



# Sam Houston State University

## BIO-Hazard & Chemical Hygiene Plan

Department of Biological Sciences – Department of Geography & Geology

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## INTRODUCTION

University faculty, staff, students, and visitors are potentially exposed to not only hazardous chemicals such as acetone, carbon monoxide, formaldehyde, hydrogen sulfide, mercury, nitric acid and xylene, but also infectious or toxic wild animals, bacteria, or tissues in the various University sponsored programs. Accidents resulting in hazard related illnesses and injury potentially pose problems to exposed workers and liability for their employer. The University encourages and supports all programs which promote safety, good health, and well being of University faculty, staff, students, participants in University sponsored programs, and visitors. It is the policy of the Sam Houston State University (SHSU) to provide safe and healthful conditions and to reduce injuries and illnesses to the lowest possible level. No task is so important and no service so urgent that it cannot be done safely. In keeping with this commitment, this BIO Hazard & Chemical Hygiene Plan (BHCHP) was developed as part of the Laboratory Safety Program and is designed to keep exposures to hazardous situations in laboratories at the lowest practical levels, below the Permissible Exposure Limits (29 CFR 1910.1000, Subpart Z) established by the Occupational Safety and Health Administration (OSHA).

The OSHA Laboratory Standard (29 CFR 1910.1450) was developed to protect laboratory personnel from exposure to hazardous chemicals and conditions. One element of compliance with the OSHA Laboratory Standard is the development and compliance with this BIO Hazard & Chemical Hygiene Plan. Although the regulations apply specifically to employees, provisions of the BHCHP also apply to students and visitors depending on their activities. It is the objective of the BHCHP to provide uniform requirements for safety in University laboratories. Basic operating procedures are detailed, including work with carcinogens, reproductive toxins, and highly acute substances. Specific standard operating procedures for operations posing a special hazard (for example, heating perchloric acid, working with pyrophorics, conducting electrophoresis, doing extractions, handling pathogens and their vectors, bacterial screening, transgenic research, working with wild mammals and birds, toxins, venomous organisms, radionuclides, etc.) must be developed independently for each laboratory.

The Laboratory Supervisor or Principal Investigator is responsible for maintaining a safe and healthy laboratory environment. However, each individual is expected to conduct all operations and procedures involving chemicals in a safe and prudent manner.

### I. ROLES AND RESPONSIBILITIES

#### A. Principal Investigator (PI) or Laboratory Director (LD)

Each PI-LD (Tenured or Tenure-track Faculty Member) has responsibility for implementation of the BIO Hazard & Chemical Hygiene Plan (BHCHP)

in his/her laboratory. Non-tenure track faculty will be under the supervision of the PI-PD in whose laboratory they will work.

The PI-LD will:

1. Ensure that workers are trained and follow the BHCHP outlined in this document;
2. Ensure that the necessary protective and emergency equipment is available, in working order, and that appropriate training has been provided;
3. Ensure that periodic laboratory inspections and inventories are performed;
4. Know current legal requirements concerning regulated substances used in the laboratory (BATF, DEA, TX Dept of Health, etc.);
5. Ensure availability of Material Safety Data Sheets (MSDS) and relevant reference materials.
6. Review, evaluate, and update laboratory specific Standard Operating Procedures (SOP) at least annually. Provide written notice of PI-LD compliance with responsibilities of the BHCHP to the Hazard Officer (HO) annually.

## **B. Laboratory Employees**

Laboratory employees are responsible for:

1. Planning and conducting research in accordance with practices and procedures established in this BHCHP ;
2. Reporting hazardous or potentially hazardous conditions to the PI-LD;
3. Being familiar with **emergency procedures**, including knowledge of the location and use of emergency equipment for the laboratory, as well as how to obtain additional help in an emergency;
4. Knowing the types of protective equipment available and using the proper type for each procedure;
5. Being alert to unsafe conditions and actions and calling attention to them so corrections can be made as soon as possible.
6. Request information or training when unsure about the handling of hazardous reagents, organisms, tissues, or fluids.

