doors closed. This aspect of design makes it very important that all occupants of Shineman keep their lab doors closed at all times, so that the hoods can function at the proper velocities and have the maximum output.

2. Fume Hoods

Fume hoods are the most commonly used local exhaust system on campus. **It is advisable to use a laboratory hood when working with all hazardous substances**. In addition, a laboratory hood or other suitable containment device must be used for all work with "particularly hazardous substances." A properly operating and correctly used laboratory hood can reduce or eliminate volatile liquids, dusts and mists.

EHS is responsible for hood inspections on an annual basis. Each hood should have a tag identifying its certification and the date of its last inspection. Each fume hood should have a current calibration sticker and a marker indicating the highest sash height to be used when working with hazardous materials. Contact EHS for a hood evaluation if these labels are missing. Air flow for fume hood ventilation is measured at nine points. The average of the nine readings must be at least 100 linear feet per minute (lfm) with a minimum of 70 lfm for any measurement.

Each fume hood must be equipped with at least one type of continuous quantitative monitoring device designed to provide the user with current information on the operational status of the hood. Many hoods also have motion sensors to determine when they are not in active use. These sensors will reduce the fume hood's air flow as part of the campus' energy savings effort. When hazardous materials are in a fume hood, but it is not under active use (e.g., during an unattended reaction or experiment), the sash should be closed. Fume hoods are not designed for storage of hazardous materials.

Outside of routine inspections, individuals in each lab are responsible for monitoring equipment, and helping to notice if there is a problem or malfunction with any fume hood or ventilation. Upon realization of malfunction Facilities should be notified and that hood should not be used until the problem is resolved.

Laboratory fume hoods are one of the most important pieces of equipment used to protect laboratory and other workers from exposure to hazardous chemicals. Chemical fume hoods should be inspected upon installation, renovation, when a deficiency is reported, or a change has been made to the operating characteristics of the hood. Since fume hoods used for regulated carcinogens have additional requirements, such as increased face velocity (average of 100-150 lfm, with no measurement less than 100 lfm), contact EHS if the intended use changes.

Table 4. Fume Hood Functionality

Fume Hood Inspections	
Step 1 – Physical Inspection (End User)	***Step 2 – Hood Performance Inspection (EHS/Professional Contractor)***
Evaluates the physical condition of the hood and the materials being used in the hood. This includes checking for: • Improper storage of materials inside the fume hood • Use of proper materials • General hood cleanliness • Physical damage to the fume hood (e.g., broken sash) • Fully functioning lighting, fume hood indicator, airflow monitor, and alarm	Evaluates the overall hood performance to ensure that it is functioning properly. This involves checking the: • Average face velocity and set minimum face velocity, which is used to determine the rating of the hood and what the hood can be used for • Noise generated by the fume hood, to ensure that it is below 85 dB • If fume hood does not pass inspection, it will be labeled with a "DO NOT USE" sign until it can be repaired.

https://ucla.app.box.com/ehs-chemical-hygiene-plan

3. Glove Boxes and Ventilation Devices

In addition to fume hoods, some laboratories use contained glove box units for working with reactive chemicals under an inert environment, working with very toxic substances in a completely closed system, or for creating a stable, breeze free, system for weighing hazardous or reactive materials. These units can be very effective because they offer complete containment.

4. Other Engineering Controls

In addition to the elements listed above, consideration must be given to providing sufficient engineering controls for the storage and handling of hazardous materials. No more than 10 gallons of flammable chemicals may be stored outside of an approved flammable storage cabinet. For refrigerated or frozen storage, flammable and explosive materials must be kept in refrigeration units specifically designed for storing these materials. Generally these units do not have internal lights or electronic systems that could spark and trigger an ignition; additionally, the cooling elements are external to the unit. These units should be labeled with a rating from Underwriters Laboratory or other certifying organization

Secondary containment must be provided for corrosive and reactive chemicals and is recommended for all other hazardous chemicals. Secondary containment should be made of chemically resistant materials and should be sufficient to hold the volume of at least the largest single bottle stored in the container.

Laboratories that use hazardous materials must contain a sink, kept clear for hand washing to remove any final residual contamination. Hand washing is recommended whenever a staff member who has been working with hazardous materials plans to exit the laboratory or work on a project that does not involve hazardous materials.

Many areas of research buildings may contain critical fire doors as part of the building design. These doors are an important element of the fire containment system and should remain closed unless they are on a magnetic self-closing or other automated self-closing system

B. Administrative Controls

The next layer of safety controls are Administrative Controls. These controls consist of policies and procedures; they are not generally as reliable as engineering controls in that the user has to carefully follow the appropriate procedures and must be fully trained and aware in order to do so.

5. Standard Operating Procedures

Standard operating procedures (SOPs) (*Appendix C*) that are relevant to safety and health considerations must be developed and followed when laboratory work involves the use of hazardous processes, and/or hazardous chemicals, especially for “particularly hazardous substances” (PHS). SOPs are written instructions that detail the steps that will be performed during a given experimental procedure and include information about potential hazards and how these hazards will be mitigated. SOPs should be written by laboratory personnel who are most knowledgeable and involved with the experimental process. The development and implementation of SOPs is a core component of promoting a strong safety culture in the laboratory and helps ensure a safe work environment.

While general guidance regarding laboratory work with chemicals is contained in this plan, PIs/Laboratory Supervisors are required to develop and implement laboratory-specific SOPs for certain hazards, hazardous chemicals, and PHS that are used in their laboratories. The Principal Investigator and all personnel responsible for performing the procedures detailed in the SOP shall work together to make sure the requirements and responsibilities outlined in the SOP are correct. The SOPs shall be reviewed by qualified personnel and shall be amended and subject to additional review and approval by the Principal Investigator where changes or variations in conditions, methodologies, equipment, or use of the chemical occurs. For certain hazardous chemicals, PHS, or specialized practices, consideration must be given to whether additional consultation with safety professionals is warranted or required.

EHS is also available to assist with the development of SOPs. SOPs must be developed prior to initiating any experiments with hazardous chemicals or PHS and are to be filed and maintained in the laboratory where they are available to all laboratory personnel.

When drafting an SOP, consider the type and quantity of the chemical being used, along with the frequency of use. The Safety Data Sheet (SDS) for each hazardous chemical or PHS that will be addressed in the SOP should be referenced during SOP development. The SDS lists important information that will need to be considered, such as exposure limits, type of toxicity, warning properties, and symptoms of exposure. If a new chemical will be produced during the experiment, an SDS will not necessarily be available. In these cases, the toxicity is unknown and it must be assumed that the substance is particularly hazardous, as a mixture of chemicals will generally be more toxic than its most toxic component.

C. Personal Protective Equipment

Personal protective equipment (PPE) serves as a researcher's last line of defense against chemical exposures and is required by everyone entering a laboratory containing hazardous chemicals.

The PPE policy outlines the basic PPE requirements, which include but are not limited to:

- Full length pants and close-toed shoes, or equivalent
- Protective gloves & eye protection when working with, or adjacent to, hazardous chemicals
- Lab coats when required by the PI or laboratory supervisor

The primary goal of basic PPE is to mitigate, at a minimum, the hazard associated with exposure to hazardous substances. In some cases, additional, or more protective, equipment must be used. If a project involves a chemical splash hazard, chemical goggles may be required; face shields may also be required when working with chemicals that may cause immediate skin damage. Safety goggles differ from safety glasses in that they form a seal with the face, which completely isolates the eyes from the hazard. If a significant splash hazard exists, heavy gloves, protective aprons and sleeves may also be needed. Gloves should only be used under the specific condition for which they are designed, as no glove is impervious to all chemicals. It is also important to note that gloves degrade over time, so they should be replaced as necessary to ensure adequate protection. The glove guide EHS suggests is available on the SUNY Oswego EHS website, as well as in Appendix F.

Personal protective equipment should be kept clean and stored in an area where it will not become contaminated. Personal protective equipment should be inspected prior to use to ensure it is in good condition. It should fit properly and be worn properly. If it becomes contaminated or damaged, it should be cleaned or repaired when possible, or discarded and replaced.

In cases where spills or splashes of hazardous chemicals on clothing or PPE occur, the clothing/PPE should immediately be removed and placed in a closed container that prevents release of the chemical. Heavily contaminated clothing/PPE resulting from an accidental spill should be disposed of as hazardous waste. Non-heavily contaminated laboratory coats should be cleaned and properly laundered, as appropriate. Laboratory personnel should **never** take contaminated items home for cleaning or laundering. Persons or companies hired to clean contaminated items must be informed of potentially harmful effects of exposure to hazardous chemicals and must be provided with information to protect themselves.

1. Respiratory Protection

Typically, respiratory protection is not needed in a laboratory. Under most circumstances, safe work practices, small scale usage, and engineering controls (fume hoods, biosafety cabinets, and general ventilation) adequately protect laboratory workers from chemical and biological hazards. Under certain circumstances, however, respiratory protection may be needed. These can include:

- An accidental spill such as a chemical outside the fume hood
- Performing an unusual operation that cannot be conducted under a fume hood or biosafety cabinet
- When weighing powdered chemicals or microbiological media outside the glove box or other protective enclosure. Disposable filtering masks are recommended for nuisance dusts. If the chemicals are toxic, contact EHS for additional evaluation.
- When exposure monitoring indicates that exposures exist that cannot be controlled by engineering or administrative controls.
- As required by a specific laboratory protocol or as defined by applicable regulations.

D. Laboratory Safety Equipment

It is important that all laboratory personnel are aware of fire extinguisher, safety shower, and eyewash station locations in case any type of emergency were to occur. It shall be a part of any orientation training that these locations are made clear to new employees and students before those individuals start working within a laboratory.

1. Fire Extinguishers

All laboratories working with combustible or flammable chemicals must be outfitted with appropriate fire extinguishers. All extinguishers should be mounted on a wall in an area free of clutter or stored in a fire extinguisher cabinet. Research personnel should be familiar with the location, use and classification of the extinguishers in their laboratory.

Laboratory personnel are <u>not required</u> to extinguish fires that occur in their work areas and should not attempt to do so unless:

- It is a small fire (i.e., small trash can sized fire)
- Appropriate training has been received
- It is safe to do so

Any time a fire extinguisher is used, no matter for how brief a period, the PI/Laboratory Supervisor, or most senior laboratory personnel present at the time of the incident, must immediately report the incident to EHS at ext. 3156.

2. Safety Showers and Eyewash Stations

All laboratories using hazardous chemicals must have immediate access to safety showers with eye wash stations. Access must be available in **10 seconds** or less for a potentially injured individual and access routes must be kept clear. Safety showers must have a minimum clearance of 16 inches from the centerline of the spray pattern in all directions at all times; this means that no objects should be stored or left within this distance of the safety shower. Keg-type shower/eyewash systems are only acceptable as a temporary solution and are not intended to replace emergency safety showers/eyewash stations.

All safety showers, eyewash stations, and sink mounted drench hoses are tested on a weekly basis by EHS. You will not find a visible record of testing as there is a barcode system which is used to input test information. You may find a complete comprehensive list of emergency shower and eyewash stations in Appendix D of this document. It should be a part of a laboratory personnel's initial training during which the nearest emergency flush stations are mapped out, to improve response time in an emergency.

