University of Idaho

# Chemical Hygiene Plan

Environmental Health and Safety
November 6, 2018

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## Purpose

The University of Idaho (UI) recognizes the importance of hazardous materials in an educational research institution and recognizes the importance of managing hazardous materials in a way that protects people, property and the environment. The UI Chemical Hygiene Plan (CHP) is designed to promote educational and research activities that use hazardous materials by providing procedures that ensure the safety of personnel working in laboratories and handling hazardous materials. The CHP promotes safety in laboratories by enlisting recommendations developed by the Association of Public and Land Grant Universities (APLU) Task Force on Laboratory Safety of 2015.

**It is the responsibility of all persons working in university laboratories (e.g., principal investigators, administrative personnel, managers, laboratory researchers, and students) to know and adhere to the provisions of this document.**

## Scope

The CHP fulfills the requirements outlined by:
Idaho General Safety and Health Standards (IGSHS) 111 – "Laboratories and Chemical Storage Safety Rule" and the Occupational Safety and Health Administration (OSHA) 29 CFR 1910.1450 "Occupational Exposure to Hazardous Chemicals in Laboratories."

The CHP applies to all laboratories within the University of Idaho, including the Moscow main campus, branch campuses and research and extension centers. Chemical safety in non-laboratory areas is covered by the University of Idaho Hazard Communication Program.

## Laboratory-Specific Procedures and Requirements

Laboratories must develop their own supplemental laboratory-specific procedures and requirements in a Laboratory Safety Plan Template. This template has been designed to be completed by each laboratory and include laboratory-specific standard operating procedures, personal protective equipment and contact information.

# 1. RESPONSIBILITIES, AUTHORITY AND RESOURCES

## 1.1 UI Laboratory Safety Officer (LSO)

The Laboratory Safety Officer within EHS assists the UI Principal Investigators (PIs) to provide a safe and healthful workplace and to maintain compliance with environmental health and safety regulations, guidelines and UI policies. The LSO's responsibilities and authority in regards to the CHP are to:

- Coordinate the evaluation, annual review and implementation of the UI CHP.
- Coordinate safety assessments of laboratories and storage areas and recommended follow-up activities.
- Provide and coordinate safety training through Netlearning@uidaho.
- Assist with personal protective equipment (PPE) selection and its proper use.
- Act as a liaison with regulatory agencies on the local, state and federal levels.
- Assist PIs in conducting their own routine hazard assessments.
- Support the investigation of all reports of laboratory hazardous incidents, chemical spills and near-misses to prevent repeat occurrences.
- Participate in the University of Idaho Hazardous Materials Emergency Response Team in providing chemical spill response services to the campus community.
- Perform workplace evaluations which may include exposure monitoring, wipe sampling, or other tests to determine the amount and nature of airborne and/or surface contamination and extrapolate personnel exposure levels from that data.
- Lead the investigation of exposure complaints or concerns for medical consultation referral or performance of exposure monitoring.
- Support decommissioning laboratories and assist investigators leaving the institution to ensure proper inactivation and disposal of chemicals.

## 1.2 Unit Safety Committees (or Laboratory Safety Committee)

Unit Safety Committees, in the absence of a Laboratory Safety Committee, ensure that research tasks are planned and executed safely in accordance with the principles of excellence in laboratory operations and with the CHP. The committees establish, maintain, and reinforce a strong safety culture for UI and provide safety leadership for all UI facility users. Safety committee representatives meet on a regular basis to discuss safety issues and provide feedback on policies, programs, and procedures. They ensure that information discussed at the safety committee meetings is communicated to everyone involved in their labs. Safety committee responsibilities are outlined in APM 35.32 - Safety & Loss Control Program. In regard to the CHP, each safety committee member:

- Provides recommendations and assistance with developing safe work practices and ensures employees and students have knowledge of safety policies and procedures.
- Identifies hazards posed by jobs and encourages job hazard analyses for research activities and development of SOPs to mitigate risk.
- Ensures training is provided on use of PPE and that PPE is provided, accessible and used.
- Assists with compliance activities for the CHP and additional safety programs.

- Reviews and makes recommendations in response to safety training reports, research protocols for hazard identification and safety requirements (as necessary), exposure evaluation requests and reports, availability of facility safety equipment and emergency response.
- Investigates and documents causes of accident/injury/exposure incidents and recommends methods for prevention.
- Conducts and reviews operations and facility safety assessments on a regular basis.
- Maintains communications with UI faculty and staff concerning quality of the work environment, including indoor air quality, ergonomics, thermal comfort, etc.
- Communicates concerns upward to UI Safety and Loss Control Committee.

## 1.3 Principal Investigator (PI)

The Principal Investigator shall ensure that all safety policies and procedures outlined in the CHP are followed by personnel working under their direction. Personnel must be trained in safe work practices appropriate to their projects. The PI has overall responsibility for a laboratory and the research/education equipment, practices, procedures and techniques employed in the laboratory. The PI holds the responsibility of ensuring laboratory workers are working in a safe environment. A PI may designate some or all of the responsibilities to another individual (Lab Manager), but the PI is ultimately responsible.

The PI must:

- Maintain a safe and healthful working environment.
- Ensure all work performed in the laboratory is conducted in accordance with the CHP and other applicable university policies and programs.
- Review compliance and discrepancies in safety performance as necessary, and work toward resolution of such issues to ensure that safe practices and techniques are continuously being employed.
- Review accident reports, share lessons learned and make recommendations for future procedures or practices to minimize the repetition of similar types of accidents.
- Ensure that chemicals are obtained and stored in an appropriate fashion.
- Establish supplemental training and SOPs for the laboratory.
- Provide oversight that helps ensure researchers are properly trained and understand procedures applicable to safety in their laboratories and work areas.
- Provide required personal protective equipment to laboratory workers and ensure proper use.

## 1.4 Laboratory Worker

A laboratory worker is any person performing or supervising work in a UI laboratory, including PIs. Laboratory workers are subject to the CHP and all its provisions and are responsible for following it. Laboratory workers must:

- Understand and follow all laboratory safety-related policies, programs, procedures and training received.
- Know the physical and health hazards, handling procedures and emergency response information for the chemicals and tasks used as part of their research.
- Understand the function and proper use of all PPE and wear required PPE when appropriate.

- Promptly report all work-related incidents, injuries and illnesses to EHS and their supervisor. Near misses, potential serious safety issues and danger of environmental contamination must also be reported. Incidents, injuries and illnesses can be reported on the [Accident/Incident Report Form].
- Contact the lab PI, LSO, or safety committee for further clarification if any of the above procedures are not clearly understood.

# 2. TRAINING REQUIREMENTS

All laboratory workers must read and understand the CHP and complete all required safety training prior to the start of any laboratory work. Periodic refresher training is required as determined by the Laboratory Safety Officer.

## 2.1 Laboratory Safety Training

The core laboratory safety training for all laboratories covered under the CHP provides general knowledge pertaining to laboratory hazards and controls to minimize exposure. Additional general laboratory training applicable to all people performing work in a specific laboratory is assigned at the discretion of the PI based on the types of hazards present in the work area. This training may include topics such as hazard communication, compressed gases, bloodborne pathogens and hazardous waste disposal.

The PI or designee must introduce new laboratory workers to operations and safety requirements unique to their project. The new employee is responsible for becoming familiar with the hazards of chemicals he or she will be handling through safety data sheets, hazard labeling, and other forms of information prior to using the chemicals.

The PI or designee must provide laboratory workers with chemical safety instruction and information that is specific to the project including project SOPs. This information and instruction must be documented by the PI. Safety instruction for the use of chemicals must satisfy the hazard awareness requirements including:

- The name of the chemical and its hazardous component(s);
- The health and physical risk(s) associated with the chemical;
- Signs of release and symptoms of exposure;
- How and when to use engineering controls and personal protective equipment;
- Labeling and storage requirements;
- Disposal procedures;
- Emergency procedures for spills and exposures; and
- Laboratory SOPs.

Training on various laboratory safety topics is available through UI EHS. NetLearning@uidaho training will be required based on the type of work each individual laboratory worker conducts. All laboratory workers must complete Safety Matters (ID08), Laboratory Safety (LS09), Hazard Communication – the New GHS Standards (HC12) and Fire Safety in the Workplace (ID22) offered through Netlearning@uidaho. Additional training may be required depending on job description. Refer to the [EHS Safety Training Matrix] for more information.

## 2.2 Laboratory Safety Training for Non-Laboratory Users

A non-laboratory user is a person that must enter a laboratory to conduct their job, but is not a laboratory worker (e.g., custodial staff, maintenance workers). These personnel are required to take Lab Safety for the Non-Lab User (UI_483), an in-person class offered through EHS and Hazard Communication – the New GHS Standards (HC12), an online course in Netlearning@uidaho. Additional training may be required based on the type of laboratory a worker must enter, such as Bloodborne Pathogens for All Employees (BP64) for those that may be exposed to human blood or other potentially infectious body fluids, human cell lines, tissues or organs. Refer to the EHS Safety Training Matrix for more information.

## 2.3 Hazardous Waste Management Training

APM 35.40 states "All employees and students who are identified by their unit administrators as one who generates and/or manages hazardous waste shall attend the university Hazardous Waste Management workshop, or other appropriate training approved by the Environmental Health and Safety Office, **prior** to generating and/or managing hazardous waste at any university facilities. After initial training, this training requirement must be met once every five years." EHS offers the Hazardous Waste Management workshop on a frequent basis. It focuses on waste generation in laboratory operations. EHS conducts a similar training workshop, Hazardous Waste Management for Facilities, targeting waste generation in facilities maintenance operations. Both workshops are conducted in classroom settings. Refer to the EHS Safety Training Matrix for more information.