## **C. Hazard Officer (HO)**

1. The HO for the Lee Drain Building is Dr. Jack C. Turner, Professor of Biological Sciences, Office: 134/ 132-LDB; (936) 294-1537 or (936) 294-1540. [Jturner@shsu.edu](mailto:Jturner@shsu.edu)
2. The HO is a Faculty employee who is qualified by training or experience to provide technical guidance in the development and implementation of the provisions of the BHCHP. The Hazard Officer will:

- a. Assist PI's and laboratory employees with development and implementation of appropriate chemical hygiene procedures and practices, including providing consultation and information as requested;
- b. Keep current of legal requirements concerning regulated substances and communicate any changes to PI's and laboratory employees; and
- c. Seek ways to improve and implement the BHCHP.

## II. EMPLOYEE INFORMATION AND TRAINING

PI's will ensure that information and training are provided at the time of an employee's initial assignment to a work area where hazardous chemicals are present and prior to assignments involving new exposure situations. Refresher information and training will be conducted at least annually and documented.

### A. Information

All laboratory personnel will be informed of:

1. Requirements of the OSHA Standard, "Occupational Exposure to Hazardous Chemicals in Laboratories,"
2. The contents and availability of this BIO Hazard & Chemical Hygiene Plan,
3. Permissible Exposure Limits (PELs) for OSHA regulated substances or recommended exposure limits where there is no applicable OSHA standard,
4. Signs and symptoms associated with exposures to hazardous chemicals used in their laboratory,
5. The location of reference materials on the hazards, safe handling, storage and disposal of hazardous chemicals found in the laboratory including, but not limited to, Material Safety Data Sheets (MSDS).

### B. Training

Employee training will include:

1. The physical and health hazards associated with chemicals held and used in their work area,
2. The contents of this BIO Hazard & Chemical Hygiene Plan,
3. Methods and observations that may be used to detect the presence or release of a hazardous chemical; e.g., exposure monitoring conducted by the HO , visual appearance or odor of hazardous chemicals when being released, etc.

## III. PRIOR APPROVAL CIRCUMSTANCES

PI-LDs must obtain prior approval to proceed with a laboratory task from the HO when, in general, the accepted working limits of a particular substance exceeds the limit concentration exposures to personnel, and specifically includes any work with:

- A. Radioactive materials;**
- B. Drug Enforcement Authority (DEA) scheduled compounds;**
- D. Biological material with a Biosafety Level  $\geq 3$ ;**
- E. Biological materials to include:**
  - 1. Human materials (e.g., human cell lines; blood or blood products; semen or vaginal secretions; fluids surrounding internal organs, the joints or a fetus; any body fluids; any tissues)
  - 2. Any plant, animal, or human pathogen
  - 3. Transgenic animals (use or creation)
  - 4. Transgenic plants
  - 5. Nonhuman primate materials
  - 6. Bio-toxins
  - 7. Wild mammal materials
  - 8. Recombinant DNA (even work that is exempt from the NIH Guidelines must be authorized. It is the University's responsibility for ensuring that all r-DNA research, irrespective of funding source, is conducted "in full conformity with the provisions of NIH Guidelines." In order to ensure compliance with the Guidelines, campus policy requires that all r-DNA research or laboratory study must be registered with the HO. Penalties for University/PI noncompliance may result in:
    - i. Suspension, limitation, or termination of NIH funds for r-DNA research at the University,
    - ii. A requirement for prior NIH approval of any or all r-DNA projects at the University
- F. Work under conditions where safeguards are not operational.**

#### **IV. STANDARD OPERATING PROCEDURES**

##### **A. General Rules**

- 1. All employees should know the following for chemicals or bio-hazards with which they are working:
  - a. The chemical's hazards, as determined from a MSDS and other appropriate references;

- b. Appropriate safeguards for using that chemical or working with the hazard, including personal protective equipment;
  - c. How to properly store or maintain the chemical or hazard when it is not in use;
  - d. **Hazardous Waste Management Procedures**;
  - e. Proper personal hygiene practices;
  - f. Appropriate procedures for emergencies, including first aid, evacuation routes, and incident or **Spill Cleanup Procedures**.
2. Employees should avoid working alone. Arrangements should be made between individuals working in separate laboratories outside of regular working hours to crosscheck each other periodically. Hazardous experiments or experiments employing hazardous reactants should not be undertaken by a PI-LD or employee who is alone in the laboratory. Telephone access should always be available.