In the event of an emergency, individuals using the safety shower should be assisted by an uninjured person to aid in decontamination and should be encouraged to stay in the safety shower for 15 minutes to remove all hazardous material.

IV. Handling of Chemicals

Definitions:

<u>DOT</u>: The United States Department of Transportation is a federal agency of the U.S. government. It is responsible for shaping and administering policies and programs to protect and enhance the safety, adequacy, and efficiency of the U.S. transportation systems and services.

A very important tool we can use to protect laboratory personnel is to teach the handling of chemicals. This includes ensuring chemicals are labeled properly, their whereabouts are known, knowing that chemicals are properly stored based on their characteristics, and being aware of how to transport them when necessary. Practicing these aspects safely can help protect those within the lab as well as those visiting a lab.

A. Chemical Inventories

Each laboratory group is required to maintain a current chemical inventory that lists the chemicals and compressed gases used and stored in the labs and the quantity of these chemicals. Specific storage locations must be kept as part of the inventory list to ensure that they can be easily located. Chemical inventories are used to ensure compliance with storage limits and fire regulations and can be used in an emergency to identify potential hazards for emergency response operations.

The chemical inventory list should be reviewed prior to ordering new chemicals and only the minimum quantities of chemicals necessary for the research should be purchased. As new chemicals are added to the inventory, each laboratory group must confirm that they have access to the Safety Data Sheet (SDS) for that chemical. Where practical, each chemical should be dated so that expired chemicals can be easily identified for disposal. As the chemical inventory bar coding system is implemented here at SUNY Oswego, inventories will be audited on an annual basis. Each Laboratory will be responsible for adhering the barcode label when given to them by the CHO, and removing the barcode sticker when the bottle is empty and keeping it for the CHO to “scan out”. By tracking disposed bottle barcode numbers, we can get an accurate snapshot of what chemicals are present at a given time.

Indications for disposal include:

- Cloudiness in liquids
- Color change
- Evidence of liquids in solids, or solids in liquids
- "Pooling" of material around outside of containers
- Pressure build-up within containers
- Obvious deterioration of containers

Access to hazardous chemicals, including toxic and corrosive substances, should be restricted at all times. On termination or transfer of laboratory personnel, all related hazardous materials should be properly disposed of, or transferred to the laboratory supervisor or a designee.

B. Chemical Labeling

Every chemical found in the laboratory must be properly labeled. Most chemicals come with a manufacturer's label that contains the necessary information, so care should be taken to not damage or remove these labels. Each chemical bottle, including diluted chemical solutions, must be labeled with its contents and the hazards associated with this chemical. In addition to the manufacturer's label, each chemical bottle must be labeled with the bar code created for that bottle. The barcode will be generated upon arrival to SUNY Oswego (Shipping Receiving Mailroom) and sent to the lab with the chemical. It is required that the lab affix the label to the bottle, and when the bottle is empty the label will be peeled and affixed to the lab's "spent" sheet. The spent sheet will be used to complete the chemical inventory. It is the goal of EHS to account for every bottle whether it is in use or empty. By being aware of the chemicals we have on site, we can be sure to cut down on excess inventory and hopefully excess waste.

Peroxide forming chemicals (e.g., ethers) must be labeled with a date on receipt and on first opening the bottle. Labels are available in appendix E. These chemicals can degrade to form shock sensitive, highly reactive compounds and should be stored and labeled very carefully. Peroxide formers at SUNY Oswego will have a manufacturer's label, barcode, and caution label.

Particularly Hazardous Substances (see *Hazard Communication Section*) require additional labeling. Printable safety labels are available in Appendix E of this document that identify the specific hazard associated with each of these chemicals (carcinogen, reproductive toxin, acute toxin). These chemicals should be segregated from less hazardous chemicals to help with proper access control and hazard identification.

We also provide an additional warning label for other hazardous materials such as pyrophoric or water reactive chemicals that may be used in the laboratory. This label is also available in appendix E.

C. Chemical Storage and Segregation

Storage guidelines are included for materials that are flammable, oxidizers, corrosive, water-reactive, explosive and highly toxic. The specific Safety Data Sheet (SDS) should always be consulted when doubts arise concerning chemical properties and associated hazards. All procedures employed must comply with OSHA, Fire Code and building code regulations. Always wear appropriate personal protective equipment (e.g., laboratory coat, safety glasses, gloves, safety goggles, apron) when handling hazardous chemicals. Be aware of the locations of the safety showers and emergency eyewash stations. Each laboratory is required to provide appropriate laboratory-specific training on how to use this equipment **prior** to working with hazardous chemicals.

Keep in mind that most chemicals have multiple hazards and a decision must be made as to which storage area would be most appropriate for each specific chemical. First you have to determine your priorities:

- **Flammability.** When establishing a storage scheme, the number one consideration should be the flammability characteristics of the material. If the material is flammable, it should be stored in a flammable cabinet.
- **Isolate.** If the material will contribute significantly to a fire (e.g., oxidizers), it should be isolated from the flammables. If there were a fire in the laboratory and response to the fire with water would exaggerate the situation, isolate the water reactive material away from contact with water.
- **Corrosivity.** Next look at the corrosivity of the material, and store accordingly.
- **Toxicity.** Finally, consider the toxicity of the material, with particular attention paid to regulated materials. In some cases, this may mean that certain chemicals will be isolated within a storage area. For example, a material that is an extreme poison but is also flammable, should be locked away in the flammable storage cabinet to protect it against accidental release.

There will always be some chemicals that will not fit neatly in one category or another, but with careful consideration of the hazards involved, most of these cases can be handled in a reasonable fashion.

D. General Recommendations for Safe Storage of Chemicals

Each chemical in the laboratory must be stored in a specific location and returned there after each use. Acceptable chemical storage locations may include corrosive cabinets, flammable cabinets, laboratory shelves, or appropriate refrigerators or freezers. Fume hoods should not be used as general storage areas for chemicals, as this may seriously impair the ventilating capacity of the hood. Chemicals should not be routinely stored on bench tops or stored on the floor.

Chemicals must be stored at an appropriate temperature and humidity level and should **never** be stored in direct sunlight or near heat sources, such as laboratory ovens. Incompatible materials should be stored in separate cabinets, whenever possible (for a comprehensive list see appendix G). If these chemicals must be stored in one cabinet, due to space limitations, adequate segregation and secondary containment must be ensured to prevent adverse reactions. All stored containers and research samples must be appropriately labeled and tightly capped to prevent vapor interactions and to alleviate nuisance odors. Flasks with cork, rubber or glass stoppers should be avoided because of the potential for leaking.

Laboratory refrigerators and freezers must be labeled appropriately with “No Food/Drink” and must **never** be used for the storage of consumables. Freezers should be defrosted periodically so that chemicals do not become trapped in ice formations. **Never** store peroxide formers (e.g., ether) in a refrigerator!

E. Flammable and Combustible Materials

Large quantities of flammable or combustible materials should not be stored in the laboratory. The maximum total quantity of flammable and combustible liquids must not exceed **60 gallons** within a flammable storage cabinet. The maximum quantity allowed to be kept outside a flammable storage cabinet, safety can, or approved refrigerator/freezer is **10 gallons**. Only the amounts needed for the current procedure should be kept on bench tops and the remainder should be kept in flammable storage cabinets, explosion proof refrigerators/freezers that are approved for the storage of flammable substances, or approved safety cans or drums that are grounded. Always segregate flammable or combustible liquids from oxidizing acids and oxidizers. Flammable materials must **never** be stored in domestic-type refrigerators/freezers and should not be stored in a refrigerator/freezer if the chemical has a flash point below the temperature of the equipment. Flammable or combustible liquids must not be stored on the floor or in any exit access.

Handle flammable and combustible substances only in areas free of ignition sources and use the chemical in a fume hood whenever practical. Only the amount of material required for the experiment or procedure should be stored in the work area. Always transfer flammable and combustible chemicals from glass containers to glassware or from glass container/glassware to plastic. Transferring these types of chemicals between plastic containers may lead to a fire hazard due to static electricity. <u>The transfer of flammable liquid from 5 gallon or larger metal containers should **not** be done in the laboratory</u>.

F. Pyrophoric and Water Reactive Chemicals

Because pyrophoric substances can spontaneously ignite on contact with air and/or water, they must be handled under an inert atmosphere and in such a way that rigorously excludes air and moisture. Some pyrophoric materials are also toxic and many are dissolved or immersed in a flammable solvent. Other common hazards include corrosivity, teratogenicity, or peroxide formation.

Only minimal amounts of reactive chemicals should be used in experiments or stored in the laboratory. These chemicals must be stored as recommended in the SDS. Reactive materials containers must be clearly labeled with the correct chemical name, in English, along with a hazard warning.

Suitable storage locations may include inert gas-filled desiccators or glove boxes; however, some pyrophoric materials must be stored in a flammable substance approved freezer. If pyrophoric or water reactive reagents are received in a specially designed shipping, storage or dispensing container (such as the Aldrich Sure/Seal packaging system), ensure that the integrity of that container is maintained. Ensure that sufficient protective solvent, oil, kerosene, or inert gas remains in the container while pyrophoric materials are stored. Never store reactive chemicals with flammable materials or in a flammable liquids storage cabinet.

Never return excess reactive chemical to the original container. Small amounts of impurities introduced into the container may cause a fire or explosion.

G. Oxidizers

Oxidizers (e.g., hydrogen peroxide, ferric chloride, potassium dichromate, sodium nitrate) should be stored in a cool, dry place and kept away from flammable and combustible materials, such as wood, paper, Styrofoam, plastics, flammable organic chemicals, and away from reducing agents, such as zinc, alkaline metals, and formic acid.

H. Peroxide Forming Chemicals

Peroxide forming chemicals (PFC) (comprehensive list found in Appendix I)should be stored in airtight containers in a dark, cool, and dry place and must be segregated from other classes of chemicals that could create a serious hazard to life or property should an accident occur (e.g., acids, bases, oxidizers). The containers should be labeled with the date received. This information, along with the chemical identity should face forward to minimize container handling during inspection. These chemicals must also be tested and documented for the presence of peroxides every 3 months using test strips. Minimize the quantity of peroxide forming chemicals stored in the laboratory and dispose of peroxide forming chemicals before peroxide formation.

Carefully review all cautionary material supplied by the manufacturer prior to use. Avoid evaporation or distillation, as distillation defeats the stabilizer added to the solvents. Ensure that containers are tightly sealed to avoid evaporation and that they are free of exterior contamination or crystallization. **Never** return unused quantities back to the original container and clean all spills immediately.

If old containers of peroxide forming chemicals are discovered in the laboratory, (greater than two years past the expiration date or if the date of the container is unknown), **do not handle the container**. If crystallization is present in or on the exterior of a container, **do not handle the container**. Secure it and contact the **EHS at x6637** for pick-up and disposal.

I. Corrosives

Store corrosive chemicals (i.e., acids, bases) below eye level and in secondary containers that are large enough to contain at least 10% of the total volume of liquid stored or the volume of the largest container, whichever is greater. Acids must always be segregated from bases and from active metals (e.g., sodium, potassium, magnesium) at all times and must also be segregated from chemicals which could generate toxic gases upon contact (e.g., sodium cyanide, iron sulfide).

