SALISBURY UNIVERSITY
CHEMICAL HYGIENE PLAN

1.1 GENERAL SAFETY PRINCIPLES

The following guidelines have been established to minimize hazards and to maintain basic safety in the laboratory:

- Examine the known hazards associated with the materials being used. Never assume all hazards have been identified. Carefully read the label before using an unfamiliar chemical. When appropriate, review the Material Safety Data Sheet (MSDS) for special handling information. Determine the potential hazards and use appropriate safety precautions before beginning any new operation. If you have any questions regarding the safe handling of the chemical, contact your supervisor or EHS.

- Be familiar with the location of emergency equipment, fire alarms, fire extinguishers, emergency eyewash and shower stations and know the appropriate emergency response procedures.

- Avoid distracting or startling other workers when they are handling hazardous chemicals. Use equipment and hazardous chemicals only for their intended purposes.

- Always be alert for unsafe conditions and actions and call attention to them so that corrective action can be taken as quickly as possible.

- Wear eye and face protection and impervious aprons when appropriate.

- Always inspect equipment for leaks, tears and other damage before handling a
- hazardous chemical. This includes fume hoods, gloves, goggles, etc.

- Avoid tasting or smelling hazardous chemicals.

- Ensure all chemical containers are properly labeled.

1.2 HEALTH AND HYGIENE

The following practices have been established to protect laboratory employees from health risks associated with the use of hazardous chemicals:

- Avoid direct contact with any hazardous chemical. Know the types of protective equipment available and use the proper type for each job.

- Confine long hair and loose clothing and always wear footwear which fully covers the feet.

- Do not pipette by mouth.

- Use appropriate safety equipment whenever exposure to gases, vapors or aerosols is suspected and ensure exhaust facilities are working properly.

- Wash hands thoroughly with soap and water after handling chemicals, before leaving the laboratory and before eating or drinking.

- Replace personal protective equipment as appropriate.

- Laboratory employees shall be familiar with the symptoms of exposure for the chemicals with which they work and the precautions necessary to prevent exposure.

1.3 FOOD AND DRINK IN THE LABORATORY

The following statement is the accepted practice regarding food and drink in laboratories and should be followed at all times:

There shall be no food, drink, smoking or applying cosmetics in laboratories which have radioactive materials, biohazardous materials or hazardous chemicals present. There shall be no storage, use or disposal of these items in laboratories (including refrigerators within laboratories). Rooms which are adjacent, but separated by floor to ceiling walls, and do not have any chemical, radioactive or biohazardous agents present, may be used for food consumption, preparation, or application of cosmetics at the discretion of the person/supervisor responsible for the area(s).

1.4 HOUSEKEEPING

Safety follows from good housekeeping practices. Use the following guidelines to maintain an orderly laboratory:

- Keep work areas clean and uncluttered. Clean up work areas upon completion of an operation or at the end of each workday, including floors.

- Dispose of wastes per the University Waste Disposal Procedures (see web link).

- Clean spills immediately and thoroughly, as per the guidelines established in section 2.0 of this document.

- Do not block exits, emergency equipment or controls or use corridors and stairways as storage areas.

- Assure hazardous chemicals are properly segregated into compatible categories.

1.5 CHEMICAL HANDLING AND STORAGE

The decision to use a hazardous chemical should be a commitment to handle and use the chemical properly from initial receipt to disposal.

- Information on proper handling, storage and disposal of hazardous chemicals and access to related MSDSs need to be made available to all laboratory employees prior to the use of the chemical.

- Always purchase the minimum amount necessary to maintain operations.

- Chemical containers with missing or defaced labels or that violate appropriate packaging regulations should not be accepted.

- Chemicals utilized in the laboratory must be appropriate for the laboratory's ventilation system.

- Chemicals should not be stored on high shelves and large bottles should be stored no more than two feet from floor level.

- Chemicals shall be segregated by compatibility.

- Chemical storage areas need to be labeled as to their contents.

- Storage of chemicals on the laboratory bench or in other work areas shall be kept to a minimum.

- Chemicals shall not be stored in the corridor.

- Any chemical mixture shall be assumed to be as toxic as its most toxic component. Substances of unknown toxicity shall be assumed to be toxic.

1.6 TRANSPORTING OF CHEMICALS

When transporting chemicals outside the laboratory, precautions should be taken to avoid dropping or spilling chemicals.

- Carry glass containers in specially designed bottle carriers or a leak resistant, unbreakable secondary container.