# 3. HAZARD IDENTIFICATION

## 3.1 Chemical Container Labeling

A chemical container label is the primary means for communicating the contents of a container and its hazard(s). Every container, even those just containing water, must be labeled to ensure employees and students are aware of its contents.

### Original Container

Chemicals in original vendor containers must have labels indicating the chemical or product name and the vendor's name. Hazard warning signs or symbols should be prominently visible on the labels.

### Secondary Container

All containers of chemicals decanted from an original container or prepared in the laboratory must be labeled with the chemical or product name(s) and primary hazard(s). This includes containers of reaction products or byproducts as well as separation processes such as distillations and extractions.

### Expiration Date

Time sensitive chemicals (e.g., peroxide formers) must be labeled with an appropriate expiration date.

### Waste Containers

All containers of chemical waste must be labeled. It is the responsibility of the laboratory worker generating the hazardous waste to label the container. Guidance on information the label should contain can be found in the Hazardous Materials Management and Disposal Policies and Procedures.

## 3.2 GHS Pictograms

In 2012, the United States adopted a United Nations standard pertaining to labeling of chemical containers, classification of chemical hazards and the distribution of the information in a standardized manner, known as the Globally Harmonized System (GHS). Included in this change are pictograms that indicate the hazard(s) of a chemical, a new format for Safety Data Sheets (SDSs, formerly called Material Safety Data Sheets or MSDSs) and a simplification of the signal words used in labeling. These changes improve quality and consistency in the classification and labeling of all chemicals and enhance worker comprehension.

# Globally Harmonized System (GHS) Pictograms

| **Health Hazard** | **Flame** | **Exclamation Mark** |
|---|---|---|
|  |  |  |
| • Carcinogen<br>• Mutagenicity<br>• Reproductive Toxicity<br>• Respiratory Sensitizer<br>• Target Organ Toxicity<br>• Aspiration Toxicity | • Flammables<br>• Pyrophorics<br>• Self-Heating<br>• Emits Flammable Gas<br>• Self-Reactives<br>• Organic Peroxides | • Irritant (skin and eye)<br>• Skin Sensitizer<br>• Acute Toxicity (harmful)<br>• Narcotic Effects<br>• Respiratory Tract Irritant<br>• Hazardous to Ozone Layer (Non-Mandatory) |
| **Gas Cylinder** | **Corrosion** | **Exploding Bomb** |
|  |  |  |
| • Gases Under Pressure | • Skin Corrosion/Burns<br>• Eye Damage<br>• Corrosive to Metals | • Explosives<br>• Self-Reactives<br>• Organic Peroxides |
| **Flame Over Circle** | **Environment (Non-Mandatory)** | **Skull and Crossbones** |
|  |  |  |
| • Oxidizers | • Aquatic Toxicity | • Acute Toxicity (fatal or toxic) |

## 3.3 Safety Data Sheets (SDSs)

An SDS is a document prepared by a supplier to summarize the health and safety information associated with a product. Manufacturers and suppliers are required to provide an SDS for each chemical they make or offer. As required by OSHA, each SDS must contain the following sections:

1. Identification
2. Hazard(s) identification
3. Composition/information on ingredients
4. First-aid measures
5. Fire-fighting measures
6. Accidental release measures
7. Handling and storage
8. Exposure controls/personal protection
9. Physical and chemical properties
10. Stability and reactivity
11. Toxicological information
12. Ecological information
13. Disposal considerations
14. Transport information
15. Regulatory information
16. Other information

### SDS Retention and Access

Each laboratory must maintain an inventory that contains every chemical and product, and every supplier of that product/chemical, used in the laboratory. SDSs must be readily accessible to any laboratory user. Past or out-of-date SDSs will be stored for 30 years.

### Obtaining an SDS

An SDS typically accompanies a chemical shipment or is mailed separately. Companies may be contacted via phone or mail to obtain one, but many SDSs are online or may be requested via company websites. The Laboratory Safety Officer may also assist in obtaining an SDS.

## 3.4 Chemical Inventory

In accordance with the CHP and 29 CFR 1910.1200 Hazard Communication, each PI is responsible for maintaining an inventory of chemicals in the laboratory that is updated at least annually. The PI must ensure a complete file of SDSs for the chemicals used and stored in the laboratory is organized for easy access to individual SDSs and cross-referenced to the chemical inventory. This inventory should be stored with the Laboratory Safety Plan Template. The inventory must be broken down by individual container and include:

- Product Name
- Manufacturer
- Location
- Quantity
- CAS Number
- SDS Availability
- Name of Person Completing Inventory
- Department
- Building
- Room Number
- Phone Number

### Inventory Example

| Item # | Qty. | CAS # | SDS | Product Name | Manufacturer | Location |
|---|---|---|---|---|---|---|
| 1 | 4L | 67-64-1 | Y | Acetone | Fisher Scientific | Flammable Cabinet 1 |
| 2 | 0.5L | 71-43-2 | Y | Benzene | Sigma Aldrich | Flammable Cabinet 1 |
| 3 | 0.1Kg | 119-26-6 | Y | 2,4-Dinitrophenylhydrazine | Sigma Aldrich | Flammable Solids Cabinet |
| 4 | 0.2L | N/A | Y | Kitagawa Detector Tube Nitrogen Dioxide S117 | Kitagawa America | Storage closet |
| 5 | 4L | N/A | Y | Multilith Blankrola Solvent, stock: Perchloroethylene, Naphtha solvent blend | AM International, Inc. | Flammable Cabinet 2 |
| 6 | 0.5L | N/A | Y | Rustoleum Ivory White Aerosol can | RUST-OLEUM Corporation | Flammable Cabinet 2 |
| 7 | 2.5L | 7697-37-2 | Y | Nitric Acid, 68-70%, ACS Reagent | Fisher Scientific | Acid Cabinet (separate tray) |

## 3.5 Laboratory Signage

### Lab Entry Door Signage


Laboratories must have a sign posted on the door that clearly identifies potential laboratory hazards and entry requirements. The signs remind laboratory staff and visitors of proper PPE and safety measures and may aid first responders. The sign must also include the laboratory's emergency contact information, PI and room number. It may include general contact information as well.

The Laboratory Safety Officer works with the PIs to update signage on a regular basis. Laboratory signs will be updated as needed and reviewed at least annually.

Refer to the EHS website for forms and definitions.

### Safety Equipment Signage

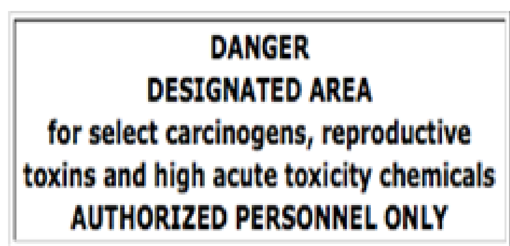
Signage must be conspicuously posted indicating location of eyewashes and safety showers. The area around and path to the eyewashes and safety showers must be kept clear. Signage must also identify the location of fire blankets, fire extinguishers, spill kits, and any other safety equipment by name or an appropriate symbol.

## 3.6 Particularly Hazardous Substances (PHSs)

The OSHA Laboratory Standard (29 CFR 1910.1450) defines a Particularly Hazardous Substance as a select carcinogen, reproductive toxin or substance with a high degree of acute toxicity. See the EHS website for thorough list of PHSs.

Use of any PHS requires:

- Establishment of a designated area;
- Use of appropriate containments devices such as fume hoods or gloves boxes;
- Procedures for safe removal of contaminated waste; and
- Decontamination procedures.




The room or area where work with PHSs is performed must be posted with a *Designated Area* sign. The posting of an established "designated area" identifies areas of higher health risk. In some laboratories, it is appropriate to establish the entire room as a "designated area." In other laboratories, a work bench or fume hood is more appropriate.

The controls used to minimize exposures to PHSs must be documented in the Laboratory Safety Plan. The SOP templates found on the EHS website provide a means to document the controls.

## 3.7 Occupational Toxicology

### Routes of Entry

To evaluate the risks of adverse health effects from chemicals, one must be aware of the routes of entry into the body, duration of exposure, toxicity of the chemical, exposure limits, and odor threshold of the chemical. This section explains these principles and describes how to reduce chemical exposure.

#### Inhalation

Inhalation is the most common route of chemical exposure in the laboratory. Exposure by this route can produce poisoning by absorption through the mucous membrane of the nasal passage, mouth, throat and lungs and can seriously damage these tissues. Inhaled gases or vapors may pass rapidly into the capillaries of the lungs and be carried into the circulatory system. Exposure can be minimized by keeping containers closed when not in use, proper storage and the use of engineering controls (e.g., fume hood). Respiratory protection may be necessary if engineering controls cannot be used or do not provide sufficient protection. UI laboratory users who wear respirators must be enrolled in the UI Respiratory Protection Program.

#### Skin and Eye Contact

Contact with the skin is the second most frequent route of chemical exposure. A common result of skin contact is localized irritation. Many materials are absorbed through the skin and quickly pass into the underlying blood vessels where they are carried through the blood stream and may cause systemic poisoning. The main routes of entry for chemicals through the skin are the hair follicles, sebaceous glands, sweat glands and cuts or abrasions of the outer layers of the skin. The follicles and the glands are abundantly supplied with blood vessels, which facilitate the absorption of many chemicals.

Skin and eye contact with chemicals can be avoided by the use of appropriate personal protective equipment. At a minimum, wear a lab coat, the appropriate chemical-resistant gloves and safety glasses with side shields when working with hazardous chemicals. For more information, see the Eye and Face Protection Selection Tool on the EHS website.