Specific types of acids require additional segregation. Mineral acids must be kept away from organic acids and oxidizing acids must be segregated from flammable and combustible substances. Perchloric acid should be stored by itself, away from other chemicals. Picric Acid is reactive with metals or metal salts and explosive when dry and must contain at least 10% water to inhibit explosion.

J. Compressed Gas Cylinders

Compressed gas cylinders must be stored with the safety cap in place when not in use. Cylinders must be stored either chained to the wall or chained within in a cylinder storage rack. For wall storage, no more than three cylinders may be chained together in the laboratory. Bolted “clam shells” may be used in instances where gas cylinders must be stored or used away from the wall. Store liquefied fuel-gas cylinders securely in the upright position. **Cylinders containing certain gases are prohibited from being stored in a horizontal position, including those which contain a water volume of more than 5 liters.** Do not expose cylinders to excessive dampness, corrosive chemicals or fumes.

Certain gas cylinders require additional precautions. Flammable gas cylinders must use only flame-resistant gas lines and hoses which carry flammable or toxic gases from cylinders and must have all connections wired. Compressed oxygen gas cylinders must be stored at least 20 feet away from combustible materials and flammable gases.

Gas cylinder connections must be inspected frequently for deterioration and must never be used without a regulator. Never use a leaking, corroded or damaged cylinder and never refill compressed gas cylinders. When stopping a leak between cylinder and regulator, always close the valve before tightening the union nut. The regulator should be replaced with a safety cap when the cylinder is not in use. Move gas cylinders with the safety cap in place using carts designed for this purpose. When the vendor comes to Oswego, gas cylinders may be stored temporarily in the “Gas Cylinder Storage Room G56 Shineman,” only if they are properly labeled and if the CHO is notified. The label should include the Name of the PI/Laboratory Supervisor, account # and status of the tank (full, empty, or partial). Empties should be called in to the vendor **before** they enter the storage room. Never allow anyone to ride along with the gas cylinder when transporting via elevator.

K. Liquid Nitrogen

Because liquid nitrogen containers are at low pressure and have protective rings mounted around the regulator, they are not required to be affixed to a permanent fixture such as a wall. However, additional protection considerations should be addressed when storing liquid nitrogen in a laboratory. The primary risk to laboratory personnel from liquid nitrogen is skin or eye thermal damage caused by contact with the material. In addition, nitrogen expands 696:1 when changing from a cryogenic liquid to a room temperature gas. The gases usually are not toxic, but if too much oxygen is displaced, asphyxiation is a possibility. Always use appropriate thermally insulated gloves when handling liquid nitrogen.

L. Transportation of Chemicals

1. On Site Transport

A secondary container and cart should be used to transport chemicals through the hallways safely. The container should be large enough to hold the contents of the chemical bottle in case it were to break. It is important to always be wearing the proper PPE when handling chemicals. However, it is bad practice to wear contaminated gloves in hallways, corridors, and public areas such as elevators. Please remove used gloves before touching doorknobs, sink handles, and before entering public areas.

2. Off-Campus Transport

    The transportation of hazardous chemicals and compressed gases over public roads, or by air, is strictly governed by international, federal, and state regulatory agencies, including the U.S. Department of Transportation (DOT) and the International Air Transport Association (IATA). Any person who prepares and/or ships these types of materials must ensure compliance with pertinent regulations regarding training, quantity, packaging, and labeling. Without proper training, it is illegal to ship hazardous materials. Those who violate the hazardous materials shipment regulations are subject to criminal investigation and penalties. SUNY Oswego campus personnel who sign hazardous materials manifests, shipping papers, or those who package hazardous material for shipment, must be trained and certified by EHS.

    Individuals who wish to ship or transport hazardous chemicals or compressed gases off-campus must contact EHS at x3150.

VI. Hazardous Waste Management

Definitions

<u>EPA</u>: Environmental Protection Agency; an independent federal agency established to coordinate programs aimed at reducing pollution and protecting the environment.

<u>CAA:</u> Central Accumulation Area; Secure location managed by environmental health and safety and the chemical hygiene officer where hazardous waste is brought from laboratory spaces. The waste is collected and documented in the CAA and prepared for pick-up by a vendor within the appropriate time period.

<u>SAA:</u> Satellite Accumulation Area; secure area within a laboratory managed by the PI or Laboratory Supervisor where waste is temporarily stored (for up to 90 Days) before being picked up by EHS. These areas are designed specifically to be located within rooms where hazardous waste is generated.

A. Program

The EHS Department manages the shipment and disposal of all hazardous waste generated on campus. Each laboratory employee must comply with the campus Hazardous Waste

Management Program requirements and all applicable regulations. There is generally a pick-up scheduled each semester by EHS involving departmental coordinators and larger volume (according to SUNY Oswego) waste producing labs. Pickups can be scheduled anytime by calling x6637. Regular pickup is within the Shineman Center where most of our labs reside, but pick-up is available upon request to other locations where hazardous waste is generated. Laboratory personnel are responsible for identifying waste, labeling it, and storing it properly in the laboratory. Laboratory clean-outs and disposal of high hazard compounds must be scheduled in advance. The PI/Laboratory Supervisor is responsible for coordinating the disposal of all chemicals from his/her laboratories prior to closing down laboratory operations.

B. Definitions

EPA regulations define hazardous waste as substances having one of the following hazardous characteristics:

- <u>Corrosive</u>: pH < 2 or >12.5
- <u>Ignitable</u>: liquids with flash point below 60º C or 140º F [e.g. Methanol, Acetone]
- <u>Reactive</u>: unstable, explosive or reacts violently with air or water, or produces a toxic gas when combined with water [e.g. Sodium metal]
- <u>Toxic</u>: Determined by toxicity testing [e.g. Mercury]

The EPA definition of hazardous waste also extends to the following items:

- Abandoned chemicals
- Unused or unwanted chemicals
- Chemicals in deteriorating containers
- Empty containers that have visible residues
- Containers with conflicting labels
- Unlabeled or unknown chemicals

Chemicals not in frequent use must be carefully managed to prevent them from being considered a hazardous waste. This is especially true for certain compounds that degrade and destabilize over time and require careful management so that they do not become a safety hazard (see the section below titled "Wastes that Require Special Handling").

C. Extremely Hazardous Waste

Certain compounds meet an additional definition known as "extremely hazardous waste". This list of compounds includes carcinogens, pesticides, and reactive compounds, among others (e.g., cyanides, sodium azide, and hydrofluoric acid). The Federal EPA refers to this waste as "acutely hazardous waste", but EPA has published a more detailed list of extremely hazardous waste. The EHS list of extremely hazardous waste (P-Listed Waste), found in Appendix H.

D. Training

All personnel who are responsible for handling, managing or disposing of hazardous waste must have training **prior** to working with these materials. The Hazardous Chemical Waste training, covers the hazardous waste program requirements and includes training on the container labeling program.

E. Identification

All the chemical constituents in each hazardous waste stream must be accurately identified by knowledgeable laboratory personnel. This is a critical safety issue for both laboratory employees and the chemical hygiene officer that handles the waste once it is turned over to EHS. Mixing of incompatible waste streams has the potential to create violent reactions and is a common cause of laboratory accidents. If there is uncertainty about the composition of a waste stream resulting from an experimental process, laboratory workers must consult the PI/Laboratory Supervisor or the Chemical Hygiene Officer. In most cases, careful documentation and review of all chemical products used in the experimental protocol will result in accurate waste stream characterization.

F. Labeling

It is extremely important that all laboratory personnel are aware and comfortable with the labeling process of hazardous waste produced at SUNY Oswego. The following is an example of the hazardous waste label we use at SUNY Oswego.

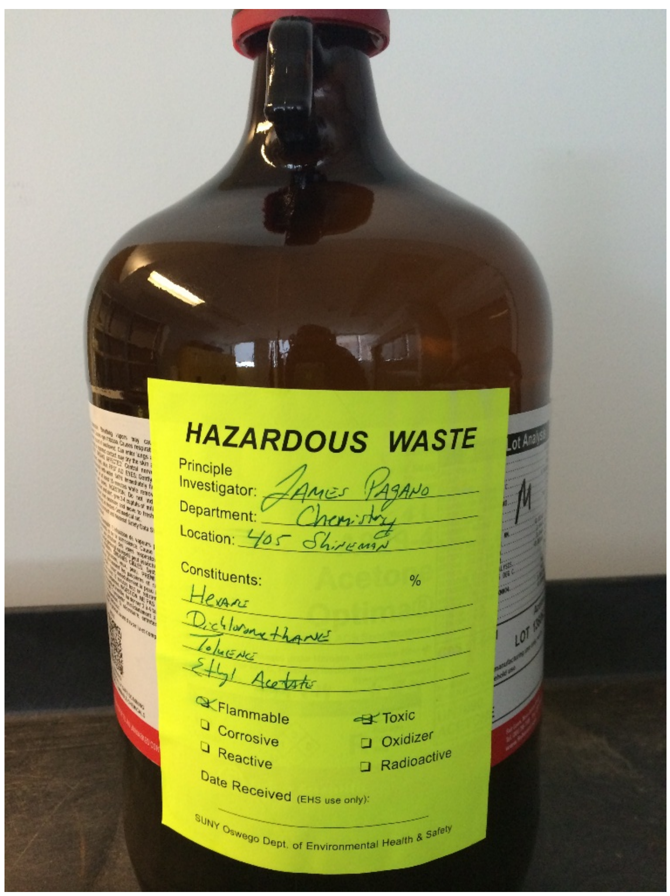


Figure 3. Correctly Labeled hazardous Waste Bottle

The label **MUST INCLUDE** the laboratory supervisor or PI, and all constituents contained within a particular hazardous waste bottle. The Date Received at the bottom of the label pertains to the date the bottle is received by EHS in the Central Accumulation Area (CAA). Best practice states to add a chemical to the label before adding a drop to the waste bottle. Using this rule ensures knowing exactly what each bottle contains, and allows for double checking that a constituent is safe to be mixed with other waste chemicals already present. Each label must be clearly written, and visible on the outward facing side of the waste bottle.