- When transporting chemicals on a cart, use a cart that is suitable for the load and one that has high edges to contain leaks or spills.

- When possible, transport chemicals in freight elevators to avoid the possibility of exposing people on passenger elevators.

1.7 COMPRESSED GASSES

Special systems are needed for handling materials under pressure. Cylinders pose mechanical, physical and/or health hazards, depending on the compressed gas in the cylinder.

- Cylinders with regulators must be individually secured. Only cylinders with valve protection caps securely in place may be safely gang-chained (chained in groups).

- When storing or moving a cylinder, have the valve protection cap securely in place to protect the valve.

- Cylinders must be secured in an upright position at all times. Use suitable racks, straps, chains, or stands to support cylinders against an immovable object, such as a bench or a wall, during use and storage. Do not allow cylinders to fall or lean against one another.

- Use an appropriate cart to move cylinders.

- Never bleed a cylinder completely empty. Leave a slight pressure to keep contaminants out.

- Oil or grease on the high-pressure side of an oxygen cylinder can cause an explosion.

- Do not lubricate an oxygen regulator or use a fuel gas regulator on an oxygen cylinder. Use an oxygen-approved regulator. All wrenches used on oxygen cylinders should be made of non-ferrous material.

- Always wear goggles or safety glasses with side shields when handling compressed gases.

- Always use appropriate gauges, fittings, and materials compatible with the particular gas being handled.

- When work with a toxic, corrosive, or reactive gas is planned, EHS should be contacted for information concerning specific handling requirements. Generally, these gases will need to be used and stored with local exhaust ventilation such as a lab hood or a gas cabinet designed for that purpose.

1.8 UNATTENDED OPERATIONS

At times, it may be necessary to leave a laboratory operation unattended. Follow these basic guidelines in the design of an experiment to be left unattended:

- Always check with your laboratory supervisor to determine if it is necessary to leave a laboratory operation unattended. If necessary, develop a protocol with your laboratory supervisor for the unattended operation of potentially dangerous equipment or methods.

- Develop a protocol for potential interruptions in electric, water, inert gas and other services and provide containment for toxic substances as part of the protocol.

- A warning notice must be posted in the vicinity of the experiment if hazardous conditions are present.

1.9 WORKING ALONE

Avoid working alone whenever possible.

1.10 STORAGE AND DISPOSAL OF HAZARDOUS WASTE

For guidelines on the storage and disposal of hazardous wastes from laboratory operations refer to the University Waste Disposal Policies and Guidelines (Web link). Any questions concerning disposal of hazardous waste should be directed to EHS at 6-6485.

2.0 STANDARD LABORATORY SAFE HANDLING / STORAGE REQUIREMENTS

2.1 HAZARD IDENTIFICATION

Identifying the specific hazard associated with a chemical greatly reduces chances of misuse by laboratory employees, new users, or visitors to the laboratory. At the very minimum, chemical containers should have labels that identify their contents and the hazards associated with the use of the chemical. With respect to identifying containers, storage areas and laboratory entrances, the following conditions entail hazard identification:

- PIs/laboratory supervisors must ensure that labels on incoming containers of hazardous chemicals are not removed or defaced. Labels contain information on the identity of the chemical(s) in the container and the hazard identification of the chemical(s). It is recommended that incoming containers be labeled with the PI's/ordering person's name and date of receipt.

- PIs/laboratory supervisors must ensure that employees have access to MSDSs.

- Chemicals should be stored according to compatibility. Particularly, hazardous chemicals should be stored and handled with extreme care. When ordering chemicals that are unfamiliar, review the MSDS before purchase so that use and storage guidelines are understood. Additionally, storage areas for biohazardous agents and radioisotopes should be appropriately labeled (Contact EHS for more information).

- Laboratories that use hazardous materials need to have signs visibly posted with emergency contact numbers (two names, preferably the laboratory supervisor or research director) on the external doorway to the lab. These names and numbers shall be updated when personnel change. Contact EHS with changes. In case of an emergency, responders need this information to contact knowledgeable personnel about specific laboratory hazards. The sign also needs to include information on the hazards in the laboratory and proper precautions to take when entering the laboratory.

- All peroxide-forming chemicals need to be labeled with the date the container was received and the date it was opened. After the recommended disposal date, the chemicals should be tested for peroxides or disposed of properly.

- See HAZARD WARNING SIGNAGE SYSTEM (web page link)

2.2 HAZARDS SUBJECT TO REVIEW OR PRIOR APPROVAL

The Laboratory Standard requires that laboratory supervisors identify those activities that the supervisor believes to be of a sufficiently hazardous nature to warrant prior approval before implementation by an employee.