## **B. Personal Hygiene**

1. Wash promptly whenever a chemical has contacted your skin. Flush for at least 15 minutes prior to seeking medical attention.
2. Avoid inhalation of chemicals. Do not “sniff” to test chemicals.
3. Do not use mouth suction to pipette anything. Pipetting aids must be used at all times.
4. Do not bring food (including gum and candy), beverages, tobacco, or cosmetic products into chemical storage or use areas. Eating, drinking, and applying cosmetics is allowed in designated areas only. Smoking is prohibited in all University facilities.
5. Wash well with soap and water before leaving the laboratory. Avoid the use of solvents for washing skin. Solvents remove the natural protective oils from skin and can cause irritation and inflammation. In some cases, washing with solvent may facilitate absorption of toxic chemicals.

## **C. Housekeeping**

Housekeeping is directly related to safety and must be given importance of equal value to other procedures. Lack of good housekeeping reduces work efficiency and may result in accidents. Laboratory personnel must adhere to the following:

1. Access to emergency equipment, showers, eyewashes, fire extinguishers, exits and circuit breakers will never be blocked or obstructed.
2. Chemical containers should be regularly monitored for proper labeling and container integrity. Labels that are fading, falling off, or deteriorating must be promptly replaced. If abbreviations are used,

- they should be kept to a minimum and clearly identify the contents of the container as well as hazards associated with use; i.e., NaCN/poison, HgCl<sub>2</sub>/poison, HCl/corrosive, MethyOH/flammable, H<sub>2</sub>O<sub>2</sub>/corrosive-oxidizer, etc. Improperly labeled or unlabeled chemicals make hazard identification and disposal difficult, creating possible hazards.
3. All chemicals should be placed in their proper storage areas at the end of each workday. Chemicals will not be stored on desks, laboratory bench tops, floors, and fume hoods or in aisles.
  4. Each laboratory must have a puncture resistant (e.g., cardboard) container specifically designated for glassware disposal (sharps container).
  5. At the end of each workday, the contents of all unlabeled containers are to be considered waste and disposed of appropriately.
  6. Collection containers for wastes must be clearly labeled including hazard identification.
  7. All work areas, especially laboratory bench tops, should be kept clear of clutter.
  8. All aisles, corridors, stairs, and stairwells will be kept clear of chemicals, equipment, supplies, boxes, and debris.
  9. Food and drink for human consumption will not be kept in the same refrigerator used to store chemicals and laboratory samples. Eating and office areas must be clearly separated from laboratory and chemical storage areas.
  10. Empty containers will be treated in the following manner:
    - a. Containers of water soluble solvents: triple rinse, deface the label, relabel as "Empty" and dispose with Biohazardous waste; and
    - b. Containers of non-water soluble solvents: triple rinse using a solvent capable of removing the chemical. ALL rinsates must be collected in a hazardous waste disposal container. Deface the label, relabel as "Empty" and dispose with Biohazardous waste.

#### **D. Protective Clothing and Equipment**

1. Carefully inspect all protective equipment prior to use. Do not use defective equipment.
2. Eye protection (safety glasses, chemical-resistant goggles, or face shield) will be worn at all times in laboratories where chemicals are being used. This includes visitors. Ordinary prescription glasses are not considered effective eye protection since they lack necessary shielding. Chemical-resistant goggles should be worn over the glasses or prescription safety glasses be provided to employees required to wear corrective lenses.