G. Storage

Figure 4: Example Satellite Accumulation Area

The hazardous waste storage area in each laboratory is considered a Satellite Accumulation Area (SAA) by the EPA. According to EPA requirements, this area must remain under the control of the persons producing the waste. This means that it should be located in an area that is supervised and is not accessible to the public. Other SAA requirements include:

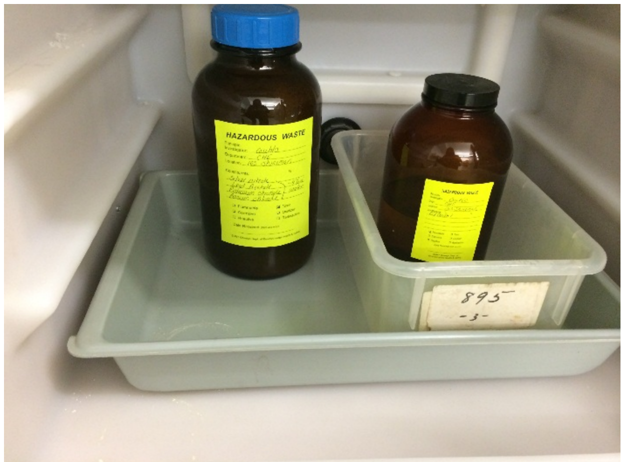


Figure 5: Inside a Satellite Accumulation Area

1. Hazardous waste containers must be labeled with an official hazardous waste tag at all times.
2. Waste must be collected and stored at or near the point of generation.
3. According to OSHA, the maximum amount of waste that can be stored in a SAA is 55 gallons of a hazardous waste or 1 liter of extremely hazardous waste. If you reach these volumes for a specific waste stream, you must date the container, and it must be removed within 3 days.
4. The maximum amount of flammable solvents allowed to be stored in a laboratory is 60 gallons; this figure also includes waste solvents
5. All hazardous waste containers in the laboratory must be kept closed when not in use
6. Hazardous waste streams must have compatible constituents, and must be compatible with the containers that they are stored in
7. Hazardous waste containers must be stored in secondary containment at all times.
8. Containers must be in good condition with leak proof lids
9. Containers must be less than 90% full
10. Dry wastes must be double-bagged in clear, 3-mil plastic bags (these do not require secondary containment).

H. Segregation

All hazardous materials must be managed in a manner that prevents spills and uncontrolled reactions. Stored chemicals and waste should be segregated by hazard class. Examples of proper segregation are:

- Segregate acids from bases
- Segregate oxidizers from organics
- Segregate cyanides from acids

Segregation of waste streams should be conducted in a similar manner to segregation of chemical products. For a more complete list of incompatible chemicals please see Appendix G of this document.

I. Explosives

Chemicals classified by the Department of Transportation (DOT) as explosives (e.g., many nitro- and azo- compounds) will require special packaging and shipping, and may require stabilization prior to disposal. Consult with the Chemical Hygiene Officer for disposal considerations of these compounds.

J. Peroxide Forming Chemicals

Peroxide forming chemicals, or PFCs, include a number of substances that can react with air, moisture or product impurities, and undergo a change in their chemical composition during normal storage. The peroxides that form are highly reactive and can explode upon shock or spark. Peroxides are not particularly volatile and thus tend to precipitate out of liquid solutions. It is particularly dangerous to allow a container of these materials to evaporate to dryness, leaving the crystals of peroxide on the surfaces of the container.

Ensure containers of PFCs are kept tightly sealed to avoid unnecessary evaporation, as this inhibits the stabilizers that are sometimes added. Visually inspect containers periodically to ensure that they are free of exterior contamination or crystallization. PFC containers must be disposed of prior to expiration date. If old containers of peroxide forming chemicals are discovered in the laboratory, (greater than two years past the expiration date or if the date of the container is unknown), **do not handle the container**. If crystallization is present in or on the exterior of a container, **do not handle the container**. Secure it and contact the **EHS at x6637**. Keep in mind that disposing of these chemicals can be costly.

K. Unknowns

Perhaps the most dangerous and costly mistake would be to have a bottle of "unknown" chemical waste. If proper labeling and safety practices are used, this should not happen on SUNY Oswego's campus. If an unknown chemical is found, never mix anything with it. The fee to have the chemical analyzed and then properly disposed of is hefty, and doesn't need to be added to. Please contact EHS at x6637 immediately if an unknown chemical or waste bottle is recovered.

L. Managing Empty Containers

Hazardous waste containers, if they are less than 5 gallons in size, should either be reused for hazardous waste collection, or should be cleaned and discarded or recycled. Proper cleaning involves triple rinsing the container, with the first rinse collected as hazardous waste. Then the labels should be completely defaced (remove it or mark it out completely). Dispose or recycle rinsed plastic or glass containers as regular trash or in a campus recycling bin. Empty containers 5 gallons in size or more should be turned in to EHS or brought to a hazardous waste pick-up.

M. Transportation

It is a violation of DOT regulations to transport hazardous waste in personal vehicles, or to carry hazardous waste across campus streets that are open to the public. As a result, EHS provides pick-up services for all hazardous waste generators. These routine waste pick-ups are for routinely generated research wastes. Special pick-ups and laboratory clean-outs are available upon request for large volumes.

N. Disposal

Frequent disposal will ensure that waste accumulation areas in labs are managed properly, and that maximum storage volumes are not exceeded. Hazardous chemical waste can be stored in a laboratory for up to 90 days. Once a waste container is 90% full or it is near the 90 day time limit, it should be picked up.

Acceptable Wastes for a Routine Pick Up

EHS accepts the following materials at a routine pick-up:

- Liquid waste in suitable containers that are clean, free of contamination, and have a leak proof cap
- Dry waste that is double bagged in clear 3-mm plastic

Wastes that will **not** be accepted at a routine pick-up location include:

- Biohazardous waste (medical waste, infectious materials or biohazardous agents)
- Radioactive Wastes
- Controlled Substances
- Reactive waste streams without a properly vented cap, or containers that are bulging, fuming or bubbling
- Leaking, overflowing, or contaminated containers, or containers that are compromised
- Bags that have protruding glass or other sharps, or bags that are ripped or punctured
- Waste streams in incompatible containers
- Unknowns and expired PFCs

VII. Minimizing Waste

In order to meet our permit obligations and our sustainability mission, a part of our chemical hygiene program is to keep waste to a minimum. In an effort to minimize the costs, health hazards, and environmental impacts associated with the disposal of hazardous waste, we first look to minimize our usage of hazardous materials.

A. Administrative Controls

In order to reduce the amount of chemicals that become waste, administrative and operational waste minimization controls can be implemented. Usage of chemicals in the laboratory areas should be reviewed to identify practices which can be modified to reduce the amount of hazardous waste generated.

Purchasing Control: Check the inventory of our chemicals input in the barcoding system with the help of the chemical hygiene officer before new products are ordered. When ordering chemicals, be aware of any properties that may preclude long term storage, and order only exact volumes to be used. Using suppliers who can provide quick delivery of small quantities can assist with reducing surplus chemical inventory

Inventory Control: Rotate chemical stock to keep chemicals from becoming outdated. Locate surplus/unused chemicals and attempt to redistribute these to other users, or investigate returning unused chemicals to the vendor.

Operational Controls: Review your experimental protocol to ensure that chemical usage is minimized. Reduce total volumes used in experiments; employ small scale procedures when possible. Instead of wet chemical techniques, use instrumental methods, as these generally require smaller quantities of chemicals. Evaluate the costs and benefits of off-site analytical services. Avoid mixing hazardous and non-hazardous waste streams. Distill and reuse solvents if possible. Spent solvents can also be used for initial cleaning, using fresh solvent only for final rinse. Use less hazardous or non-hazardous substitutes when feasible. Some examples include:

- Specialty detergents can be substituted for sulfuric acid/chromic acid cleaning solutions
- Gel Green and Gel Red are recommended in place of ethidium bromide

B. Drain Disposal

SUNY Oswego does not permit drain disposal of chemical wastes, unless a specific dilution and/or neutralization method for a consistent waste stream has been reviewed and approved by EHS. This applies to weak acid and base solutions. As indicated in previous sections, EPA hazardous waste definitions specify that materials with a pH between 2.5 and 12.5 are not hazardous wastes. However, local industrial waste water discharge requirements have more restrictive pH thresholds. For our output on campus discharge must be a pH between 4 and 10. Drain disposal of these materials is still not permitted, because local industrial waste water discharge requirements have more restrictive pH thresholds. In addition, acid and base neutralization is considered waste treatment, a process that is strictly regulated by the EPA (see “Bench Top Treatment” below). Contact EHS for specific questions about drain disposal variances.

Drain disposal of properly disinfected infectious or bio-hazardous liquids is acceptable, if disinfection is conducted as specified by the EHS Biosafety Program, and the liquids disposed contain no other hazardous constituents.

- Bench Top Treatment
  EPA regulations allow some limited bench top treatment of certain chemical waste streams in laboratories provided that specific procedures are followed. Due to the stringent nature of these requirements, any treatment of hazardous waste in labs must be reviewed and approved by EHS. The EPA requirements for treating hazardous waste in laboratories generally follow the "Prudent Practices in the Laboratory 1995" (p. 160-171) National Research Council procedures, or other peer-reviewed scientific publications. The quantity of waste treated in one batch cannot exceed 5 gallons of liquid or 18 kilograms of solid/semi-solid waste. As treatment may result in residuals which may have to be managed as hazardous waste, all residual hazardous waste must be handled according to SUNY Oswego’s Hazardous Waste Management Program.

VIII. Training

Effective training is critical to facilitate a safe and healthy work environment and prevent laboratory accidents. All PIs/Laboratory Supervisors must participate in formal safety training and ensure that all their employees have appropriate safety training before working in a laboratory. All laboratory personnel must complete general safety training before:

1. Beginning work in the laboratory;
2. Prior to new exposure situations; and
3. As work conditions change.

A. General Training

All Persons working in a lab must complete a general knowledge safety training on an annual basis which includes the following:

- Review of safe general practices in a lab (Appendix _)
- Review of reference materials available and their locations such as Chemical Hygiene Plan and Safety Data Sheets
- Identifying Hazards in the Lab
- Proper Hazardous Waste storage/disposal
- Locations of emergency showers and eyewash stations
- Proper use of PPE and Engineering Controls

The general training is to be completed at least annually and need to include all persons working in a lab. This can easily be coordinated at the Department level, and EHS is always available for resources and help with the training. Attendance should be taken and sent to EHS.

B. Specific Training

PIs and Laboratory Supervisors are responsible for conducting training in their specific labs for their specific hazards. Topics for this training should include but are not limited to the following:

- Review of laboratory rules, regulations, and specific hazards
- Use of engineering controls, administrative controls and personal protective equipment to mitigate hazards
- Exposure limits for hazardous chemicals
- Signs and symptoms associated with exposures to hazardous chemicals
- Chemical exposure monitoring
- Procedures for disposing of hazardous chemical waste
- Fire safety and emergency procedures
- Location and use of the Chemical Hygiene Plan, IIPP, SDS(s) and other regulatory information
- Review of Emergency Management Plan, including location of emergency equipment (nearest eyewashes and showers) and exit routes

- Specialized equipment
- Standard Operating Procedures
- Specialized procedures and protocols
- Particularly Hazardous Substances including physical and health hazards, potential exposure, medical surveillance, and emergency procedures

It is expected that written records of the training time, place, and attendance will be kept by the laboratory supervisor or PI.

C. Documentation

Accurate recordkeeping is a critical component of health and safety training. Per OSHA regulations, departments or laboratories are responsible for documenting health and safety training, including safety meetings, one-on-one training, and classroom and online training.

IX. Medical/Exposure Monitoring

A. Reducing Exposure

All University employees require protection from exposure to hazardous chemicals above PELs. The following measures should be used to reduce any possible exposures to chemicals hazardous in nature or not.

1. Engineering controls, whenever feasible;
2. Administrative controls whenever engineering controls are not feasible or do not achieve full compliance and administrative controls are practical; and
3. Personal protective equipment, including respiratory protection, during:

    · For the time period necessary to install or implement feasible engineering controls;
    · When engineering and administrative controls fail to achieve full compliance;
    · And in emergencies.