2.3 CHEMICALS DEVELOPED IN THE LABORATORY

The following requirements apply to chemical substances developed in the laboratory:

- If the composition of the chemical substance, which is produced exclusively for the laboratory's use, is known, the supervisor must determine if it is a hazardous chemical. This can be done by a literature search for similar substances. If the chemical is determined to be hazardous, the supervisor must provide appropriate training to protect employees.

- If the chemical produced is a product or a by-product whose composition is not known, the supervisor must assume that the substance is hazardous and must comply with the requirements of the CHP.

- If the chemical is produced for sale or use outside of the laboratory, the supervisor must prepare an appropriate MSDS in accordance with the OSHA Hazard Communication Standard.

2.4 PROVISIONS FOR PARTICULARLY HAZARDOUS SUBSTANCES

Permissible Exposure Limits (PEL). The Laboratory Standard requires that employers assure that employees' exposures do not exceed the PELs. The PELs represent Time Weighted Averages (TWAs) in parts per million (ppm) or milligrams of substance per cubic meter of air (mg/m^3). The TWA represents the ratio between exposure and work shift.

The American Conference of Governmental Industrial Hygienists (ACGIH) has established Threshold Limit Values (TLVs), which are TWA values similar to PELs. The TLVs are in some cases lower than the PELs. To keep employee exposures as low as reasonably achievable, employers will be expected to uphold the lowest exposure limit, be it a PEL or a TLV.

Exposure limits can be found on the chemical's MSDS or by contacting EHS.

Employee Exposure Determination. Employers must contact EHS to perform employee exposure monitoring under the following circumstances:

A. Initial monitoring must be performed if there is reason to believe employee exposure levels routinely exceed _ the PEL.

B. Periodic monitoring must be performed when initial monitoring reveals an exposure over _ the PEL. Monitoring can be terminated in accordance with the relevant standard. EHS will notify each employee of the monitoring results within 15 working days after receipt of monitoring results. The results must be either individually distributed in writing or posted in a location accessible to all affected employees.

Special Considerations. The OSHA Laboratory Standard requires that special precautions for additional employee protection be followed for the laboratory use of select carcinogens, reproductive toxicants and chemicals with a high degree of acute toxicity.

Protection from these hazards is provided by assuring exposure to such hazards is minimized, i.e. kept under the PEL, TLV, or Short Term Exposure Limit (STEL), or eliminated. To minimize exposure, it is necessary to determine the route by which exposure may occur, whether by inhalation, absorption, injection, ingestion or a combination of exposure routes. To ensure employees do not receive exposures in excess of the PEL or TLV, hygienic standards have been established for many toxic materials. The following general hygiene standards should be observed when using select carcinogens, reproductive toxicants and chemicals with a high degree of acute toxicity.

Establish a designated area:

- Use and store materials only in designated areas: a restricted access hood, glovebox, or portion of a lab, designated for use of highly toxic substances. Assure that all personnel with access are aware of necessary safety precautions.

- Label all containers, storage and use areas appropriately.

Use proper containment devices for the protocol and chemical(s) being used.

- Use a hood or other containment device for procedures which may result in the generation of aerosols or vapors; trap released vapors to prevent their discharge with fume hood exhaust.

- It is recommended that breakable containers be stored in chemical-resistant trays. Work and mount apparatus above such trays or cover work and storage surfaces with removable, absorbent, plastic backed paper.

Removal of Contaminated Waste:

- Follow the guidelines established in the University Hazardous Waste Disposal policies.

Follow decontamination procedures prior to leaving the designated area:

- On leaving the designated area, remove protective apparel (place it in an appropriate, labeled container) and thoroughly wash hands, forearms, face, and neck. Thoroughly decontaminate or dispose of contaminated clothing or shoes. If possible, chemically decontaminate by chemical conversion to a less toxic product. Decontaminate vacuum pumps or other contaminated equipment, including glassware, before removing them from the designated area.

- Decontaminate the designated area before normal work is resumed.

- Use a wet mop or a vacuum cleaner equipped with a HEPA filter to decontaminate surfaces. DO NOT DRY SWEEP SPILLED POWDERS.

- Protect vacuum pumps against contamination with traps and/or appropriate filters and vent effluent into the hood.

Always take extra precautions when working with particularly hazardous chemicals:

- Consult the MSDS for toxic properties and follow the specific precautions and procedures.