#### Ingestion

Chemicals used in the laboratory can be extremely dangerous if they enter the mouth and are swallowed. In addition, some chemicals may damage the tissues of the mouth, nose, throat, lungs and gastrointestinal tract producing systemic poisoning if absorbed through these tissues. To prevent entry of chemicals into the mouth, laboratory workers should wear gloves and wash their hands immediately after use of any chemical substance and before leaving the laboratory. Keep hands and tools (pens and pencils) away from the face and mouth. Storing or consuming food and drinks in the laboratory is prohibited. Mouth pipetting is also prohibited.

### Injection

Exposure to chemicals by injection can inadvertently occur through mechanical injury from glass or metal contaminated with chemicals or when chemicals are handled in syringes. Use proper sharps handling practices. Inspect glassware prior to use. Sharps, including razors and cutting blades, should be disposed of in a special sharps container or another glass disposal container. Sharps contaminated with a biohazardous substance must be disposed of in a biosafety sharps container. Broken glass or spilled sharps must be collected using mechanical means (e.g., broom and dustpan) and never with bare hands.

## 3.8 Exposure Assessment and Monitoring

The Laboratory Safety Officer may be required to perform an exposure assessment of some laboratory work. An exposure assessment takes into consideration any hazardous materials in use, the task being performed and the work environment including engineering controls, administrative controls and PPE. Monitoring may be necessary to assess exposure levels to hazards.

Laboratory workers should contact their manager, PI or the Laboratory Safety Officer to discuss exposure concerns and request an assessment.

### Exposure Limits

Exposure limits have been established to reduce exposure to “acceptable” levels. OSHA sets regulatory exposure limits called permissible exposure limits (PELs). The American Conference of Governmental Industrial Hygienists (ACGIH) has developed recommended exposure limits called Threshold Limit Values (TLVs). The National Institute for Occupational Safety and Health (NIOSH) has developed Recommended Exposure Limits (RELs). Quite often, TLV and REL values are less than OSHA-specified PELs.

### Frequency

Initial monitoring will be performed if there is reason to believe exposure levels for a substance could exceed the action level (see Appendix A: Definitions and Abbreviations) or PEL. Monitoring may be necessary after equipment or process changes, or an unanticipated chemical release.

Periodic monitoring will be performed if the initial monitoring exceeds applicable action levels or PELs. Monitoring frequency will be established by the Laboratory Safety Officer based on exposure levels (current and previous monitoring) and any additional requirements outlined in applicable standards. Monitoring may be terminated in accordance with the applicable standard.

### Records

Laboratory workers will be notified of monitoring results in writing within 15 days of receipt of any laboratory results either individually or by posting in an appropriate location.

The Laboratory Safety Officer shall maintain records in accordance with the record keeping requirements of applicable OSHA standards.

## 3.9 Medical Surveillance

The University of Idaho shall coordinate an offer for medical consultation or examination under the following circumstances:

- A laboratory worker develops signs or symptoms potentially associated with a hazardous chemical that they may have been exposed to in the laboratory;

- Exposure monitoring reveals an exposure level above OSHA permissible exposure limits, ACGIH action levels or where the applicable standard requires such medical surveillance; or
- An event occurs such as a chemical spill, leak or explosion that results in the likelihood of a hazardous exposure.

### Reporting Exposure

Laboratory workers who believe they have had an exposure or injury should seek medical attention immediately and contact their PI and the Laboratory Safety Officer. An Accident/Incident Report Form must be completed and submitted as soon as possible. More information on the reporting and investigation requirements is available on the Environmental Health and Safety website.

# 4. PHYSICAL AND HEALTH HAZARDS OF CHEMICALS

The following is an overview of physical and health hazards as defined by the Globally Harmonized System (GHS). Sections are separated by the GHS pictogram and their associated hazards. Materials that present physical and health hazards can be safely used if the specific hazard(s) are understood. If appropriate precautions are not taken, personal injury or property damage can occur. Additionally, certain chemicals cannot be safely mixed or stored with other chemicals because of the danger of a violent reaction or a reaction that generates toxic gas. The use of hazardous chemicals requires that employees follow special procedures for handling and storage.

## 4.1 Health Hazard

### Aspiration Toxicity

Chemicals or mixtures of liquids or solids that can damage the respiratory system if inhaled (i.e., aspirated).

### Carcinogen

A chemical or mixture that will induce cancer or increase its incidence. Carcinogens cause cancer through irreversible, uncontrolled growth of cells in an organ or tissue. It is assumed that there is no known minimum dose that can remove all danger of cancer.

Select carcinogens are substances that meet one of the following criteria:

- It is regulated by OSHA as a carcinogen;
- It is listed under the category, “Known to be Human Carcinogens,” in the Annual Report on Carcinogens published by the National Toxicology Program (NTP) (latest edition);
- It is listed under Group 1 (“carcinogenic to humans”) by the International Agency for Research on Cancer Monographs (IARC) (latest editions); or
- It is listed in either Group 2A or 2B by IARC or under the category “reasonably anticipated to be carcinogens” by NTP, and causes statistically significant tumor incidence in experimental animals in accordance with any of the following criteria:
  - After inhalation exposure of 6-7 hours per day, 5 days per week, for a significant portion of a lifetime to dosages of less than 10 mg/m 3;
  - After repeated skin application of less than 300 (mg/kg of body weight) per week; or
  - After oral dosages of less than 50 mg/kg of body weight per day.

### Germ Cell Mutagenicity

Chemicals that will cause mutations to germ cells of humans that can be transmitted to progeny.

### Reproductive Toxicity

Includes substances that have adverse effects on various aspects of reproduction including substances that cause chromosomal damage (mutagens) and substances with lethal or teratogenic effects on fetuses. Information about chemical reproductive toxins is available through the OSHA web site and on the State of California's Proposition 65 list, which is updated annually.  Always consult the Safety Data Sheet for a chemical to determine if it could be a reproductive toxin prior to use.

### Specific Target Organ Toxicity Single/Repeated Exposure

Chemicals and mixtures that have been demonstrated to cause non-lethal but both reversible and irreversible damage to specific organs.

### Respiratory or Skin Sensitizer

A substance that will lead to hypersensitivity of the airways or allergic responses to the skin following inhalation/contact.

## 4.2 Skull and Crossbones

### High Acute Toxicity

Chemicals having high acute toxicity are those that have oral, inhalation, or dermal $LD_{50}$ and $LC_{50}$ values below specified thresholds listed in the OSHA Lab Standard. These values are as follows:

- Oral $LD_{50}$ (rats) $< 50$ mg/kg
- Dermal $LD_{50}$ (rabbits) $< 200$ mg/kg
- Inhalation $LC_{50}$ (rats) $< 200$ ppm in air

## 4.3 Corrosion

### Corrosive to Metal

A substance or a mixture, which by chemical action will materially damage, or even destroy metals.

### Skin Corrosion/Burns

A substance or a mixture, which will cause irreversible damage to the skin. Corrosive substances cause destruction of living tissue by chemical action at the site of contact. Corrosives can damage personal protective equipment such as gloves, lab coats and eye protection. Ensure personal protective equipment is rated to withstand corrosives. Eye protection and gloves should always be used when handling corrosive materials. An eyewash and safety shower must be readily accessible to areas where corrosives are used or stored. If skin or eye contact occurs, immediately flush the area of contact for 15 minutes.

### Serious Eye Damage

Chemicals or mixtures that produce irreversible tissue damage or serious physical decay of vision.

## 4.4 Exclamation Mark

### Irritants (Skin & Eye)

A substance that may cause reversible changes to the eye or skin. Irritants are chemicals that cause reversible inflammatory effects on living tissue at the site of contact. Many chemical irritants also cause other health effects or have other hazardous properties. Common examples include acetone, ammonia, and formaldehyde. Avoid skin and eye contact when using all chemicals in the laboratory by utilizing adequate PPE.

### Skin Sensitizer

A substance that causes an allergic response following skin contact.

### Acute Toxicity

Chemicals that are harmful if inhaled, ingested, or absorbed through the skin in relatively moderate amounts.

### Narcotic Effects

A substance that may cause drowsiness, dizziness, lack of coordination, vertigo, reduced alertness, or similar condition.

### Respiratory Tract Irritant

A substance that may cause redness, cough, pain, or similar effect on the respiratory tract.

## 4.5 Flame Over Circle

### Oxidizers

A substance that oxidizes another substance, especially one that supports the combustion of fuel; an oxidizing agent. Oxidizing agents may react violently when they encounter reducing materials, and sometimes with ordinary combustibles. Oxidizers should be kept away from heat, clothing, and other combustible materials. Take any precaution to avoid mixing with combustibles and store away from combustibles. Oxidizers can have other associated hazards, such as corrosive or toxic (e.g., nitric acid, sodium nitrite). Make sure that all the potential hazards are understood before handling any chemical.

## 4.6 Gas Cylinder

### Gases Under Pressure

Gases under a pressure of 200 kPa (29 psi, 2 atm) or more, or which are liquefied, or liquefied and refrigerated. Carefully read the label and SDS before using or storing compressed gas.

Always use the minimum size cylinder required to perform the work. Gas cylinders should be stored in an upright position at or slightly above midpoint to a secured surface at all times. When moving a compressed gas cylinder, appropriate carts should be used. The cylinder must be capped and securely strapped to the cart. Compressed gas cylinders must be secured to an unmovable surface by means of a strap or stand. Do not store cylinders or lecture bottles with the regulator in place. If the regulator fails, the entire contents of the gas cylinder may be discharged. The various hazard classes must be segregated and stored in quantities dictated by International Fire Code (IFC). Contact EHS for assistance with compliance.