A. Exposure Assessment

In the occurrence that proper conditions are not met using the aforementioned controls, an exposure assessment may ensue. OSHA requires the person supervising, directing or evaluating the exposure assessment monitoring be competent in the practice of industrial hygiene. Thus, exposure assessment should be performed only by representatives of EHS and not the PI/Laboratory Supervisor.

Personal exposure assessment will be performed under either of the following situations:

1. Based on chemical inventories, review of Standard Operating Procedures (SOPs), types of engineering controls present, laboratory inspection results and/or review of the annual Laboratory Hazard Assessment Tool, EHS determines whether an exposure assessment is warranted; or

2. User of a hazardous chemical has concern or reason to believe exposure is not minimized or eliminated through use of engineering controls or administrative practices (such as transfer of chemical through double needle performed entirely in a fume hood) and the potential for exposure exists. The user should then inform his or her PI/Laboratory Supervisor, who will in turn contact the EHS.

In event of any serious injury or exposure, including chemical splash involving dermal or eye contact, immediately call **911 or 5555** from a campus phone or **315-312-5555** from an off-campus or cell phone and obtain medical treatment immediately. Do not wait for an exposure assessment to be performed before seeking medical care.

B. Medical Evaluation

All employees, student workers, medical health services volunteers, or laboratory personnel who work with hazardous chemicals shall have an opportunity to receive a free medical evaluation, including supplemental examinations which the evaluating physician determines necessary.

All work-related medical evaluations and examinations will be performed under the direction of SUNY Oswego's EHS Department by licensed physicians or staff under the direct supervision of a licensed physician. Any laboratory employee or student worker who exhibits signs and symptoms of adverse health effects from work-related exposure to a hazardous chemical should report to EHS immediately to discuss medical evaluation.

- **Medical Surveillance**

  A medical professional and/or outside vendors may provide medical surveillance services. Medical surveillance is required of employees who are routinely exposed to certain hazards as part of their job description (such as asbestos) and may be offered to other employees based upon quantifiable or measured exposure. Examples of hazards that are monitored through the medical surveillance program may include:

  a. Asbestos
  b. Beryllium
  c. Formaldehyde
  d. Lead
  e. Methylene Chloride
  f. Noise

g. Radioactive Chemicals
h. Respirator Use
i. Other Particularly Hazardous Substances

X. Inspections and Compliance

As part of EHS's obligation to uphold as safe working and learning environment here at SUNY Oswego, we are committed to performing routine inspections which ensure compliance to the Chemical Hygiene Program in its integrity. Inspections will cover the following material:

- Documentation and Training;
- Hazard Communication (including review of SOPs);
- Emergency and Safety Information;
- Fire Safety;
- General Safety;
- Use of personal protective equipment (PPE);
- Housekeeping;
- Chemical Storage;
- Fume Hoods;
- Chemical Waste Disposal and Transport; and
- Mechanical and Electrical Safety.

If all expectations of compliance are not met, EHS will work with the laboratory supervisor or PI to ensure that all necessary resources are available to meet compliance. All labs and areas containing hazardous materials or processes should meet the general safety expectations of not only EHS at SUNY Oswego, but also of OSHA.

XI. Emergencies

Laboratory emergencies may result from a variety of factors, including serious injuries, fires and explosions, spills and exposures, and natural disasters. All laboratory employees should be familiar with and aware of the location of their laboratory's emergency response plans and how to use them. **Before beginning any laboratory task**, know what to do in the event of an emergency situation. Identify the location of safety equipment, including eye washes, safety showers, fire extinguishers, fire alarm pull stations, and spill kits. Plan ahead and know the location of the closest fire alarms, exits, and telephones in your laboratory.

For all incidents requiring emergency response, call UP at 911 from a campus phone or 315-312-5555 from off-campus or cell phones.

A. Accidents

PIs/Laboratory Supervisors are responsible for ensuring that their employees receive appropriate medical attention in the event of an occupational injury or illness. All accidents and near misses must be reported to the **EHS Department**. EHS will conduct an accident investigation and develop recommendations and corrective actions to prevent future accidents. At a minimum, each laboratory must have the following preparations in place:

1. Posting of emergency telephone numbers and locations of emergency treatment facilities, including OHF
2. Training of staff to accompany injured personnel to medical treatment site and to provide medical personnel with copies of SDS(s) for the chemical(s) involved in the incident

Table 5. Minimizing Accidents in the Laboratory

Accident Prevention Methods	
Do	**Don't**
• Always wear appropriate eye protection • Always wear appropriate laboratory coat • Always wear appropriate gloves • Always wear closed-toe shoes and long pants • Always confine long hair and loose clothing • Always use the appropriate safety controls (e.g., certified fume hoods) • Always label and store chemicals properly • Always keep the work area clean and uncluttered	☐Never enter the laboratory wearing inappropriate clothing (e.g., open-toe shoes and shorts) ☐Never work alone on procedures involving hazardous chemicals, biological agents, or other physical hazards ☐Never eat, drink, chew gum or tobacco, smoke, or apply cosmetics in the laboratory ☐Never use damaged glassware or other equipment

https://ucla.app.box.com/ehs-chemical-hygiene-plan

If an employee has a severe or life threatening injury, call for emergency response University Police x5555. Employees with minor injuries should be treated as appropriate, and sent to Mary Walker Health Center for further evaluation and treatment. After normal business hours, treatment can be obtained at designated medical centers and emergency rooms.

Serious occupational injuries, illnesses, and exposures to hazardous substances must be reported to EHS at 315-312-6637 within 8 hours. EHS will report the event to OSHA, investigate the accident, and complete exposure monitoring if necessary. Serious injuries include those that result in permanent impairment or disfigurement, or require hospitalization. Examples include amputations, lacerations with severe bleeding, burns, concussions, fractures and crush injuries. As soon as PIs/Laboratory Supervisors are aware of a potentially serious incident, they must contact EHS.

B. Fire-Related Emergencies

If you encounter a fire, or a fire-related emergency (e.g., abnormal heating, smoke, burning odor), immediately follow these instructions:

1. Pull the fire alarm pull station **and call 911 from a campus phone or 315-312-5555** from an off-campus or cell phone to notify the Fire Department;
2. Evacuate and isolate the area
   - Use portable fire extinguishers to facilitate evacuation and/or control a small fire (i.e., size of a small trash can), if safe to do so
   - If possible, shut off equipment before leaving
   - Close doors;
3. Remain safely outside the affected area to provide details to emergency responders; and
4. Evacuate the building when the alarm sounds. **It is against state law to remain in the building when the alarm is sounding.** If the alarm sounds due to a false alarm or drill, you will be allowed to re-enter the building as soon as the Fire Department determines that it is safe to do so. **Do not go back in the building until the alarm stops and you are cleared to reenter.**

If your clothing catches on fire, stop, drop, and roll. A fire extinguisher may be used to extinguish a fire on someone's person. Report any burn injuries to the supervisor immediately and seek medical treatment. Report to the EHS Hotline at 310-825-9797 within 8 hours every time a fire extinguisher is discharged.

C. Spills

If a spill occurs in the laboratory, follow the steps outlined below.

1. Immediately alert your co-workers and supervisor of the spill.
2. Eliminate potential sources of ignition
3. All personnel should leave the immediate area

- Minor Spills
  OSHA defines an incidental spill as a spill that does not pose a significant safety or health hazard to employees in the immediate vicinity nor does it have the potential to become an emergency within a short time frame. The period that constitutes a short time frame is not defined. Lab workers can handle incidental spills because they are expected to be familiar with the hazards of the chemicals they normally handle. If the spill exceeds the scope of the lab worker's experience, training, and willingness to respond, the workers must be able to determine the spill cannot be dealt with internally.

  General Guidelines for Cleaning up a Chemical Spill

  a. If there is a fire or medical attention is needed call University Police at x5555

  b. Attend to any persons who may be contaminated. Contaminated clothing must be removed immediately and the skin flushed with water for no less than 15 minutes.

  c. Don personal protective equipment, as appropriate to the hazards. Refer to your Safety Data Sheet or Standard Operating Procedure for information.

d. Loose spill control materials should be distributed over the entire spill area, working from the outside and circling to the center.

e. Once the chemical or waste has been controlled, absorbed, and/or neutralized, use a brush and scoop (spark resistant if flammable materials are involved) to consolidate the spill. Clean up materials by sweeping inward, and collect in a suitable container.

f. Notify the Chemical Hygiene Officer or EHS that you have a full container of spill cleanup materials. The CHO will ensure the container is labeled properly and goes to the CAA.

- Major Spills
  Major Spills are incidents falling outside the scope of Minor Spills. Report Major Spills to Environmental Health and Safety at x6637 or University Police at x5555. If needed, seek emergency medical attention. When calling in the incidents be sure to state name and specific location, identify the chemical and amount spilled, and identify injuries and special circumstances. Be sure to control access to the area until EHS or University Police arrive.

Appendix A. General Best Safe Practices in the Laboratory

A safety program must include layers of policies and protective equipment to allow for a safe working environment, but to achieve effectiveness, a number of fundamental elements must become basic working habits for the research community. Some of these elements are detailed below:

1. Personal Protective Equipment*:*

- Wear closed-toe shoes and full length pants, or equivalent, at all times when in the laboratory
- Utilize appropriate PPE while in the laboratory and while performing procedures that involve the use of hazardous chemicals or materials
- Confine long hair and loose clothing
- Remove laboratory coats or gloves immediately on significant contamination, as well as before leaving the laboratory
- Avoid use of contact lenses in the laboratory unless necessary. If they are used, inform supervisor so special precautions can be taken
- Use any other protective and emergency apparel and equipment as appropriate. Be aware of the locations of first aid kits and emergency eyewash and shower station

2. Chemical Handling:

- Properly label and store all chemicals. Use secondary containment at all times
- Deposit chemical waste in appropriately labeled receptacles and follow all other waste disposal procedures of the Chemical Hygiene Plan
- Do not smell or taste chemicals
- Never use mouth suction for pipetting or starting a siphon
- Do not dispose of any hazardous chemicals through the sewer system
- Be prepared for an accident or spill and refer to the emergency response procedures for the specific material. Procedures should be readily available to all personnel. Information on minor chemical spill mitigation may also be referenced in *Appendix O*. For general guidance, the following situations should be addressed:
    - Eye Contact: Promptly flush eyes with water for a prolonged period (15 minutes) and seek medical attention
    - Skin Contact: Promptly flush the affected area with water and remove any contaminated clothing. If symptoms persist after washing, seek medical attention

3. Equipment Storage and Handling:

- Store laboratory glassware with care to avoid damage. Use extra care with Dewar flasks and other evacuated glass apparatus; shield or wrap them to contain chemicals and fragments should implosion occur
- Use certified fume hoods, glove boxes, or other ventilation devices for operations which might result in release of toxic chemical vapors or dust. Preventing the escape of these types of materials into the working atmosphere is one of the best ways to prevent exposure
- Keep hood closed when you are not working in the hood
- Do not use damaged glassware or other equipment
- Do not use uncertified fume hoods or glove boxes for hazardous chemical handling
- Avoid storing materials in hoods
- Do not allow the vents or air flow to be blocked

4. Laboratory Operations:

- Keep the work area clean and uncluttered
- Seek information and advice about hazards, plan appropriate protective procedures, and plan positioning of equipment before beginning any new operation
- If unattended operations are unavoidable, and have been approved by the PI/Laboratory Supervisor, place an appropriate sign on the door, leave lights on, and provide for containment of toxic substances in the event of failure of a utility service (such as cooling water)
- Be alert to unsafe conditions and ensure that they are corrected when detected
- Research staff and students should never work alone on procedures involving hazardous chemicals, biological agents, or other physical hazards
- Do not engage in distracting behavior such as practical jokes in the laboratory. This type of conduct may confuse, startle, or distract another worker

Figure 6. Safe Hallway Food/Drink Storage During Lab

5. Food/Drink:

- No food or drink may be present or consumed in a laboratory or any other space in which hazardous materials are stored or handled.
- Do not smoke, chew gum, or apply cosmetics in areas where laboratory chemicals are present; wash hands before conducting these activities
- Do not store, handle, or consume food or beverages in storage areas, refrigerators, glassware or utensils which are also used for laboratory operations
- Wash areas of exposed skin well before leaving the laboratory

Signed By ______________________________________Date _________

PI/Laboratory Supervisor___________________________

Appendix B. Particularly Hazardous Substances

Exposure to harmful chemicals can result in local toxic effects, systemic toxic effects, or both. Local effects involve injury at the site of first contact, for example skin, nose, and respiratory tract. Systemic effects, however, occur after the substance has been absorbed into the bloodstream and distributed throughout the body. Some terms are critical to understanding health effects and information from documents such as Safety Data Sheets. For example, the term "acute exposure" refers to a local or systemic effect from a single exposure while the term "chronic exposure" refers to repeated or long-duration exposures.