3. The wearing of contact lenses in the laboratory is very controversial. Consult with an Optometrist prior to wearing contacts in the laboratory. Safety glasses or chemical-resistant goggles will be worn over contacts at all times.
4. When working with corrosive, toxic, allergenic, or sensitizing chemicals, rough or sharp-edged objects, very hot or very cold materials, gloves made of material known to be resistant to permeation by the substance will be worn. No one glove can protect against all hazards. Cloth gloves, while not appropriate for use around liquids, can protect against light abrasive materials and moderate temperature changes. Synthetic or rubber gloves protect against corrosives, solvents, and poisons. Leather gloves, often used for tasks like welding, protect against sparks, heat, and rough abrasives. Consult the manufacturer's performance chart or contact the HO to determine the proper choice of glove material.
5. Low-heeled shoes with fully covered uppers will be worn at all times in the laboratory. Shoes or sandals with open toes will not be worn.
6. Long pants and long sleeves should be worn when working with or around chemicals.
7. Long hair should be held in place behind the head.
8. Loose clothing, especially loose trouser legs and sleeves, should not be worn in the laboratory.
9. A full-body-length rubber, plastic, or neoprene apron appropriate for the material being handled should be worn if there is risk of splash or spill.
10. A proper respirator must be worn whenever exposure by inhalation is likely to exceed the action level or Personnel Exposure Limit (PEL) and a fume hood is not accessible. Consult the HO before doing any work requiring a respirator.

#### **E. Chemical Storage**

1. Store chemicals by hazard class, i.e. flammable, corrosive, reactive, toxic and general (non-hazardous). Maintain adequate separation of incompatible chemicals.
2. Store flammable solvents and strong acids or bases separately and in appropriate cabinets.
3. Secure compressed gas cylinders (strap, chain or cylinder stand).
4. All stored chemicals must be in appropriate containers, tightly sealed, properly labeled, and in good condition.
5. Flammable materials may not be stored or used in refrigerated equipment, unless the refrigerator is specifically designed for that purpose.

## F. Flammable Materials

1. Flammability is defined, depending on physical state:
  - a. Aerosol: A material that can produce a flame or flashback from a valve opening,
  - b. Gas: Any gas at ambient conditions that will cause a flammable mixture with air in concentration of  $\leq 13\%$ ,
  - c. Liquid: Any liquid or mixture with  $\geq 1\%$  of a liquid, with a flash point  $\geq 141^\circ\text{F}$  but  $< 200^\circ\text{F}$
  - d. Solid: a material that is liable to cause fire through friction, contact with moisture, spontaneous reaction, or retained heat, or which can be readily ignited and burns with enough persistence or violence to cause a serious health hazard.
2. Precautions for safe handling of flammable materials include the following:
  - a. Storage of flammable substances will be limited to the minimal quantities needed.
  - b. Flammable substances will be handled only in areas free of ignition sources.
  - c. Flammable substances should never be heated by using an open flame. Preferred heat sources include steam baths, water baths, oil baths, heating mantles, and hot air baths.
  - d. Transfer of flammable liquids from 5-gallon containers (or less) to smaller containers will be conducted in a laboratory fume hood or an approved flammable liquid storage room.
3. Class I flammable liquids will not be transferred from one vessel to another in an exit way. Class I liquids have a flash point  $\leq 100^\circ\text{F}$  and includes gasoline, naphtha and associated petroleum products.

## G. Reactive Chemicals

A reactive chemical is one that:

1. Fits the OSHA definition of "unstable" in 1910.1450(b): "Unstable (reactive)" means a chemical which in the pure state, or as produced or transported, will vigorously polymerize, decompose, condense, or will become self-reactive under conditions of shocks, pressure, or temperature,
2. Is ranked by the National Fire Protection Association (NFPA) as 3 or 4 for reactivity,
3. Is identified by the Department of Transportation (DOT) as:
  - i. An oxidizer (a chemical that initiates or supports combustion of other materials, causing fire by itself or by the release of oxygen or other gasses.),
  - ii. An organic peroxide, (an organic compound with bivalent O-O structure, which may be considered a peroxide derivative with one or both of the hydrogen atoms replaced with an

- organic molecule. They present dangerous fire and explosion risks; many are strong oxidizers),
- iii. A class A, B, or C explosive, (A chemical that causes a sudden, almost instantaneous release of gas, pressure, and heat when subjected to sudden shock, high temperature or pressure)
  - iv. Violently reacts with exposure to water or air.
8. Handle reactive chemicals with all proper safety precautions. This includes designating a separate storage area, monitoring periodically for degradation, and using appropriate personal protection.

## H. Corrosive Chemicals

1. Materials are classified as corrosive if they:
  - a. Are capable of rapidly eroding building materials or metals,
  - b. Burn, irritate or destructively attack organic tissues such as skin, eyes, lungs and stomach.