## 4.7 Exploding Bomb 

### Explosives

A solid or liquid substance (or mixture of substances), which is capable of extremely violent decomposition. Except in the case of law enforcement officers engaged in official duties, explosive substances are prohibited on university premises unless the university safety officer approves their use (UI APM 35.34 Property and Asset Conservation, Part e).

### Self-Reactives

Thermally unstable liquid or solid chemicals liable to undergo a strongly exothermic decomposition even without participation of oxygen (air).

### Organic Peroxides

Thermally unstable chemicals, which may undergo exothermic self-accelerating decomposition and which may be sensitive to impact or friction, explosive decomposition, or explosive reaction with other substances. Certain laboratory chemicals form peroxides on exposure to oxygen in the air. Organic peroxides may have one or more of the following properties:

- Be liable to explosive decomposition;
- Burn rapidly
- Be sensitive to impact or friction;
- React dangerously with other substances

Some chemicals can form explosive peroxides when stored; exposure to light and heat increase the rate of peroxide formation. Other chemicals form peroxides that become hazardous when concentrated, such as through distillation.

- Dispose of or check for peroxide formation after the recommended time (3 or 6 months, depending on chemical).
- Date all peroxidizable chemicals upon receipt and upon opening.
- Do not open any container which has obvious solid formation around the lid.
- Addition of an inhibitor to quench the formation of peroxides is recommended.
- It is recommended to chemically test for peroxides periodically.

## 4.8 Flame 

### Pyrophorics

A liquid, solid, or gas which is liable to ignite shortly after coming into contact with air, even in small quantities. Examples of pyrophoric materials are *tert*-butyllithium, silane, silicon tetrachloride, and white or yellow phosphorous. Pyrophoric chemicals should be used and stored in inert environments.

### Flammable Substances

A flammable substance is one that readily catches fire and burns in air. Three conditions must exist in order for a fire to occur; an oxygen-containing atmosphere, a fuel and an ignition source. When handling flammable materials, observe the following guidelines:

- Eliminate ignition sources such as open flames, hot surfaces, sparks from welding or cutting, operation of electrical equipment and static electricity.
- Assure appropriate fire extinguishers and/or sprinklers systems are in the area.
- Flammable chemicals may not be stored in household-type refrigerators, freezers and cold rooms. Use laboratory-safe refrigerators and freezers specifically designed to store flammable chemicals.

*Flammable Gases*
A gas at 20° C and standard atmospheric pressure that has a flammable range in air.

*Flammable Liquids*
A liquid having a flash point of not more than 199.4°F (93°C). The flash point is the lowest temperature at which the application of an ignition source causes the vapors of a liquid to ignite under specified test conditions. Store flammable liquids in NFPA approved flammable liquid containers or storage cabinets, in an area isolated from ignition sources or in a special storage room designed for flammable materials. Ensure there is proper bonding and grounding when it is required such as when transferring or dispensing a flammable liquid from a large container or drum. Assure bonding and grounding is checked periodically.

*Flammable Solids*
A solid that is readily combustible, or may cause or contribute to fire through friction. Readily combustible solids are powdered, granular or pasty chemicals which are dangerous if they can be easily ignited by brief contact with an ignition source, such as a burning match, and if the flame spreads rapidly.

### Emits Flammable Gas

Solids or liquids that are liable to become spontaneously flammable or give off flammable gases in dangerous quantities when in contact with water.

### Self-Reactives

Thermally unstable liquid or solid chemicals liable to undergo a exothermic decomposition even without participation of oxygen (air) when heated and which may result in fire (but not explosion).

### Organic Peroxides

Thermally unstable chemicals, which may undergo exothermic self- accelerating decomposition and which may be sensitive to impact or friction, explosive decomposition, or explosive reaction with other substances.

## 4.9 Other Physical and Health Hazards

### Water Reactive Chemicals

Water reactive materials are those that react violently with water. Water reactive materials include alkali metals (lithium, sodium, potassium), organometallic compounds and some hydrides that react with water to produce heat and flammable hydrogen gas, which can ignite or combine explosively with atmospheric oxygen.

### Cryogens

Cryogenic liquids can pose both physical and health hazards. Cryogenic liquids can cause frostbite and these liquids often have large volume expansion factors when they boil. As such cryogenic liquids also pose the health hazard of asphyxiation. Common cryogenic liquids found in laboratories include liquid nitrogen and argon. When using cryogens, confirm that the cryogenic tank's safety relief valves have not been modified. Under normal conditions, these containers will periodically vent product. Do not plug, remove, or tamper with any pressure relief devices. Some of the hazards associated with cryogens are fire, pressure, weakening of materials, and skin or eye burns upon contact with the liquid. Cryogenic materials should be stored in well ventilated areas to avoid asphyxiation hazards.

### Asphyxiants

Substances that interfere with transport of an adequate supply of oxygen to the vital organs of the body. Exposure to asphyxiants lead to collapse and death. Simple asphyxiants displace oxygen from the air being breathed to an extent that adverse effects occur. Example include acetylene, carbo dioxide, argon, helium and nitrogen. Chemical asphyxiants can combine with hemoglobin which reduces the capacity of blood to transport oxygen. Examples include carbon monoxide and hydrogen sulfide.

### High Pressure Reactions

Experiments that generate high pressures or are carried out at pressures above 1 atm can lead to explosion from equipment failure. High pressure reactions require special pressure vessels and may require additional controls to avoid rapid swings in pressure that could spontaneously depressurize resulting in serious injuries and/or property damage. Main hazards include impact from an explosion, exposure to hazardous chemicals from uncontrolled release, or fire.

### High Temperature

High temperature reactions can cause burns from touching hot equipment or from fire. Laboratories will often use heating plates, sand baths, oil baths, heating mantels, ovens, and occasionally open flame to achieve high temperatures. Do not touch items while they are hot. Often, hot and cold items look the same, so assume that heating equipment is hot. Job safety analysis may be appropriate for some high temperature experiments.

### Vacuum Work

Precautions to be taken when working with vacuum lines and other glassware used at sub-ambient pressure are mainly concerned with the substantial danger of injury in the event of glass breakage. Hazards of vacuum work include injury due to flying glass, possible toxicity of chemicals contained in the vacuum system, and fire following breakage of a flask.

### Ultraviolet (UV), Visible, and Near-Infrared Radiation (IR)

UV, visible, and IR from lamps and lasers in the lab can produce hazards. UV lights used in biosafety cabinets for decontamination can cause skin and corneal burns. Light from lasers that are incorrectly used pose a hazard to the eyes of the operators and others present in the room. Hazards vary depending on the class of laser.

### Radiofrequency (rf) and Microwave Hazards

Rf and microwaves occur within the range 10 kHz and 300,000 mHz and are used in rf ovens and furnaces, induction heaters and microwave ovens. Only microwave ovens designed for lab or industrial used should be used. If microwaves are used improperly superheating of liquids can occur. Metal in microwave ovens can results in arcing. Capping vials or other containers used in the oven can result in pressure buildup and subsequent explosion. Inappropriately selected plastic containers may melt.

### Electrical Hazards

Electrical safety inside a lab is very important as general practice and because some laboratory equipment requires high voltage and power. Such equipment includes lasers and electrophoresis power supplies. Do not use extension cords for permanent wiring. Do not use any damaged electrical equipment including worn or frayed wiring. Never block electrical panels. Only UI approved electricians should modify any wiring or circuits.

### Magnetic Fields

Magnetic fields can be found near large magnets such as machines using magnetic resonance imaging (MRI) and nuclear magnetic resonance (NMR). Many instruments now have internal shielding, which reduces the strength of the magnetic field outside of the instrument. Health effects of exposure to static magnetic fields is an active area of research and health effects of magnets are not fully understood. The main hazards are to individuals with pacemakers or metal implants in their body.

### Slips, Trips, and Falls

Overall good lab housekeeping can prevent slips, trips, and falls. Lab floors should be kept clear of clutter. Additionally, when a liquid is spilled it is important to clean it up as soon as possible so individuals do not slip.

### Sharp Edges

Injuries from broken glass are among the most common in research laboratories. To minimize cuts, lab occupants should use correct handling procedures, proper PPE, and pay careful attention to manipulation. Always check glassware for chips or cracks before use. Dispose of glass in the proper glass disposal containers. Other cut hazards come from scalpels, razors, and box cutters. Always use these tools in a safe manner. Inspect them before use and never use a cutting tool for a task for which it was not designed.

### Ergonomic Hazards in the Lab

Repetitive motions within the lab, such as pipetting or typing on a computer, can lead to injury. Like the general workplace, laboratory workers need to be aware of the noise levels within the lab, ergonomic stressors, lighting (too bright or not bright enough), vibration, and other hazards. If you are concerned with these hazards, consult with EHS for a workplace evaluation.

# 5. CONTROLLING HAZARDS

## 5.1 Hazard Minimization, Elimination and Substitution

Using smaller quantities of hazardous chemicals or substituting a less hazardous chemical reduces the risk of serious exposure or spill. Consider the following possibilities:

- Substitute less hazardous chemicals;
- Work on a smaller scale;
- Order only what is needed; and/or
- Share chemicals when possible.

## 5.2 Engineering Controls

Engineering controls eliminate or minimize exposure by removing a hazard or acting as barrier between a hazard and a worker. Engineering controls are typically more effective at controlling hazards than administrative control practices or personal protective equipment. They often require a higher cost upfront; however, they may be more cost effective in the long run. Engineering controls range in complexity and cost from something as simple as using sharps containers to minimize needle sticks to an interlocking mechanism on an x-ray unit to minimize radiation exposure. In a laboratory, they are often used to minimize contact with a hazard due to chemical splash, explosion or inhalation.