Table 6. Hazardous Substances

Irritant: Non-corrosive chemical that causes reversible inflammatory effects (redness and swelling) on living tissue by chemical action at the site of contact.		
Acrylamide	Formaldehyde	Peracetic Acid
Acetic anhydride	Propylamine	Ozone
Corrosive: Chemical that causes destruction of living tissue by chemical action at the site of contact. These can be solids, liquids, or gases.		
Sodium hydroxide	Perchloric acid	Trifluoroacetic acid (TFA)
Nitric acid	Hydrochloric acid	Hydrofluoric a cid

Allergen:

A chemical that causes an adverse reaction by the immune system to a chemical resulting from a previous sensitization to that chemical or a structurally similar chemical. Once sensitization occurs, allergic reactions can result from exposure to extremely low doses of the chemical. Symptoms often include red, itchy, swollen skin or eyes, or difficulty breathing.

Formaldehyde — Latex — Toluene diisocyanate

Asphyxiant:

A chemical that interferes with the transport of oxygen to the vital organs of the body leading to rapid collapse and death. Some asphyxiants simply displace oxygen in the air while others interact with hemoglobin in the blood to reduce the capacity of blood to carry oxygen.

Nitrogen — Carbon monoxide — Halon

Neurotoxin:

A chemical that adversely affects the structure or function of the central and/or peripheral nervous system. Effects can be reversible or permanent. Confusion, slurred speech, and staggered gait are common symptoms of overexposure.

Acrylamide — Dimethyl mercury — Phenol — Hexane

Target Organ Toxin:

Chemical that causes adverse effects to organs other than the reproductive or neurological systems. These organs typically include the liver, kidneys, blood producing organs, and lungs.

Acrylonitrile — Carbon tetrachloride — Phenol — Benzene

Highly Flammable Substances

A gas, liquid, or solid that readily catches fire and burns in air. A highly flammable substance has a flash point of less than room temperature. *(The flashpoint is the lowest temperature at which a liquid has a sufficient vapor pressure to form an ignitable mixture with air near the surface of the liquid.)*

Acetone (-18°C) — Diethyl ether (-45°C) — Acetaldehyde (-37.8°C)

Benzene (-11.1°C) — Tetrahydrofuran (-14°C) — Potassium hydride *(ignites on contact with moist air)*

<http://www.sfsu.edu/~safety/Web_documents/files_chp/Chem_Hygiene_Plan/CHP_AppE.pdf>

OSHA's Definition of "Hazardous Substance"

OSHA defines "**hazardous substance**" as "a chemical for which there is statistically significant evidence based on at least one study, conducted in accordance with established scientific principals, that acute or chronic health effects may occur in exposed employees". Classifications of "health hazards" include carcinogens, sensitizers, hepatotoxins (liver), nephrotoxins (kidneys), neurotoxins (CNS), hematopoietic toxins (blood), reproductive toxins (mutagens, teratogens), and agents which damage the lungs, skin, eyes, or mucous membranes.

Particularly Hazardous Substances

OSHA's Laboratory Standard states that the employer must make "provisions for additional employee protection for work with "particularly hazardous substances".

1. Establishment of a designated area;
2. Use of containment devices such as fume hoods or glove boxes; 3. Procedures for safe removal of contaminated waste; and
4. Decontamination procedures.

These chemicals include select carcinogens, reproductive toxins, and substances with a high degree of acute toxicity. **Review the individual SDS for toxicity information.**

Table 7. Particularly Hazardous Substances

Select Carcinogens: A chemical that is capable of causing cancer, or the uncontrolled growth of cells. Often there is no immediately apparent harmful effect upon exposure. Chemicals that are known to pose the greatest carcinogenic hazard are referred to as "select carcinogens" and must be handled as "particularly hazardous substances". A select carcinogen is defined in the OSHA Laboratory Standard as a substance that meets one of the following criteria. 1. It is regulated by OSHA as a carcinogen in **29 CFR 1910, Subpart Z, Toxic and Hazardous Substances.** 2. It is listed as "known to be a carcinogen" in the latest Annual Report on Carcinogens issued by the **National Toxicology Program**. 3. **International Agency for Research on Cancer** (IARC), "Monographs" o Group 1 – carcinogenic to humans o Group 2A – probably carcinogenic to humans o Group 2B – possibly carcinogenic to humans o Reasonably anticipated to be a carcinogen by the National Toxicology Program **AND** causes statistically significant tumor incidence in experimental animals.	2-Acetylaminofluorene Acrylamide Acrylonitrile Aflatoxins 4-Aminobiphenyl Arsenic *(and certain arsenic compounds)* Asbestos Azathioprine Barium chromate Benzene Benzidine Bis(chloromethyl) ether Chloroemthyl methyl ether 1,4-Butanediol dimethylsulfonate Chlorambucil Chromium *(and compounds)* Cyclophosphamide 1,2-Dibromo-3-chloropropane 3,3'- Dichlorobenzidine *(and its salts)* Diethylstilbestrol 4-Dimethylaminoazobenzene	Dimethyl sulfate Ethylene dibromide Ethylene oxide Ehtylenamine Formaldehyde Hexamethylphosphoramide Hydrazine Melphalan 4,4'-Methylene-bis[2chloroaniline]Mustard gas N,N-Bis(2-chloroehtyl)-2-naphthylamine Nampthylamine (α and β) Nickel carbonyl 4-Nitrobiphenyl *N*- Nitrosodimethylamine β-Propiolactone Thorium dioxide Treosulfan Vinyl chloride
Reproductive Toxins: A chemical that affects reproductive capabilities, including chromosomal damage (mutations) and effects on fetuses (teratogenesis)	Arsenic *(and certain of its compounds)* Benzene Carbon disulfide Cadmium *(and certain compounds)* Toluene Xylene	Ethidium bromide Ethylene glycol monomethyl Ethyl ethers Ethylene oxide Ethylene dibromide Lead compounds Vinyl chloride
High Level Acute Toxins Chemicals that can cause extremely harmful effects after a single exposure. "Prudent Practices in the Laboratory" indicates that substances with a toxicity rating of "highly toxic" or "extremely toxic", based on an animal oral LD_{50} of 50 mg per kg (or less), are considered to have a high level of acute toxicity	Acrolein Arsine Chlorine Diazomethane Diborane (gas) Hydrogen cyanide Hydrogen fluoride Methyl fluorosulfonate	Nickel carbonyl Nitrogen dioxide Osmium tetroxide Ozone Phosgene Sodium azide Sodium cyanide *(and other cyanide salts)* Hydrofluoric acid

http://www.sfsu.edu/~safety/Web_documents/files_chp/Chem_Hygiene_Plan/CHP_AppE.pdf

Appendix C. Standard Operating Procedures Form and Link

Below is the finished form that appears what an SOP is completed. In RED below, you will find guiding instructions with each section. The red text does not appear in the form when you are actually filling it out. To complete an SOP please click HERE. https://docs.google.com/a/oswego.edu/forms/d/11AtIZLly2-pqNdah8kcGjv4smiolryslBa-iBEHkvTU/edit

Standard Operating Procedure: HAZARDS

This form is to be filled out in compliance with 29 CFR 1910.1450. A standard operating procedure should be complete and on file for each hazardous process or chemical that is regularly used here at SUNY Oswego. Documentation and approval of SOPs ensures that all parties involved are informed of the dangers of the chemical or process, how to safely carry out the task, what forms of protection are required, and what to do in case of an emergency.

The following contact information should be used in case of a life threatening emergency:

On-Campus: ext.5555 or 911 Cell Phone: 315-312-5555 Campus Police

For Emergencies, spills, questions, concerns, and for notification purposes, call EHS:

Shineman: ext. 6637 Cell Phone: 315-312-6637 Charlene Walthert

On-Campus: ext. 3150 Cell Phone: 315-312-3150 Eric Foertch

Your username (___.___**@oswego.edu**) will be recorded when you submit this form.
* Required

Department *

Date *

Principle Investigator/Laboratory Supervisor *

Please include all authorized personnel qualified in this lab specific hazardous procedure. *
This list will be sent to the PI/Laboratory Supervisor for approval.

Laboratory Room # *

Laboratory Phone # *

Emergency Contact (Name, Phone #) *

Alternate Emergency Contact (Name, Phone #) *

Type of SOP *

- ☐ Hazardous Process For dangerous processes in the lab, an SOP must be written to ensure the procedure is consistent and all safety measures are being implemented.
- ☐ Hazardous Chemical For Hazardous Chemicals, and SOP must be written to ensure all personnel working with the chemical are aware of its dangers, and that the procedure in which the chemical is used is as safe and consistent as possible.

What is the Purpose of this SOP? *

Hazardous Chemical Name (Applicable for Hazardous Chemical SOP)
Physical and Chemical Properties to define Hazardous Chemical

CAS #
Chemical Abstract Service #

Class of Chemical
Which category does the hazardous chemical fit into?

- ☐ Flammable
- ☐ Corrosive
- ☐ Toxic

- Health Hazard
- Explosive
- Oxidizer
- Other

Is the hazardous chemical a "Particularly Hazardous Substance" according to OSHA?
Please refer to Appendix B of SUNY Oswego's Chemical Hygiene Plan

- Yes
- No

What is the form which the hazardous chemical is used in the laboratory?
(Physical State)

What is the color/appearance of the hazardous chemical?

Please describe the potentially hazardous procedure or process used? *
Applicable for hazardous chemical and hazardous process SOP

What engineering controls are most important for safety during this process? *
Please check ALL that apply.