Examples of commonly used chemicals that have corrosive properties are:

glacial acetic acid hydrofluoric acid hydrochloric acid acetic anhydride	nitric acid bromine potassium hydroxide chlorine	sodium hydroxide fluorine sulfuric acid
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Safe handling procedures will vary with each operation, type, and concentration of the corrosive chemical used.

2. The following general guidelines should be followed for procedures involving acids and bases:
  - a. Never pour water into acid. Slowly add the acid to the water and stir.
  - b. Open bottles or carboys slowly and carefully, wearing protective equipment to guard hands, face, and body.
  - c. OSHA requires suitable facilities, such as a safety shower and eyewash, to be located within the work area. The American National Standards Institute (ANSI) recommends that the safety shower and eyewash be within 100 feet of the work area for quick drenching or flushing of the eyes and body. Laboratory personnel should flush eyewash stations and showers on a monthly basis. Physical Plant personnel will test eyewash stations and showers annually.
  - d. Procedures requiring the use of concentrated acids and bases must be conducted in a fume hood.

- e. Never mix acid wastes with other materials such as organic solvents, metal-contaminated solutions, etc. Neutralized (pH 6.0-8.0) all acids or bases before disposing of them into the sanitary sewer system (i.e., down the drain). Neutralization may be conducted in the laboratory when included as part of a written experiment protocol, and should be conducted in a fume hood. The solution should then be poured slowly down the drain with copious amounts of water; i.e., leave the water running for approximately 5 minutes.
- f. Contact **SAFETY OFFICE at (936) 294-1921** for assistance with disposal of large quantities [more than 4 liters (1 gallon) or 250 grams (1/2 pound)] of acids and bases.
- g. Each laboratory should have access to a spill kit that includes acid and base neutralizer; follow **Spill Response Procedures**. Never use combustible organic materials (sawdust, excelsior, wood scraps and shavings, paper, rags, or burlap bags) to absorb or cleanup spillage.

## I. Compressed Gas Cylinders

A compressed gas may be unitary or a mixture with an absolute pressure exceeding 40 p.s.i. at 70°F, or exceeding 104 p.s.i. at 130° F, or a liquid having a vapor pressure exceeding 40 p.s.i. at 100° F as determined by ASTM D-232-72, a standard of the American Society of Testing Materials. Use of compressed gases in the laboratory requires anticipating chemical, physical, and health hazards. Cylinders that are knocked over or dropped can be very dangerous. If a valve is knocked off, the cylinder can become a lethal projectile. Accidental releases in close quarters or confined spaces may result in an oxygen depleted atmosphere or adverse health effects. In short, improper handling and use can cause structural damage, severe injury, and possibly death. The following guidelines will help ensure safe handling, use, and storage of compressed gas cylinders.

- 1. Receiving and Storage
  - a. Be sure to arrange a return agreement with the supplier prior to purchase since disposal of compressed gas cylinders is difficult and very expensive.
  - b. Cylinders should not be accepted unless the cylinder contents are clearly labeled. Color code only should not be accepted, since it does not constitute adequate labeling. Cylinders should be tagged with an "Activity Tag" delineating the cylinders activity condition (Full, In-Use, Empty).
  - c. Do not accept cylinders which are damaged or do not have a valve protection cap.
  - d. All gas cylinders in use will be secured in an upright position in racks, holders, or clamping devices. When cylinders are

grouped together, it is preferred that tanks be individually secured and conspicuously labeled on the neck area.

- e. Oxygen cylinders will never be placed near highly combustible materials, especially oil and grease, or near stocks of carbide and acetylene or other fuel gas cylinders, nor near any other substance likely to cause or accelerate a fire unless being used in specifically designed dual operations employing both oxygen and combustible materials, gasses, liquids, etc. (oxy-acetylene torch or burner). Systems and components used for other gases and purposes must never be used for oxygen or interconnected with oxygen unless specifically designed for such connections.
- f. Cylinders should have current hydrostatic test date (normally less than 5 years old for steel and 3 years old for aluminum) engraved on the cylinder. Cylinders should be returned to the supplier for servicing prior to the expiration date.
- g. Do not place cylinders near heat, sparks, flames, or where the cylinder(s) might become part of an electrical circuit.
- h. Do not store cylinders in exit corridors or hallways in such a manner as to impede egress.