- Guard against spills and splashes. Appropriate safety apparel, especially gloves, should be worn. All hoods, glove boxes, or other essential engineering controls should be operating properly before work is started.

- Notify the supervisor of all incidents of exposure or spills.

2.5 PHYSICAL HAZARDS

Materials which present a physical hazard can be safely used if the specific hazard(s) are understood. If appropriate precautions are not taken, personal

injury or property damage may occur. Additionally, certain chemicals cannot be safely mixed or stored with other chemicals because of the danger of a severe or extremely toxic reaction.

Hazardous chemicals require that employees follow special procedures for handling and storage. The PI or laboratory supervisor should create specific SOPs working with the material.

Flammable/Combustible Material. The National Fire Protection Agency (NFPA) places flammable and combustible liquids in the following classes:

	Flash Point	**Boiling Point**
Flammable		
Class IA	< 73 deg F (22.8 deg C)	< 100 deg F (37.8 deg C)
Class IB	< 73 deg F (22.8 deg C)	100 deg F (37.8 deg C)
Class IC	73 deg F (22.8 deg C)	
Combustible		
Class II	100 deg F (37.8 deg C) & < 140 deg F (60 deg C)	
Class IIA	140 deg F (60 deg C) & < 200 deg F (93 deg C)	
Class IIIB	200 deg F (93 deg C)	

Note: The flash point is defined as the minimum temperature at which a liquid gives off vapor in sufficient concentration to form an ignitable mixture with air near the surface of the liquid. For handling flammable/combustible 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.

Store 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.

Assure appropriate fire extinguishers and/or sprinkler systems are in the area.

Corrosives. Materials which can react with the skin, causing burns similar to thermal burns, and/or which can react with metal, causing a deterioration of the metal's surface.

- Containers and equipment used for storage and processing of corrosive materials need to be corrosion resistant.
- Eye protection and appropriate gloves must be used when handling corrosive materials. A faceshield, rubber apron, and/or rubber boots may also be appropriate.

- Never add water to acid. When mixing concentrated acids with water, add the acid slowly to water.

- An eyewash and safety shower must be readily accessible to areas where corrosives are used and stored. In the event of skin or eye contact with corrosives, immediately flush the area of contact with cool water for 15 minutes. Remove all affected clothing. Obtain medical help. See the "Personal Protective and Safety Equipment" section of this document for eyewash and safety shower specifications.

Oxidizers. Materials which react with other substances by giving off electrons and undergoing reduction. This reaction may result in fire or explosion. The intensity of the reaction depends on the oxidizing-reducing potential of the materials involved. The following steps need to be followed:

- Know the reactivity of the materials involved in the experiment or process. Ensure there are no extraneous materials in the area which could become involved in a reaction.

- If the reaction is anticipated to be violent or explosive, use shields or other methods for isolating the materials or the process.

Water Reactive Materials. Materials which react with water to produce a flammable or toxic gas or other hazardous condition. Often a fire or explosion results. Safe handling of water reactive materials will depend on the specific material and the conditions of use and storage. Examples of water reactive chemicals include alkali metals such as lithium, sodium, and potassium; acid anhydrides, and acid chlorides.

Pyrophoric Materials. Materials which ignite spontaneously upon contact with air. Often the flame is invisible. Examples of pyrophoric materials are silane, silicon tetrachloride, and white or yellow phosphorous. Pyrophoric chemicals need to be used and stored in inert environments.

Peroxidizable Chemicals (Organic Peroxides). Materials which undergo auto-oxidation (a reaction with oxygen in the air) to form peroxides (an O2 group) which can explode with impact, heat, or friction. Since these chemicals may be packaged in an air atmosphere, peroxides can form even though the container

has not been opened, necessitating careful handling. The following steps need to be taken.

- Date all peroxidizables upon receipt and upon opening. After the recommended disposal date, test the chemical for peroxides or dispose of them properly.

- Do not open any container which has obvious solid formation around the lid.

- Addition of an appropriate inhibitor to quench the formation of peroxides is recommended.

- It is recommended to chemically test for peroxides periodically.

- Follow same basic handling procedures as for flammable materials.

- Waste Management must be contacted to remove any peroxidizables that are undated or have not been used for extended periods of time.

Light-Sensitive Materials. Materials which degrade in the presence of light, forming new compounds that can be hazardous, or resulting in conditions such as pressure build-up inside a container which may be hazardous. Examples of light sensitive materials include chloroform, tetrahydrofuran, ketones and anhydrides.