### Local Exhaust Ventilation

Local exhaust ventilation is an engineering control used to reduce inhalation exposure. Common laboratory examples include glove boxes, extraction arms (snorkels) and fume hoods.

#### Glove Box

Glove boxes are complete enclosures used to perform work in a separate environment. A different environment may be necessary to control worker exposure or to protect the chemical itself (e.g., an inert atmosphere). Gloves secured to ports allow manipulation inside the unit. Requirements for use are training and SOPs, and depending on the manufacturer's recommendations, sensor calibration and integrity testing of the unit and gloves.

#### Biosafety Cabinet

Biosafety cabinets (BSCs) are used to control exposure to biological aerosols and protect work materials from contamination using a High Efficiency Particulate Air (HEPA) filter. HEPA filters do not capture chemical vapors. A BSC where the treated exhaust is returned to the laboratory cannot be used for procedures involving flammable liquids or volatile, toxic or odorous chemicals except for small quantities of alcohols used for decontamination. BSCs are inspected annually by an outside vendor. Contact the university's Biosafety Officer for more information.

### Extraction Arm (Snorkel)

Extraction arms, or snorkels, are typically constructed of flexible ducting and connected to the exhaust ventilation system. They are useful for capturing vapors, fumes and dust at the source of generation. Extraction arms work well when designed properly for a given process with an adequate flow rate. They are typically ineffective for any source beyond the distance of the ducting's radius.

### Fume Hood

The fume hood is the most common method of controlling inhalation exposures to hazardous substances in the laboratory. They are useful against fumes, mists, dusts and vapors. Their use is recommended whenever handling hazardous materials and may be required to reduce exposure to levels below applicable exposure limits.  Consideration of the types and quantities of chemicals used will determine the effectiveness of the fume hood.

*Alarm*

Some fume hoods are equipped with a low flow alarm. The alarm is an indication the face velocity may be inadequate and not providing proper protection. Contact EHS and Facilities with any issues.

*Emergency Shut-Off*

Some buildings are equipped with emergency shut-offs for the fume hood exhaust system and differ from the alarm control mentioned above. The emergency shut-offs are only to be used by Facilities or the fire department.

*Certification and Maintenance*

Fume hood certification is maintained by EHS and completed on an annual basis as indicated by a sticker on the fume hood. The sticker is typically found on the side of the sash indicating the height at which the hood was certified.

The certification process ensures the fume hood is functioning properly and maintaining a minimum face velocity of 80 feet per minute when measured at the sash threshold.

Any suspected fume hood malfunctions or issues must be reported to the PI and EHS or Facilities.  Alterations must be coordinated and approved by EHS and Facilities. Any repair, relocation or alteration requires recertification of the fume hood by EHS.

*Minimizing Materials in the Fume Hood*

For a fume hood to operate properly, adequate airflow is essential. An easy way to accomplish this is by minimizing the number and size of materials in a fume hood. Materials such as large equipment, supplies or chemical containers, cannot be used in a fume hood if it prevents the fume hood from functioning properly. The most common issue stems from blocking the lower baffle, which reduces adequate flow at the sash and can disrupt airflow patterns. It may be possible to elevate the materials to maintain flow to the lower baffle. For large equipment, it is generally more effective to install a specially designed enclosure so the chemical fume hood can be used for the intended purpose. Contact EHS for assistance and assessment.

*Sash Height*

When working at the chemical fume hood, open the sash only as far as necessary to access the work area. The lowered sash helps contain contaminants in the hood and the smaller hood opening makes the hood less susceptible to room drafts and other external air disturbances. Open sashes can result in an inadequate face velocity and reduce hood effectiveness. The certification sticker indicates the height at which the hood was tested and is the maximum working height for the sash.

When a fume hood is not in use, the sash should be closed.

The sash can also help protect against splashes or projectiles from chemical spills or reactions. A lowered sash does not eliminate the necessity for appropriate personal protective equipment.

*Additional Work Practices*

- Work at least six inches behind the sash threshold.
- Never put your head (or face) inside an operating chemical fume hood to check on an experiment.
- Move slowly in and around fume hoods. Be aware that opening/closing doors can disturb the airflow.
- Unless instructed otherwise, fume hoods shall remain on at all times.

*Perchloric Acid Use*

Perchloric acid digestions and other procedures performed at elevated temperatures must be conducted in a specifically designed and dedicated fume hood with a wash-down system due to potential formation and build-up of explosive perchloric acid salts. The fume hood cannot be used for any other purpose.

## 5.3 Administrative Controls

Administrative controls consist of policies, programs and procedures which guide work practices to minimize exposure. Programs, such as the CHP, provide guidance on specific topics typically applying to multiple laboratories to guide compliance with university policy and regulatory requirements.

### Safety Information and Standard Operating Procedures (SOPs)

Laboratories must establish and maintain standard operating procedures for equipment, processes and procedures performed in the laboratory. An SOP can be used to:

- Communicate to the laboratory worker the potential hazards, required hazard controls and steps to complete a task safely and correctly.
- Satisfy regulatory requirements documenting required personal protective equipment.
- Train laboratory workers in proper procedure and maintain consistency between laboratory workers.

EHS develops periodic informational bulletins applicable to common laboratory hazards and processes. Typically, these take the form of Guidance Documents, Hazard Alerts, or SOPs. Guidance Documents are intended to clarify recommended safety procedures and expectations for various campus operations whether in a laboratory, maintenance or office setting. Hazard Alerts are designed to notify the campus community of recent incidents or accidents that may recur if similar conditions exist. Highlighted events may have happened at our university or other locations. SOPs are provided as a template for routine work and equipment use. Each procedure is prepared in a standardized format. For the safety and health of personnel, some laboratory operations may require the need to create SOPs specific to the work performed. See the EHS website for existing SOPs and a template to create SOPs specific to your laboratory. Contact EHS if you need assistance.

### Work Practices

The information in this section applies to the majority of laboratory work or work areas. Information regarding specific chemicals, chemical hazard classes and additional hazards may be obtained from the Laboratory Safety Officer.

*Prepare for Work with Hazardous Chemicals*

- Take the time to read and familiarize yourself with the CHP and all appendices before handling any hazardous chemical.
- Read the university's Hazardous Materials Management and Disposal Policies and Procedures that contains information covering safe and proper disposal of hazardous chemicals.
- Follow applicable laboratory protocols or SOPs, which outline requirements for handling hazardous chemicals.
- Know the nearest location of all safety equipment as well as evacuation routes and assembly location.
- Be familiar with the spill and exposure response procedures in the Laboratory Safety Plan located within the laboratory.
- Become familiar with the health and physical hazards of the chemicals you will be handling.
- For extremely hazardous chemicals or procedures, consider performing a "dry" run with a manager to become familiar with the steps.

### Minimize Routine Exposure

The following are general work practices designed to minimize exposure from routine procedures.

- Activities involving hazardous chemicals should be conducted in a chemical fume hood whenever possible.
- Always mark chemical containers for identification. Do not smell chemicals to determine their identity.
- Change gloves regularly.
- Inspect gloves for tears, cracks, discoloration, and holes before and during use.
- Exhaust of an apparatus that may discharge toxic chemicals should be vented into a chemical fume hood, exhaust ventilation system or filter.
- Storing, handling or consuming food or beverages in laboratories, storage areas, refrigerators, environmental rooms or laboratory glassware is prohibited.

### Personal Hygiene

Personal hygiene in the laboratory can minimize exposure to hazardous chemicals. Some general requirements for personal hygiene in the laboratory include:

- Eating, drinking, smoking, or applying cosmetics in laboratory areas is prohibited.
- Mouth pipetting of any substance is prohibited.
- Hands must always be washed before leaving the laboratory. Solvents must never be used to wash hands.

- Required appropriate PPE (e.g., laboratory coat, eye protection, gloves) must be worn in the laboratory whenever there is a potential for exposure to chemical or physical hazards. Please refer to laboratory specific requirements.
- PPE must be removed before leaving and not be worn in public areas such as bathrooms, offices, conference rooms, eating areas and outdoors.
- Gloves must not be worn while touching doorknobs, light switches, telephones or other common items unless required by the laboratory-specific or standard operating procedures.

### Housekeeping

General guidelines for good housekeeping include:

- Keeping areas and pathways around emergency equipment, showers, eyewashes and exits clear;
- Keeping areas around all circuit panels clear;
- Keeping all aisles, hallways and stairs clear;
- Keeping all work areas clear of clutter;
- Returning all chemicals to the proper storage area at the end of the day;
- Cleaning up spills promptly; and
- Cleaning benchtops and fume hoods regularly.

### Disposal of Chemical Waste

The university is responsible for removing hazardous chemical waste from all laboratories. Hazardous chemical waste procedures are outlined on the EHS website under "Hazardous Materials and Waste" and detailed in the Hazardous Materials Management and Disposal Policies and Procedures Manual. APM 35.40: Hazardous Waste Management provides additional information and specifies that all employees and students who generate, handle and/or manage hazardous waste shall attend the university's Hazardous Waste Management Workshop, or other appropriate training approved by the EHS Office, prior to generating and/or managing hazardous waste at any university facility. After initial training, this training requirement must be met once every five years.

## 5.4 Personal Protective Equipment

Personal protective equipment (PPE) is worn to minimize exposure to potential hazards and must be worn when handling hazardous materials or performing potential hazardous activities in the laboratory. Appropriate PPE is based on the potential hazards and associated risks of the types and quantities of chemicals in use, location of use and how the chemicals are used. The hazards and risks can stem from temperatures, pressures or mechanical actions.