- Fume Hood
- Bio-safety Cabinet
- Glove Box
- Flammable Storage Area
- Secondary Containment

Personal Protective Equipment

Please complete each section to ensure you are using the correct PPE for the correct procedure.

Please list all PPE that is required for this process *
Check all that Apply

- Eye Protection
- Gloves/Hand Protection
- Lab Coat/Body Protection

- ☐ Foot Protection
- ☐ Respirator
- ☐ Other:

***Respirators should be used under the following circumstances** *

- As a last line of defense after engineering controls and administrative controls have been exhausted
- When Permissible Exposure Limit is exceeded or has the possibility of being exceeded
- When regulations require the use of a respirator
- When an employer requires the use of a respirator
- When there is a potential for harmful exposure due to an atmospheric contaminant (in the absence of PEL
- As PPE in the event of a chemical spill clean-up process
- All of the Above

Is the hand protection you are using rated for the correct chemical?
Please consult the link below to find a preferred glove option that is compatible for you.

- ☐ http://www.mapa-pro.com/advanced-safety-glove-finder.html

First Response Procedures

Please Describe what the immediate first aid response would be if the hazardous chemical or process led to any of the following exposures.

If Inhaled

What would happen if this material was inhaled?

In case of skin contact

What would happen if this material got on your skin?

If swallowed

What would happen if this material was accidentally ingested?

Spill and Accident Procedure

Call EHS: Cell Phone#: 315-312-3150 or 315-312-6637 On-Campus#: x3150 or x6637 Campus Police: Cell Phone#: 315-312-5555 On-Campus#: x5555 1. Asses the extent of Danger 2. Evacuate the area and help contaminated or injured persons 3. If you feel comfortable and it is possible contain the spill 4. Keep others from entering the contaminated area

Please check the following boxes to show you understand the terms of a chemical spill. *

- ☑ Those working within the laboratory should be familiar with the chemicals they are working with to know if they need assistance in the cleanup, or just to notify EHS or a spill of hazardous or particularly hazardous substances. Those qualified to do so may safely clean up a minor spill being sure to double bag waste clean up material, and use all proper PPE.
- ☐ A major spill would be a spill falling outside the category of a minor spill and EHS and Campus Police should be notified for assistance. Follow the steps of the spill/accident procedure in chapter XI section C of the Chemical Hygiene Plan. .
- ☐ If a chemical spills on the body or clothing, remove clothing and rinse body in nearest emergency shower for at least 15 minutes. Seek medical attention, and always notify the lab supervisor and EHS.
- ☐ If a chemical splashes in the eye, immediately rinse the eyeball and inner surface of the eyelid in the nearest emergency eyewash for at least 15 minutes. Seek medical attention and always notify the lab supervisor and EHS.

Decontamination/Waste Disposal Procedure

General hazardous waste disposal guidelines:

Label Waste

Each satellite accumulation area has available blank hazardous waste labels. As soon as the first drop of waste enters the waste bottle, there should be a label on the container. The tag should clearly indicate what is in the bottle and who is responsible for that bottle.

Store Waste

Hazardous waste is stored in a closed container within a secondary containment inside a designated satellite accumulation area.

Disposal of Waste

Regularly generated hazardous waste should be picked up within 90 days. EHS/CHO will pick up waste in a timely fashion from satellite accumulation areas. The CHO may be contacted at ext. 6637 anytime a pickup is needed outside the scheduled pick-up.

Protocol/ Procedure

Please list the location of the SDS sheets in the lab. *

Pleas insert or supply a link to the lab specific hazardous chemical or process SOP here. *

This SOP must be signed off by the PI or Laboratory Supervisor

This Document should also be available in the lab.

Send me a copy of my responses.

Submit

Never submit passwords through Google Forms.

Appendix D. Shineman Center Emergency Shower and Eyewash locations

Table 8. Emergency Equipment Locations

Type	Room	Location
Drench Hose	G02	IN CLASS
Drench Hose	G04	IN CLASS
Drench Hose	G06	IN CLASS
Drench Hose	G08	IN CLASS
Drench Hose	G14	IN CLASS
Drench Hose	G16	IN CLASS
Drench Hose	G78	IN CLASS
Drench Hose	G80	IN CLASS
Drench Hose	G84	IN CLASS
Drench Hose	G87	IN CLASS
Drench Hose	G88D	IN CLASS
Drench Hose	101	IN CLASS
Drench Hose	103	IN CLASS
Drench Hose	104	IN CLASS

Drench Hose	106	IN CLASS
Drench Hose	108	IN CLASS
Drench Hose	112	IN CLASS
Drench Hose	170	IN CLASS
Drench Hose	122A	IN CLASS
Drench Hose	203	IN CLASS
Drench Hose	204	IN CLASS
Drench Hose	205	IN CLASS
Drench Hose	206	IN CLASS
Drench Hose	207	IN CLASS
Drench Hose	208	IN CLASS
Drench Hose	210	IN CLASS
Drench Hose	212	IN CLASS
Drench Hose	236	IN CLASS
Drench Hose	240	IN CLASS
Drench Hose	242	IN CLASS
Drench Hose	244	IN CLASS
Drench Hose	270	IN CLASS
Drench Hose	272	IN CLASS
Drench Hose	274	IN CLASS
Drench Hose	275	IN CLASS
Drench Hose	276	IN CLASS
Drench Hose	277	IN CLASS
Drench Hose	278	IN CLASS
Drench Hose	282	IN CLASS
Drench Hose	285	IN CLASS
Drench Hose	301	IN CLASS
Drench Hose	303	IN CLASS
Drench Hose	304	IN CLASS
Drench Hose	305	IN CLASS
Drench Hose	306	IN CLASS
Drench Hose	308	IN CLASS
Drench Hose	309	IN CLASS
Drench Hose	310	IN CLASS
Drench Hose	312	IN CLASS
Drench Hose	314	IN CLASS
Drench Hose	315	IN CLASS
Drench Hose	336	IN CLASS
Drench Hose	338-1	IN CLASS
Drench Hose	338-2	IN CLASS
Drench Hose	342	IN CLASS
Drench Hose	344	IN CLASS
Drench Hose	346	IN CLASS
Drench Hose	348	IN CLASS
Drench Hose	370	IN CLASS

Drench Hose	372	IN CLASS
Drench Hose	376	IN CLASS
Drench Hose	405-1	IN CLASS
Drench Hose	405-2	IN CLASS
Drench Hose	412	IN CLASS
Station	G87	IN CLASS
Station	101	IN CLASS
Station	106	In Hallway Outside
Station	108	In Hallway Outside
Station	204	In Hallway Outside
Station	210	In Hallway Outside
Station	238	In Hallway Outside
Station	242	In Hallway Outside
Station	272	In Hallway Outside
Station	306	In Hallway Outside
Station	310	In Hallway Outside
Station	338	In Hallway Outside
Station	344	In Hallway Outside
Station	372	In Hallway Outside
Station	380	In Hallway Outside
Station	403	In Hallway Outside
Station	410	In Hallway Outside

Appendix E. Labels

Please Use this label for PFC's to make it easier to

Peroxide Forming Chemical

Date Obtained__________

****Check every 3rd month**

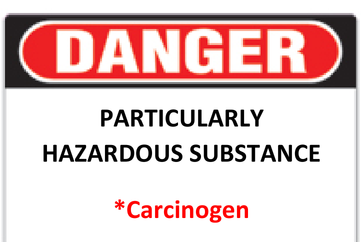
track changes over time and eliminate risk.

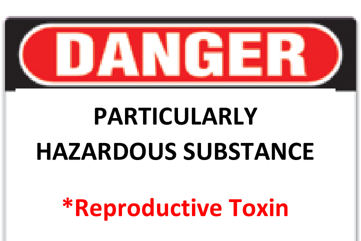
Use this label for any unusual or

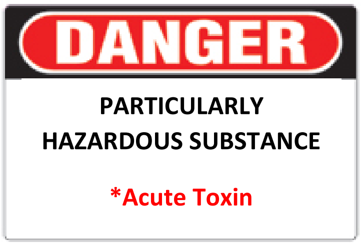
- ☐ Pyrophoric
- ☐ Water Reactive
- ☐ Highly Flammable
- ☐ Other________

dangerous chemicals that may warrant additional labeling.

Particularly Hazardous Chemicals should be labeled additionally with these danger labels to make lab personnel, cleaners, contractors, and emergency responders aware of their whereabouts.







Appendix F. Proper PPE Selection

1. Gloves

Figure 7. Some Examples of Gloves

http://water.me.vccs.edu/courses/env211/changes/gloves.jpg

Why Wearing Gloves is Important

It is important to wear gloves when working with hazardous chemicals and other materials because they protect our hands from infection and contamination. Protective gloves should be selected on the basis of the hazards involved.

- Nitrile gloves protect against most chemicals and infectious agents.
- Rubber gloves protect against mild corrosive material.
- Neoprene gloves protect against most solvents, oils, and mild corrosive materials.
- Latex is not the first choice as many people are allergic or develop allergies to this material.

For glove selection guidance try:

http://www.mapa-pro.com/advanced-safety-glove-finder.html

When to Wear Gloves

Wear gloves when your hands may come into contact with:

- infectious materials
- radioactive materials
- chemicals

When NOT to Wear Gloves

- Don't wear gloves when touching common surfaces, such as telephones, computers, door knobs, and elevator buttons, or that may be touched without gloves by others.
- Don't wear gloves outside of the lab. When transporting hazardous materials between labs, use secondary containers that can be carried without gloves. (Bring gloves and spill materials in case of an accident.)

2. Eye and Face Protection

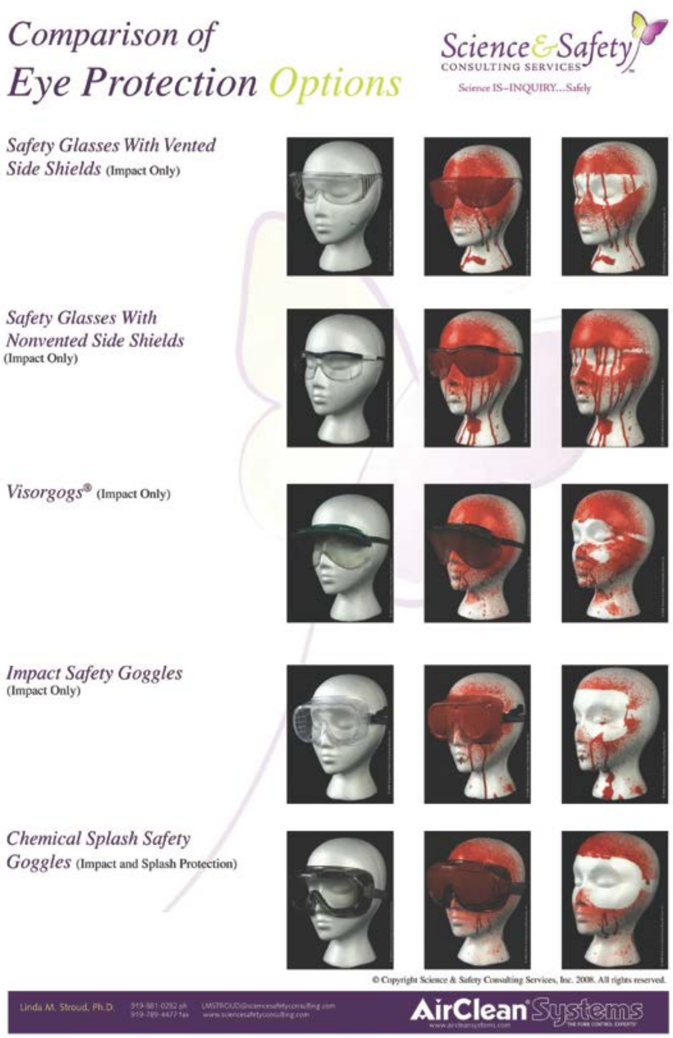


Figure 8. Impact of Wearing Safety Glasses/Goggles

http://cenblog.org/_img/EyeProtectionPoster1.jpg

Faculty, staff, students, contractors, and visitors shall wear the appropriate eye and face protection when working with or around hazardous chemicals/materials/equipment including but not limited to:

- Handling of hot solids, liquids, or molten metals
- Flying particles from chiseling, milling, sawing, turning, shaping, cutting, etc.
- Heat treatment, tempering, or kiln firing of any metal or other materials
- Lasers
- Intense light radiation (UV and IR) from gas or electric arc welding, glassblowing, torch brazing, oxygen cutting, etc.
- Repair or servicing of any vehicle
- Working with *or around* chemicals and gases

Eye and/or face protection is determined and enforced by the PI or Laboratory Supervisor, but each person is responsible for ensuring they are wearing eye protection at the proper time. Eye and face protection choices include the following:

Safety Glasses

Ordinary prescription glasses do not provide adequate protection. Eye protection must conform to the American National Standards Institute (ANSI), Standard Z87.1-1989. Look for this stamp on the inside of the safety glass frame. Prescription safety glasses are recommended for employees who must routinely wear safety glasses in lieu of fitting safety glasses over their personal glasses. All safety glasses shall have side protection.

Goggles

Goggles are intended for use when protection is needed against chemicals or particles. Impact protection goggles which contain perforations on the sides of goggle are not to be used for chemical splash protection, therefore are not recommended. Splash goggles which contain shielded vents at the top of the goggle are appropriate for chemical splash protection, and also provide limited eye impact protection. Goggles only protect the eyes, offering no protection for the face and neck

Face Shields

Full face shields provide the face and throat and partial protection from flying particles and liquid splash. For maximum protection against chemical splash, a full face shield should be used in combination with chemical splash goggles. Face shields are appropriate as secondary protection when implosion (e.g. vacuum applications) or explosion hazards are present.

Eye Protection for Intense Light Sources

(welding, glassblowing, gas welding, oxygen cutting, torch brazing, laser use, etc.)

Goggles with filter plates or tinted glass are available for glassblowing and other operations where intense light sources are encountered, including but not limited to, gas welding or oxygen cutting operations. Spectacles with suitable filter lenses may be appropriate for light gas welding operations, torch brazing, or inspection. Users and visitors to Laser use areas (the laser nominal hazard zone) must be protected with suitable laser protection eye wear. Contact the laser manufacturer or the for assistance in selecting laser eye wear.

3. Lab Coats

Why Should We Wear Lab Coats?

- Lab coats are personal protective equipment and should be worn in the lab when working with hazardous chemicals and biologicals to protect the skin and clothing from splatter and spills.
- Appropriate lab coats should be fully buttoned with sleeves rolled down. They should also be fire-resistant.
- In case of an accident, it is much faster and easier to remove a lab coat than street clothes to minimize skin contact with hazardous materials.

When to Wear Lab Coats

- Always wear lab coats when working with hazardous materials.

When NOT to Wear Lab Coats

- Don't wear lab coats in public places, such as offices, lunch rooms, lounge areas, or elsewhere outside the laboratory, as they can transfer hazardous materials and contaminate these areas.
- Don't bring lab coats home because you may contaminate others in the household.
- Don't launder lab coats at home or with other clothing.

Questions on glove, lab coat or other safe practices? Contact EHS x6637

Appendix G. Incompatible Chemicals

Table__ contains a list of incompatible chemicals. Per row, the chemicals listed in the left column should not be used with chemicals listed in the right column, except under specially controlled conditions. Per row, chemicals in the left column should not be stored in the immediate area with chemicals in the right column. Incompatible chemicals should always be handled, stored or packed so that they cannot accidentally come into contact with one another. This list is representative of chemical incompatibilities and is not complete, nor are all incompatibilities shown.

Table 9. Incompatibles

Chemical	Keep out of Contact with
Alkaline metals, such as	Carbon tetrachloride or other chlorinated

powdered aluminum, magnesium, sodium, potassium, etc.	hydrocarbons, carbon dioxide and water
Acetic Acid	Chromic acid, nitric acid, hydroxyl compounds, ethylene glycol, perchloric acid, peroxides and permanganates
Acetylene	Chlorine, bromine, copper, fluorine, silver and mercury
Ammonia	Mercury, chlorine, calcium, hypochlorite, iodine, bromine and hydrofluoric acid
Ammonium nitrate	Acids, metal powders, flammable liquids, chlorates, nitrites, sulfur, finely divided organic or combustible materials
Carbon, activated	Calcium hypochlorite
Copper	Acetylene and hydrogen peroxide
Chromic acid	Acetic acid, naphthalene, camphor, glycerin, turpentine, alcohol and flammable liquids
Chlorine	Ammonia, acetylene, butadiene, butane, methane, propane, hydrogen, sodium carbide, turpentine, benzene and finely divided metals
Cyanides	Acids - organic or inorganic
Hydrogen peroxide	Copper, chromium, iron, most metals, alcohols, acetone, organic materials, aniline, nitromethane, flammable liquids and combustible materials
Hydrogen sulfide	Fuming nitric acid and oxidizing gases
Hydrocarbons (butane, propane, benzene, gasoline, turpentine etc.)	Fluorine, chlorine, bromine, chromic acid and sodium peroxide
Iodine	Acetylene, ammonia and hydrogen
Nitric acid	Acetic acid, aniline, chromic acid, hydrocyanic acid, hydrogen sulfide, flammable liquids, flammable gases, copper, brass and any heavy metals

Perchloric acid	Acetic anhydride, bismuth and its alloys, alcohol, paper, wood, ether, oils and grease
Phosphorous	Oxidizing agents, oxygen, strong bases
Potassium chlorate	Sulfuric and other acids
Potassium permanganate	Glycerin, ethylene glycol, benzaldehyde and sulfuric acid
Sodium	Carbon tetrachloride, carbon dioxide and water
Sodium nitrite	Ammonium nitrate and other ammonium salts
Sodium peroxide	Ethyl or methyl alcohol, glacial acetic acid, acetic anhydride, benzaldehyde, carbon disulfide, glycerin, ethylene glycol, ethyl acetate, methyl acetate and furfural
Sulfides, inorganic	Acids Sulfuric acid Potassium chlorate, potassium perchlorate and potassium permanganate

SPECIAL SEGREGATION OF INCOMPATIBLE CHEMICALS

Table _ contains examples of dangerously incompatible substances. Per row, the chemicals listed in the left column are dangerously incompatible with chemicals listed in the right column. Per row, chemicals in the left column must be stored away from chemicals in the right column so that accidental mixing will not occur.

Table 10. Dangerously Incompatible Substances

Chemical	Keep out of Contact with
Chlorine	Acetylene
Chromic acid	Ethyl alcohol
Oxygen (compressed, liquefied)	Propane
Sodium	Chloroform and aqueous solutions
Nitrocellulose (wet, dry)	Phosphorous

Potassium permanganate	Sulfuric acid
Perchloric acid	Acetic acid
Sodium chlorate	Sulfur in bulk

Table 3 contains examples of incompatible oxidizing agents and reducing agents. Every chemical in the left column is incomptabile with every chemical in the right column. These chemicals must be stored away from one another so that accidental mixing will not occur.

Table 11. Oxidizing and Reducing Agents

Oxidizing Agents	Reducing Agents
Chlorates	Ammonia
Chromates	Carbon
Dichromates	Metals
Chromium trioxide	Metal hydrides
Halogens	Nitrates
Halogenating agents	Organic Compounds
Hydrogen peroxide	Phosphorus
Nitric acid	Silicon
Nitrates	Sulfur
Perchlorates	
Peroxides	
Permanganates	
Persulfates	

https://www.ehs.ucla.edu/research/lab/chem/storage

Appendix H. Acutely Hazardous Waste

According to the New York State Department of Environmental Conservation:

"The commercial chemical products, manufacturing chemical intermediates or off-specification commercial chemical products or manufacturing chemical intermediates, are identified as acute hazardous wastes." Otherwise known as the P-List of Hazardous Waste.

http://www.dec.ny.gov/regs/14898.html

Rules to remember about discarding acutely hazardous waste:

- Container size: When collecting p-listed chemicals as waste, the volume of the hazardous waste container must not exceed one quart (approximately one liter).
- Empty containers: Empty containers that held p-listed chemicals must also be disposed of as hazardous waste. They are not allowed to be washed or re-used.
- Contaminated materials: Disposable materials that become contaminated with p-listed chemicals (e.g. gloves, weighing boats, etc.) must also be disposed of as hazardous waste. Non-disposable materials must be "triple-rinsed", or rinsed three times to remove the contamination. This rinsate must be collected as hazardous waste. Materials contaminated with p-listed chemicals may not be washed or re-used until they have been triple-rinsed.

A Complete list of "p-listed" chemicals or acutely Hazardous waste can be found at the following Link:

http://www.epa.gov/wastes/hazard/wastetypes/listed.htm

Appendix I: Peroxide Forming Chemicals Common to Research

Class 1 PFCs

Class 1 chemicals form peroxides after prolonged storage. The chemicals listed below should be tested for the formation of peroxides on a periodic basis. Several methods are available to check for peroxides; the two most common are the use of peroxide test strips or the potassium iodide test.

Class 1 PFCs		
Isopropyl ether	Potassium amide	Vinylidene chloride
Divinyl acetylene	Potassium metal	
Divinyl ether	Sodium amide	

Class 2 PFCs

This group of chemicals will readily form peroxides when they become concentrated (e.g., via evaporation or distillation). The concentration process defeats the action of most auto-oxidation inhibitors. As a result, these chemicals should be disposed of within12 months of receiving.

Class 2 PFCs		
Acetal	Diethylether	Methyl isobutyl ketone
Cumene	Dioxane	Tetrahydrofuran
Cyclohexene	Ethylene glycol dimethyl ether	Tetrahydronaphthalene
Cyclopentene	Furan	Vinyl ethers
Diacetylene	Methylacetylene	
Dicyclopentadiene	Methylcyclopentane	

Class 3 PFCs

This group of chemicals forms peroxides due to initiation of polymerization. When stored in a liquid state, the peroxide forming potential dramatically increases. These chemicals should be disposed of if they become degraded or are no longer needed.

Class 3 PFCs		
Acrylic acid	Chlorotrifluoroethylene	Vinyl acetate
Acrylonitrile	Methyl methacrylate	Vinyl acetylene Vinyl chloride
Butadiene	Styrene	Vinyl pyridine
Chlorobutadiene	Tetrafluoroethylene	Vinylidene chloride