- Store light-sensitive materials in a cool, dark place in amber colored bottles or other containers which reduce or eliminate penetration of light.

Unstable Materials. Compounds which can spontaneously release large amounts of energy under normal conditions, or when struck, vibrated, or otherwise agitated. Some chemicals become increasingly shock-sensitive with age. Of great concern in the laboratory is the inadvertent formation of explosive or shock-sensitive materials such as peroxides, perchlorates (from perchloric acid), picric acid and azides.

- Contact EHS when it is suspected that the inadvertent formation of shock-sensitive materials in ductwork, piping, or chemicals being stored has occurred.

- Date all containers of explosive or shock-sensitive materials upon receipt and when opened.

- If there is a chance of explosion, use barriers or other methods for isolating the materials or the process.

Cryogens. Cryogenic liquids such as oxygen, nitrogen, argon, helium and hydrogen are substances that are normally in the gaseous state but are cooled to extremely low temperatures so that they are liquids. Some of the hazards associated with cryogens are fire, pressure, weakening of materials, and skin or eye burns upon contact with the liquid. The following precautions should be taken when working with cryogens.

- Equipment needs to be kept clean, especially when working with liquid or gaseous oxygen.

- Mixtures of gases or fluids need to be strictly controlled to prevent formation of flammable or explosive mixtures.

- Always wear safety glasses with side shields or goggles when handling cryogens. If there is a chance of a splash or spray, a full face protection shield, an impervious apron or coat, cuffless trousers, and high topped shoes should be worn. Watches, rings, and other jewelry must not be worn. Gloves should be impervious and sufficiently large to be readily thrown off should a cryogen spill occur. Pot holders could also be used.

- Cryogenic containers and systems should have pressure relief mechanisms.

- Cryogenic containers should be made from materials such as austenitic stainless
- steels, copper, and certain aluminum alloys that are capable of withstanding extremely low temperatures.

- Since glass ampoules can explode when removed from cryogenic storage if not sealed properly, storage of radioactive, toxic or infectious agents should be placed in plastic cryogenic storage ampoules.

2.6 RADIOACTIVE MATERIAL HAZARDS

Use of radioactive materials at the University is strictly controlled. Contact the Radiation Safety Officer, Dr. Elichia Venso if you plan to use radioactive materials.

3.0 EMERGENCY / MEDICAL PROCEDURES

3.1 BASIC STEPS FOR EMERGENCY AND SPILL RESPONSE

Releases of hazardous substances that pose a significant threat to health and safety or that, by their very nature, require an emergency response regardless of the circumstances surrounding the release or the mitigating factors are emergency situations. The following definitions designate an emergency situation:

- The situation is unclear to the person causing or discovering the spill.
- The release requires evacuation of persons.
- The release involves or poses a threat of fire, suspected fire, explosion or other imminent danger; conditions that are Immediately Dangerous to Life and Health (IDLH); high levels of exposure to toxic substances.
- The person(s) in the work area is uncertain they can handle the severity of the hazard with the personal protective equipment (PPE) and response equipment that has been provided and/or the exposure limit could easily be exceeded.

Conversely, releases that do not pose significant safety or health hazards to person(s) in the immediate vicinity or to the person(s) cleaning up the material and do not have the potential to become emergencies within a short time frame are not emergency situations. The following situations ARE NOT emergency situations:

- The person causing or discovering the release understands the properties and can make an informed decision as to the exposure level.
- The release can be appropriately cleaned by the lab personnel.
- The materials are limited in quantity, exposure potential, or toxicity and present minor safety or health hazards to persons in the immediate work area or those assigned to clean up the activity.
- Incidental releases of hazardous substances that are routinely cleaned up by EHS need not be considered an emergency.

Emergency Situation - Fire. The following steps are basic protocol for handling a fire or fire-related emergency situation in the laboratory:

1. Pull the fire alarm

2. Notify University Police at 3-6222

3. Evacuate

4. Inform building evacuation supervisor of the nature and location of the fire

Emergency Situation - Spill. If the spill is of high toxicity or flammability or you are unsure of how to proceed or is more than one liter, execute the following:

1. Notify University Police at 3-6222

2. Evacuate personnel from the spill area and alert neighbors to the spill

3. If possible, isolate the spill area and close doors to the room where the spill occurred

4. Shut down equipment if possible

5. Provide information on the nature and location of spill to emergency response personnel

Evacuation of the building may be necessary if chemicals or contaminants could enter the air handling system of a building.