Use of PPE shall only be considered after exercising all other options for reducing hazards. Eliminating unnecessary processes and substances should be the first method used to control hazards. Engineering controls such as chemical fume hoods and glove boxes can be used to control hazards, and further minimize required PPE.

The PI for each project, with EHS assistance if necessary, is responsible for determining PPE requirements. PPE requirements must be documented by the laboratory in the form of either job hazard analyses or SOPs.

The PI must ensure that appropriate types and sizes of PPE are readily available, laboratory workers are properly trained in use and maintenance and laboratory workers comply with PPE requirements.

Common laboratory PPE is discussed below. Keep in mind different or additional PPE may be required based upon the hazards and associated risks.

### Hand and Forearm

*Gloves*

Gloves are required when handling hazardous chemicals or for protection from physical hazards such as cuts, extreme temperatures and abrasion. There is no glove currently available that will protect against all chemicals or all types of tasks. Many glove manufacturers have charts available to help determine the most appropriate glove material. Gloves come in a variety of materials, thicknesses and cuff lengths. Selection must consider the chemicals in use, potential contact time, splash potential and dexterity needs.

It is recommended to change thin disposable gloves once they become contaminated or on a regular interval. In some applications, thicker gloves may be reused, but they must be inspected regularly for nicks, punctures or signs of degradation and discarded when necessary.

Laboratory workers must remove at least one glove before leaving the immediate work site to prevent contamination of public areas (e.g., doorknobs, light switches, telephones, etc.).

#### *Latex Allergy*

Latex has been shown to be a sensitizer to some individuals. Sensitization occurs over time with increased symptoms. Exposure to the latex protein is greatly increased through the use of powdered latex. The use of powdered latex is highly discouraged. If a powdered glove is desired, a powdered nitrile glove is recommended.

*Tyvek sleeves/Gauntlet gloves*

Tyvek sleeves and gauntlet gloves provide greater forearm protection than a laboratory coat. Uncoated sleeves are fluid resistant and coated sleeves provide increased fluid protection. The sleeves must be worn over a laboratory coat or paired with other necessary body protection. Gauntlet gloves that reach to or extend above the elbow are readily available.

### Body

Body protection may be necessary to protect against chemical splash or particulates which could cause injury or contamination of an individual or clothing. It may also be necessary to protect a work area from outside contamination (e.g., clean room).

*Laboratory Coat*

A long-sleeved laboratory coat must be worn whenever infectious, chemical or radioactive hazards exist assuming a similar or more protective level of PPE is not required. A laboratory coat, though not impervious, provides some protection against contact and contamination. Tyvek laboratory coats or coveralls may also be a suitable option and offer added convenience since they are disposable. See the Laboratory Guidance Sheet "Lab Coats for Flammable Liquids, Flammable Solids and Pyrophorics" for additional information.

Contaminated laboratory coats must be immediately removed and laundered or disposed of properly. Laundering must be done through a commercial laundry service. Home laundering is prohibited.

*Chemical Resistant Apron*

Some chemicals or activities may require protection beyond a laboratory coat's capabilities due to splash potential and the hazardous chemical properties. It is important to select an apron compatible with the chemical in use and an appropriate thickness for adequate protection.

## Eye/Face Protection

The most common types of eye and face protection include safety glasses, safety goggles and face shields. Each serve their own purpose, but all must meet requirements outlined in American National Standards Institute (ANSI) Z87.1. "Z87" must be imprinted on the equipment indicating it meets proper specifications. If an individual chooses to wear contact lenses in the laboratory, chemical splash goggles must be worn.

*Safety Glasses*

Safety glasses must be worn when handling hazardous materials or where there is the potential of flying particulate. They must have side shields for added protection. Safety glasses are adequate for handling small quantities of moderately hazardous materials with limited splash potential or materials of low hazard and flying particulate.

Regular prescription glasses have not been determined to meet the Z87.1 requirements. Over-the-glasses (OTG) safety glasses are available and fit over most prescription lenses and frames. A number of retailers offer prescription safety glasses. The frames are marked with Z87 and are fitted with polycarbonate lenses. Side shields are required and typically snap on the bows.

*Safety Goggles*

Safety goggles must be worn when handling liquid hazardous materials with the potential for splash, volatile hazardous materials and concentrated acids or bases. Goggles fit tightly to the face, minimizing liquid and vapor contacting the eye area. Vented and non-vented models are available. Vented goggles have openings which reduce fogging but increase contact potential. Non-vented goggles have a greater tendency to fog but provide greater protection. An anti-fog coating is an important feature. Most prescription glasses fit under standard safety goggles.

Goggles provide better protection against large amounts of particulates and liquids when compared to safety glasses.

*Face Shield*

A face shield helps protect the face from splashes and flying particulates. A face shield is only considered supplementary eye protection. Safety glasses or goggles must also be worn underneath.

## Leg and Foot

Laboratories must require leg protection such as long pants or similar clothing when handling hazardous chemicals or corrosive, cryogenic or highly toxic liquids to minimize chemical contact with exposed skin. Leg protection beyond regular clothing may be required for protection from hazards such as molten metal, heat and cutting hazards. Foot protection, at a minimum, must consist of closed-toed shoes covering the top and sides of the foot. Sandals and open-toed shoes are prohibited. Additional foot protection including steel-toe shoes, leather, or slip-resistant shoes may be required.

### Respiratory Protection

Respirator use requires training, medical approval and fit testing as outlined in APM Policy 35.51 "Respirator Protection and Use." Respirators, including dust masks, are not to be used in any area without prior approval. Contact EHS for additional information on respirator use.

### Additional Considerations

Additional or different types of PPE may be necessary dependent upon the laboratory and associated activities. Each laboratory shall designate minimum PPE for entry to work areas and include the requirements in the Laboratory Safety Plan.

Contaminated PPE must be decontaminated or properly disposed. Contaminated PPE may require classification as hazardous waste. Please refer to the Hazardous Materials Management and Disposal Policies and Procedures or contact EHS.

# 6. EMERGENCY RESPONSE

Emergency response policies and procedures are outlined in the Comprehensive Emergency Management Plan. Emergency responders can be reached by dialing 911. The following emergency numbers must be posted near a laboratory phone: fire department, hospital emergency room, poison control center, police and rescue.

All incidents, accidents and emergency response activities must be reported to your supervisor and on the Accident/Incident Report Form on the EHS website.

## 6.1 Emergency Equipment

In any emergency, it is critical that all staff members are familiar with the use and location of all emergency equipment. This includes fire extinguishers, fire alarms, safety showers, eyewash stations, first aid kits and chemical spill kits.

All emergency equipment shall be on a preventive maintenance schedule. Fire alarms are tested periodically, and extinguishers are inspected monthly. UI EHS tests all campus and research and extension facility safety showers and eyewash stations annually. Laboratories are responsible for activating their eyewashes and showers weekly and recording the checks on the provided log.

## 6.2 Seeking Medical Treatment

### 911

911 should be contacted for a serious medical emergency. If you are unsure of the seriousness of the situation, make the call. If emergency responders are deemed necessary, they will respond to the scene and assess the situation.

### Emergency Room or Additional Care

Any person seeking medical attention, but not needing emergency transport or response, should notify their PI and obtain care.

## 6.3 Chemical Exposure

The treatment of a chemical exposure takes precedent over spill cleanup, spill containment or property damage including water damage from the use of an eyewash or safety shower.

If the material is dry or in powder form, brush off all visible contaminant before flushing with water. When possible, obtain assistance to remove contaminated PPE and clothing and contact emergency responders if necessary. If medical attention is sought, provide medical care personnel with copies of the applicable Safety Data Sheets.

#### Eye Contact

Eyes must be promptly flushed with water using an eyewash for 15 minutes following contact with any chemical. The eyes should be held open. Medical help should be sought immediately after flushing.

#### Skin Contact

The affected areas must be immediately flushed with water for 15 minutes. Once the flushing has started, contaminated PPE and clothing must be removed. Medical attention should be sought immediately after flushing.

#### Inhalation/Ingestion

Move to a clean environment or seek assistance to get away from the contamination and immediately contact emergency responders for guidance.

#### Contaminated Sharps Injury

The affected areas must be immediately flushed with water for 15 minutes. Once the flushing has started, contaminated PPE and clothing must be removed. Medical attention should be sought immediately after flushing.

#### Chemical Spill

Laboratory personnel can clean up small spills if trained and equipped to do so. Small spills include chemical spills that are up to 1 liter liquids or 0.5 kilograms solids and of limited toxicity and reactivity. Small spills of metallic mercury from broken thermometers (about 1.5 grams) can be cleaned up by laboratory personnel. If respiratory protection is needed for a spill clean-up, the spill is too large to be handled by laboratory personnel – dial 911 or call EHS at 208-885-6524 during normal business hours. See Appendix B for additional spill clean-up procedures.

# 7. CHEMICAL STORAGE

## 7.1 Segregation

Materials should always be segregated and stored according to their chemical family or hazard classifications. Do not store chemicals alphabetically unless they are compatible. The most common hazard classes include:

- Flammables/ combustibles
- Corrosive acids
- Corrosive bases/ caustics
- Toxic
- Highly toxic
- Oxidizers
- Compressed gases
- Cryogens
- Pyrophoric
- Water reactive
- Explosives

Accidental contact between incompatible chemicals can result in a reaction causing fire, explosions, the formation of highly toxic and/or flammable substances or other potentially harmful situations.