## 2. Handling and Use

- a. Only Compressed Gas Association fittings and components are permitted for use with gas cylinders. Only use regulators approved for the type of gas in the cylinder. Do not use adapters to interchange regulators.
- b. Open cylinder valves slowly and away from the direction of people (including yourself). Never force a gas cylinder valve. If the valve cannot be opened with the operating wheel or the small wrench provided, the cylinder should be returned to the supplier.
- c. No attempt will be made to transfer gases from one cylinder to another, to refill cylinders, or to mix gases in a cylinder in the laboratory.
- d. All cylinders are to be considered full unless properly identified as empty by the user. Empty cylinders must be returned to the supplier and not accumulated.
- e. Compressed gases must not be used to clean (blow-off) your skin or clothing.
- f. Never heat cylinders to raise internal pressure.
- g. Do not use copper (>65%) connectors or tubing with acetylene. Acetylene can form explosive compounds with copper, silver, and mercury.

- h. Always leave at least 30 psi minimum pressure in all “empty” cylinders. Do not leave an empty cylinder attached to a pressurized system.

## J. Control Measures

1. Ventilation  
Laboratory ventilation is normally designed to provide a minimum of 8 air changes per hour. This flow is not necessarily sufficient to prevent accumulation of chemical vapors. Laboratory work will be conducted in a fume hood, glove box, or similar device when:
  - a. Procedures call for work with toxic substances which are volatile; i.e., evaporate at room temperatures and pressure, or
  - b. There is a possibility the action level or PEL will be exceeded.
2. The protection provided by laboratory fume hoods is dependent upon two important factors:
  - a. Proper use of the hood, and
  - b. Maintenance of adequate airflow through the hood.
3. The way the hood is used will determine the extent of protection it will provide. Each employee is responsible for implementing the following work practices when using a hood.
  - a. Continually monitor air being drawn into the hood. This can be done by attaching a lightweight strip of paper to the bottom of the sash.
  - b. Operate the hood at a sash position that will provide splash protection for the user; e.g. 10-12 inch opening for hoods with vertical sliding (up and down) sashes and the sashes closed as much as possible for continuous air flow hoods with horizontal sliding (left and right) sashes. This helps to ensure optimum protection when conducting operations in the hood. However, do not attempt to work in a hood where the sash level is so low that it likely impedes or compromises the safety of your reason for using the hood. Sashes must be kept closed when the fume hood is unattended.
  - c. Avoid using the hood for long-term storage of bottles and equipment, especially along the back wall. Any apparatus that must be housed within the hood should fit completely inside the hood. Elevate the apparatus on blocks (at least 2 inches off the bench top) to allow air to flow freely around and beneath.
  - d. Manipulations within the hood should be performed at least 6 inches inside the face of the hood or as far towards the back

- of the hood as possible. This minimizes the possibility of contaminants escaping from the hood.
- e. Conditions that cause air turbulence across the face of the fume hood, such as fans, window air conditioning units, or excessive movement, should be avoided.
  - f. Exhaust hoods do not provide adequate protection for all operations involving toxic materials. A higher level of containment should be used for procedures where minor contamination can be serious, such as radioactive materials. If you are in doubt about the level of containment needed for your operation, ask your PI, Lab Supervisor, and Radiation Safety Officer (RSO) or contact the HO.
4. Physical Plant personnel will conduct annual surveys of fume hoods to ensure adequate airflow is maintained through the hood face. Face velocities should be between 80 and 120 feet per minute (fpm). Hoods that do not meet these minimum standards are considered “inadequate” and should not be used for protection from toxic or volatile materials. Report “suspect” fume hoods to the HO.