Each chemical family should be separated from all other chemical families. Ideally, each hazard class would be kept in a cabinet or on a shelf segregated from other hazard classes. Incompatible chemicals within the same hazard class should also be separated from one another. For example, both nitric and perchloric acids are incompatible with organic acids and should not be stored together.

Most laboratories have limited space. The following priorities may help you decide how to store chemicals.

- Limit the amount of chemicals on hand to just what is needed to complete work.
- Do not store chemicals alphabetically unless they are compatible.
- Store flammable liquids in approved safety containers in flammable storage cabinets. Do not store anything but flammable or combustible liquids in these cabinets.
- Segregate acids from bases.
- Segregate most organic acids from oxidizing mineral acids.
- Keep oxidizers away from other chemicals, especially flammables, combustibles and toxic materials.
- Keep corrosives away from substances that may react with and release corrosive, toxic or flammable vapors.

## 7.2 Basic Storage Requirements

The following basic storage requirements apply to all hazardous chemicals. Refer to the EHS website for additional requirements that apply to chemicals in a specific hazard class.

### Storage Area Requirements

- Label storage areas according to the type of chemical family or hazard classification.
- Inspect storage areas annually or at the end of projects.
- Keep storage areas well-lit and appropriately ventilated.
- Eliminate ignition sources such as open flames, heat sources, or direct sunlight.
- Confine chemical storage areas so that leaks or spills are controlled. Prevent chemicals from running into sinks or floor drains. Clean up spills and drips immediately.
- Do not store chemicals in sinks or fume hoods. Chemicals must not be stored on the floor or window ledges.

### Storage Cabinets

Use only UL-approved storage cabinets. Never alter a flammable storage cabinet unless directed to do so by EHS.

Label cabinets with the hazard class of the chemicals.

### Storage Shelves

Shelves should be level, stable and secured to the wall or other stable surface. Shelves should have stable raised edges or lips to prevent containers from falling. Containers should not protrude over edges. Storage of materials must not be above eye level.

Shelves should be kept free of chemical contamination and dust and be located away from direct sun, flame, or heat sources.

### Storage Containers

Keep containers closed unless you are dispensing a chemical or adding to the container. Never store a container open or with a funnel in it.

Provide secondary containment for liquids in containers larger than 1 gallon in size.

Use approved containers for flammable solvents.

## 7.3 Chemical Stability

Stability refers to the susceptibility of the chemical to dangerous decomposition. Ethers and olefins form peroxides on exposure to air and light. Since these chemicals are packaged in an air atmosphere, peroxides can form even though the containers have not been opened. Write the date received and date opened on all containers of ether. Unless an inhibitor was added by the manufacturer, closed containers of ether should be discarded after 1 year. Containers of ether should be discarded within 6 months of opening. The label and SDS will indicate if a chemical is unstable.

The following are examples of materials that may form explosive peroxides:

- acetal
- decahydronaphthalene
- dicyclopentadiene
- diethylene glycol
- dioxane
- ethyl ether
- isopropyl ether
- tetrahydrofuran
- vinyl ethercyclohexene
- diacetylene
- diethyl ether
- dimethyl ether
- divinyl acetylene
- terahydronaphthalene
- methyl acetylene
- vinylidene chloride
- ethylene glycoldimethylether (glyme)

Refer to the EHS Hazardous Materials Management and Disposal Policies and Procedures (Part 600) for additional information on chemical hazards and suggested storage procedures.

## 7.4 Expired Chemicals

Any expired or out-of-date chemical must be properly disposed if it presents an increased safety risk over time such as peroxide formers and picric acid. The PI may choose to retain chemicals past their expiration if the chemical has no increased risk and it is properly stored. EHS strongly recommends disposal of expired chemicals if they are not needed in the foreseeable future.

### Time-Sensitive Expired Chemical Disposal

Failure to dispose of time sensitive chemicals prior to their expiration date can result in unnecessary risk, disposal difficulty and increased cost. Depending on the chemical and its age, testing and disposal by an outside vendor may be required. In extreme cases, an explosive ordinance disposal unit (i.e., bomb squad) may be required. Costs associated with the testing and disposal of time-sensitive chemicals beyond their expiration date is the responsibility of the PI.

# 8. LAB CLOSEOUTS AND DECOMMISSIONING

Researchers are required to follow the UI Laboratory Decommissioning Procedure prior to vacating any laboratory or other space where chemical, biological or radioactive materials have been used or stored. Events requiring decommissioning of a laboratory include:

- Terminating affiliation with the University of Idaho;
- Relocating to another laboratory space;
- Major laboratory renovation; and
- Retirement from research activities.

The PI is fully responsible for complying with all laboratory decommissioning requirements. In the event that the PI is unable to fulfill these requirements, the department or college administrator becomes responsible for implementing the decommissioning procedure. Department or college administrators are responsible for oversight of the decommissioning procedure and certifying that the vacated laboratory space has been properly decommissioned. Researchers who are vacating shared laboratory space shall ensure that this procedure is implemented for their portion of the laboratory space. The department will be held responsible for costs, deficiencies or any regulatory actions or fines resulting from the improper management or disposal of regulated materials from laboratories that have not been properly decommissioned.

# Appendix A
# Definitions and Abbreviations

| | |
|---|---|
| ACGIH | American Conference of Governmental Industrial Hygienists |

**Acute Toxicity**

Chemicals having high acute toxicity are those that have oral, inhalation, or dermal LD50 and LC50 values below specified thresholds listed in the OSHA Hazard Communication Standard. These values are as follows:

- Oral LD50 (albino rats) < 50 mg/kg
- Dermal LD50 (albino rabbits) < 200 mg/kg
- Inhalation LC50 (albino rats) < 200 ppm in air

**Asphyxiants**

An asphyxiant is a chemical (gas or vapor) that can cause death or unconsciousness by suffocation. Simple asphyxiants such as nitrogen, either use up or displace oxygen in the air. They become especially dangerous in confined or enclosed spaces. Chemical asphyxiants, such as carbon monoxide and hydrogen sulfide, interfere with the body's ability to absorb or transport oxygren to the tissues.

**Carcinogens**

Carcinogens cause cancer through irreversible, uncontrolled growth of cells in an organ or tissue. It is believed that there is no known minimum dose that can remove all danger of cancer. Benzene is a known carcinogen.

Select carcinogens are substances that meet one of the following criteria:

- It is regulated by OSHA as a carcinogen;
- It is listed under the category, “Known to be Human Carcinogens,” in the Annual Report on Carcinogens published by the National Toxicology Program (NTP) (latest edition);
- It is listed under Group 1 (“carcinogenic to humans”) by the International Agency for Research on Cancer Monographs (IARC) (latest editions); or
- It is listed in either Group 2A or 2B by IARC or under the category “reasonably anticipated to be carcinogens” by NTP, and causes statistically significant tumor incidence in experimental animals in accordance with any of the following criteria:
    - After inhalation exposure of 6-7 hours per day, 5 days per week, for a significant portion of a lifetime to dosages of less than 10 mg/m 3;
    - After repeated skin application of less than 300 (mg/kg of body weight) per week; or
    - After oral dosages of less than 50 mg/kg of body weight per day.

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| Corrosives | Corrosives cause rapid death of the body cells contacted. Exposure may cause pain, burning, bleeding and fluid loss. Corrosives include acids and bases. Due to the nature of bases and some acids, pain response may not be immediate upon exposure. |
| Division of Building Safety (DBS) | The Idaho Division of Building Safety is a state agency that provides regulatory guidelines and performs regular building safety inspections. |
| Health Effects | • **Acute health effects** happen immediately after a chemical exposure. Effects are generally apparent and can often be easily traced to the exposure. Acute reactions are normally short-lived and may be followed by recovery, although occasionally permanent damage occurs**.**<br>• **Chronic health effects** are not always obvious and onset of symptoms is gradual. It is much harder to trace the cause of a chronic effect, since the exposure could have been 20 – 30 years prior to the appearance of the effect. |
| LC50 (Lethal Concentration) | The concentration that kills 50% of test animals within a specified time. |
| LD50 (Lethal Dose) | The dose required to produce death in 50% of the exposed population within a specified time. |
| Occupational Safety and Health Administration (OSHA) | OSHA is part of the federal government and provides regulations and assistance for workplace health and safety. |
| Particularly Hazardous Substances (PHSs) | PHSs are chemicals defined by OSHA to be select carcinogens, reproductive toxins and chemicals having high acute toxicity. Laboratories using PHSs must prepare and implement laboratory-customized standard operating procedures for these substances. |
| Permissible Exposure Limit (PEL) | PELs are OSHA and DBS regulatory limits for inhalation which may consist of:<br>• **Time Weighted Average, 8 hour ($TWA_8$)** – Average concentration over an 8-hour period.<br>• **Short Term Exposure Limit (STEL)** – Average concentration over a 15-minute interval.<br>• **Ceiling (C)** – Maximum concentration at any given time.<br>• **Action Level (AL) –** concentration designated in 29 CFR part 1910 for a specific substance, calculated as an 8-hour time-weighted average, which initiates certain required activities such as exposure monitoring and medical surveillance.<br>Exceeding any of these levels for a chemical requires additional actions to be taken which may include additional monitoring, engineering controls, administrative controls or PPE. |

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| Personal Protective Equipment (PPE) | PPE is worn for protection against exposure to chemicals, projectiles, or other hazards. Examples include safety glasses, safety goggles, gloves, and laboratory coat. |
| Reproductive Toxins | Reproductive toxins are chemicals that may adversely affect male and female reproductive health and the developing fetus. Information about chemical reproductive toxins is available through the OSHA web site and on the State of California's Proposition 65 list, which is updated annually. Always consult the Safety Data Sheet for a chemical to determine if it could be a reproductive toxin prior to use. |
| Threshold Limit Value (TLV) | A time-weighted average concentration under which most people can work consistently for 8 hours a day, day after day, with no harmful effects. A table of these values and accompanying precautions is published annually by the ACGIH. |

# Appendix B Spill Response

**Introduction/Purpose**

Laboratory personnel can clean up small spills if trained and equipped to do so. Small spills include chemical spills that are up to 1 liter of liquids or 0.5 kilograms of solids and of limited toxicity and reactivity. Small spills of metallic mercury from broken thermometers (about 1.5 grams) can be cleaned up by laboratory personnel. If respiratory protection is needed for a spill clean-up, the spill is too large to be handled by laboratory personnel – dial 911 or call EHS at 208-885-6524 during normal business hours. Table 1 provides some examples of chemicals that should not be cleaned up by laboratory personnel until the situation is assessed by EHS.

**Table 1: Chemicals That Should Not Be Cleaned Up By Laboratory Personnel**

| Chemical Class | Examples |
|---|---|
| Strong Acids – Any acid that is concentrated enough to fume or emit acid gases, or presents severe health/physical hazards | Concentrated Hydrochloric Acid<br>Fuming Sulfuric Acid<br>Red Nitric Acid<br>Hydrofluoric Acid<br>Perchloric Acid |
| Strong Bases – Any base that is concentrated enough to emit vapors | Ammonium Hydroxide |
| Poison by Inhalation – Any chemical that readily emits vapors/gases at normal temperature and pressure that are extremely toxic by inhalation | Phosphorous Oxychloride<br>Titanium Tetrachloride<br>Chloroformates<br>Isocyanates |
| Reactive – Any chemical that is reactive to air, water, shock, friction and/or temperature | Dry Picric Acid<br>Lithium Aluminum Hydride<br>Sodium Borohydride<br>Phosphorous Metal<br>Organic Peroxides |
| Mercury –unless a small quantity, e.g. from a broken thermometer | Metallic Mercury<br>Mercury Salts<br>Organomercury Compounds<br>Aqueous Mercury Solutions |
| Extremely Toxic/Known Carcinogen – Any chemical that is readily absorbed through the skin and is extremely toxic at small concentrations (e.g. $LD_{50/30}$ < 50 mg/kg) | Benzene<br>bis-Chloromethyl Ether<br>Phenol<br>Sodium Cyanide |

**General Spill Clean-up Procedures**

1. Alert others in the laboratory or work area.
2. If the spill presents a severe health or safety risk, activate the building fire alarm at the nearest pull station, and evacuate the building.
3. Decide if you are trained, knowledgeable and equipped to handle the incident. If not, request assistance from others who are trained or call 911.
4. Never proceed to clean up a spill if you do not know the hazards associated with the chemical.
5. If anyone is injured or contaminated, call 911 and begin decontamination measures or first aid, if trained and safe to do so.
6. Barricade the spill area to prevent people from walking through it.
7. Obtain a Chemical Spill Kit or gather the supplies you will need. See Chemical Spill Kit inventory below.
8. Refer to a Safety Data Sheet (SDS) for the spilled material.
9. Don the personal protective equipment from the spill kit. At a minimum, you should wear splash goggles, nitrile gloves, a laboratory coat and disposable booties or disposable chemical-resistant overalls with integrated booties.
10. If broken glass is involved, use the scoop from the spill kit and place the broken pieces in a plastic bag. Then place the bag in a strong tight container such as a 5-gallon plastic pail.
11. All tools used in the clean-up need to be decontaminated. Remove gross contamination with a wet paper towel and collect for proper waste disposal. Wash the tools with soap and water. Dry the tools and return to the spill kit.
12. Decontaminate goggles in the same manner as with tools. Dry and return to the spill kit.
13. Dispose of gloves and chemical-resistant overalls as waste.
14. Restock supplies in the Chemical Spill Kit.

**Specific Procedures – Flammable Liquid Spills**

1. Control all sources of ignition such as flames, hot surfaces or sparking.
2. Use the 4’ absorbent sock to protect floor drains.
3. Absorb the spill with the gray “Universal” spill pads. Paper towels, sponges, kitty litter or “Floor-Dry” may also be used. Place used absorbents in a plastic bag, preferably using tongs or other device to minimize direct contact.
4. Wipe the area down with a wet paper towel. Dispose the towel in the plastic bag. Dispose gloves and overalls in the plastic bag.
5. Double-bag, then seal the plastic bags with tape.
6. Submit a Chemical Waste Collection Request to EHS via the online system. Attach the completed chemical waste label to the bag.

**Specific Procedures – Liquid Spill Other Than Flammable Liquids**

1. A spill of a weak or dilute inorganic acid or base can be neutralized first to a pH of 5 to 9 using a neutralizing agent such as **sodium bicarbonate, sodium bisulfate, or citric acid**. Gradually sprinkle the neutralizing agent on the spill. Check with pH paper.
2. Absorb the spill with the yellow “Aggressive” spill pads or other suitable absorbent.
3. Use the plastic scoop from the spill kit if solids are present.
4. Place used absorbents in a plastic bag, preferably using tongs or other device to minimize direct contact.
5. Wipe the area down with a wet paper towel. Dispose the towel in the plastic bag. Dispose gloves and overalls in the plastic bag.
6. Double-bag, then seal the plastic bags with tape.

7. Submit a Chemical Waste Collection Request to EHS via the online system. Attach the completed chemical waste label to the bag.

**Specific Procedures – Solid Spills**

1. Use the plastic scoop, scrapers and brush to collect the material. Place spilled material in a plastic bag.
2. Care should be taken to avoid creating dust or causing the spilled material to become airborne.
3. After the bulk of the material is cleaned up, wet a yellow spill pad with water and wipe the area down. Place the pads in the plastic bag.
4. Wipe the area down with a wet paper towel. Dispose the towel in the plastic bag. Dispose gloves and overalls in the plastic bag.
5. Double-bag, then seal the plastic bags with tape.
6. Submit a Chemical Waste Collection Request to EHS via the online system. Attach the completed chemical waste label to the bag.

**Specific Procedures – Broken Thermometer Clean-Up**

1. Clean up the spill immediately after is has occurred.
2. Be sure to wear shoe covers or place plastic bags over your shoes during the clean-up.
3. Carefully pick up the broken thermometer pieces and place in a plastic bag.
4. Push the mercury droplets together into a bead using an index card, small scraper, or rubber squeegee.
5. Aspirate the beaded mercury into a disposable syringe, or use a disposable Pasteur pipette attached with tubing to a vacuum flask to aspirate mercury into the flask. The flask should contain a small amount of water.
6. Chemically inactivate the residual mercury by:
   a. Using a commercial inactivating powder or sponge (e.g. “Hg Absorb”). Be sure to follow its directions for use and dispose in a plastic bag; or
   b. Sprinkling zinc powder over the spill area. Then moisten the zinc with a 5-10% sulfuric acid solution until a paste is formed. Scour the contaminated surface and allow the paste to dry. Gently sweep up the dried paste with the brush and scoop. **CAUTION**: $H_2S$ gas will be emitted!
7. Thoroughly wash the area with a detergent solution. Dispose sponges/paper towels in the plastic bag.
8. Dispose the collected mercury, inactivating material, gloves, booties and overalls in the plastic bag. If you used a flask to aspirate the mercury droplets, stopper the flask and submit separately from the bag.
9. Double-bag, then seal the plastic bags with tape.
10. Submit a Chemical Waste Collection Request to EHS via the online system. Attach the completed chemical waste label to the bag.

**Chemical Spill Kit**

Every laboratory should have a chemical spill kit readily available and stocked with supplies that are appropriate for the types of chemicals that are used. The **Chemical Spill Kit** is a five-gallon pail consisting of the following supplies:

- 1 – 5-gallon plastic pail with lid, labeled “CHEMICAL SPILL KIT”
- 10 – Universal Chemical Absorbent Pads, 20"W x 15"L (Vapor Suppressive)
- 10 – “Aggressive” Chemical Absorbent pads, 15”W x 10”L for acid and caustic spills
- 1 – 4 ft Universal Chemical Absorbent Sock, 2-3” inch diameter
- 1 – 1-qt plastic scoop
- 1 foxtail brush
- Plastic scrapers or putty knife

- 10 - 4mm polyethylene plastic bags
- 1 roll duct tape
- 2 – pair of Nitrile gloves (North LA115EB or equivalent)
- 1 – pair of splash goggles
- 1 – pair disposable plastic-coated Tyvek or similar coveralls
- 2 – pair disposable booties
- “Hazardous Waste” labels
- 1 “Chemical Spill Clean-Up Procedures”

Supplemental supplies (optional depending on chemicals present in the work area):

- 2 – pair Silver Shield gloves (Note: to improve dexterity, don disposable nitrile gloves over the Silver Shield gloves)
- 1 – 1 lb box of baking soda to neutralize acid spills
- Mercury spill kit, including:
  - Hg Absorb powder
  - Hg Absorb sponges
  - Small plastic suction bottle (500 mL)
  - Flashlight
- Hydrofluoric acid (dilute solutions only)
  - 1 lb Calcium carbonate
  - 1 tube Calcium gluconate gel for skin exposure first aid

You can either assemble your own spill kit or purchase one from a supplier, such as Fisher Scientific or Lab Safety Supply. Everyone working in the laboratory should know where the spill kit is located and how to use it properly.

For any questions about assembling a hazardous material/waste spill kit or questions about spills, please contact EHS at 208-885-6524.