#### **K. Spill Clean-up Procedures**

1. Attend to anyone who may have been contaminated.
2. Notify occupants in the immediate area about the source of contamination or spill.
3. Evacuate all nonessential personnel from the contaminated area.
4. If the contaminated material is flammable, turn off all ignition and heat sources; this includes magnetic stirrers.
5. Avoid breathing vapors or making physical contact with the contaminant. Call **University Police at (936) 294-1000**.
6. Ensure the fume hood(s) is on. Open the windows where possible to increase exhaust ventilation, if appropriate
7. Secure cleanup supplies. Ensure protective apparel is resistant to the spill material.
8. Confine or contain spills to a small area.

#### **L. Exposure Monitoring**

Exposure monitoring will be performed when there is reason to believe that exposures are in excess of the action-level or the PEL. Materials that require monitoring under these conditions are listed in the OSHA Regulations. If an employee requests an exposure assessment to be conducted, the HO will make the request of the University Safety Office. Exposure assessments, or other documentation of exposure monitoring, will be kept and maintained as part of each employee’s personnel record.

#### **M. Medical Consultations and Examinations**

Given an incident with hazardous materials, employees will be provided an opportunity to receive medical attention, including any related follow-up examinations, at the University's expense, under the following circumstances:

1. An individual develops signs or symptoms associated with exposure to hazardous materials in the laboratory.
2. Exposure monitoring reveals an exposure level routinely above the action level or PEL for an OSHA regulated substance for which there are exposure monitoring and medical surveillance requirements.
3. An accident such as a spill, leak, equipment failure, or explosion results in possible over-exposure to hazardous materials.
4. The PI-LD is responsible for establishing and maintaining an accurate record of any medical consultations and examinations provided to an employee resulting from a laboratory incident.

**N. Select Carcinogens, Reproductive Toxins, Highly Acute Toxins**

The procedures described in this section are mandatory when performing laboratory work with greater than 10 mg or 100 mL of any carcinogen, reproductive toxin, venom, venomous organism, or substance that has a high degree of acute toxicity.

1. Definitions:
  - a. Carcinogens are substances to which exposure is known or suspected to result in cancer according to the International Research on Cancer, or is listed as such in the National Toxicology Program Annual report on Carcinogens; <http://ehis.niehs.nih.gov/roc/>
  - b. Reproductive toxin: chemicals that affect reproductive capabilities including chromosomal damage (mutagenesis) and/or effects on embryos or fetuses (teratogenesis).
  - c. Highly Acute Toxins are substances for which:
    - i. Toxic chemical has an oral lethal dose of 50–500 mg/kg, a cutaneous lethal dose of 200–1000 mg/kg, or a lethal concentration in air of 200–2000 ppm.
    - ii. The median oral LD<sub>50</sub> ≤ 50 mg/kg when administered orally to albino rats, or
    - iii. The median inhalation lethal concentration, LC<sub>50</sub>, value is ≤ 200 ppm by volume of gas or vapor, or 2 mg/liter or less of dust, mist, or fume when administered continuously for one hour or less to albino rats, or the median LD<sub>50</sub> ≤ 200 mg/kg when administered by continuous contact for 24 hours or less with the bare skin of albino rabbits.

- iv. Designated area: a hood, glove box, portion of a laboratory, or an entire laboratory room, designated as the only area where work will be conducted with quantities of select carcinogens, reproductive toxins, or highly acute toxins in excess of the limits specified above.
2. Designated Area:
- Access to designated areas will be restricted. Only trained employees will be allowed to work with chemicals in the designated area. All such persons will:
- a. Use the smallest amount of chemical that is consistent with the requirement of the work to be done.
  - b. Always use these chemicals in a hood with adequate airflow (face velocity between 80 and 120 ft<sup>3</sup> per minute) or other containment device for procedures, which may result in the generation of aerosols or vapors containing the substance.
  - c. Use high-efficiency particulate air (HEPA) filters or high-efficiency scrubber systems to protect vacuum lines and pumps.
  - d. Decontaminate designated areas before normal work is resumed there. This includes contaminated equipment.
  - e. Remove any protective apparel, place it in an appropriately labeled container, and thoroughly wash hands, forearms, face, and neck on leaving a designated area.
  - f. Prepare wastes for disposal in accordance **Hazardous Waste Management Procedures**.
  - g. Do not wear jewelry when working in designated areas since decontamination of jewelry may be difficult or impossible.

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