Attend to victims for a body splash:

1. Remove person(s) from spill area to fresh air only if attempts to rescue victim(s) does not present a danger to the rescuers.

2. Remove contaminated clothing while under an emergency shower.

3. Flood affected area with water for at least 15 minutes or longer if pain persists.

4. Wash skin with mild soap and water - do not use neutralizing chemicals, unguents, creams, lotions or salves.

5. Contact emergency response personnel and assure they know the chemical(s) involved. Have MSDS(s) available if possible.

Attend to victims for an eye splash:

1. Remove victim(s) from spill area to fresh air only if attempts to rescue victim(s) does not present a danger to the rescuers.

2. Lead the victim(s) immediately to an emergency eye wash facility.

3. Hold eyelids open.

4. Flush eyes for at least 15 minutes or longer if pain persists.

5. Contact emergency response personnel and assure they know the chemical(s) involved. Have MSDS(s) available if possible.

Mercury Spills**.** Each laboratory that utilizes mercury should have or have access to a mercury spill clean-up kit. In the event of a spill (broken thermometer) isolate the area in which the material was spilled and prevent people from stepping on the mercury. Follow the directions provided by the mercury spill clean-up kit and contact EHS to pick up mercury waste when you are done. For spills larger than the laboratory can handle, contact EHS for spill cleanup, instructions or assistance.

Non-Emergency Situation - Spill. If the spill is less than one liter and the chemical involved is of low toxicity and a low flammable hazard, handle it in the following manner:

If there are questions about proper spill response techniques, call EHS at 6-6485. After-hours dial 3-6222 (University Police).

1. Utilize absorbent materials (i.e., paper towels).

2. Choose the proper protective equipment:

- Always wear gloves and protective eyewear

- Use additional protective equipment such as an apron, coveralls, or boots if necessary.

3. Confine or contain the spill.

For non-reactive spills:

1. Cover liquid spills with absorbent and scoop into a plastic disposal bag.

2. Sweep solid materials into a dustpan and place in a sealed container.

3. Contact the EHS for proper disposal instructions.

For reactive or potentially reactive spills:

1. Cover liquid spills with absorbent and scoop into an appropriate disposal container.

2. Wet mop dry substances to avoid spreading hazardous dust, provided it is non-water reactive.

3. If spilled chemical is a volatile solvent, transfer disposal bag to a hood for containment.

4. Follow the University Hazardous Waste Disposal Procedures for disposal.

Power Outages. If emergency lighting and fire alarms ARE NOT operable, evacuate the building after the following steps have been taken:

- Place lids on all open containers of volatile chemicals
- Lower the sash on chemical fume hoods
- Shut down all equipment (leave cooling water and purge gases on as necessary)
- Turn off ignition sources
- Secure or isolate reactions that are underway (boiling liquid on a hot plate, distillations)
- Take your books, coats, purse/wallet, keys, etc.
- Close fire doors
- In anticipation of possible power outages, do the following:
- Have a flashlight conveniently located or other emergency lighting
- Make sure that all emergency contact numbers on the door are accurate and updated
- Shut down experiments

3.2 INJURY AND ILLNESS

The "Employee's First Report of Injury" form must be completed on all work-related employee injuries. The completed form must accompany the injured worker to Student Health Services. If the injury is not treated by Student Health Services, a copy of the completed form must be faxed or delivered to Human Resources as soon as possible.

The "Supervisor's Report of Injury" and the "Accident Witness Statement" should be completed and faxed immediately to Human Resources whenever possible.

All serious injuries should be reported immediately to EHS.

Failure to follow the above procedure may result in the delay of payment for medical expenses and/or jeopardize the proper leave status for your work injury.

3.3 MEDICAL CONSULTATIONS AND EXAMINATIONS

Health assessments prior to work assignment for new employees may be required under certain circumstances.

The University must provide employees who work with hazardous chemicals an opportunity to receive medical attention, including any follow-up examinations which the examining physician determines to be necessary, under the following circumstances:

- When an employee develops signs or symptoms associated with a hazardous chemical to which the employee may have been exposed in the laboratory, the employee must be provided an opportunity to receive an appropriate examination.

- Where exposure monitoring reveals an exposure level routinely above the action level (or in the absence of an action level, the Permissible Exposure Limit) for an OSHA-regulated substance for which there are exposure monitoring and medical surveillance requirements, medical surveillance shall be established for the affected employee as prescribed by the particular standard.

- Whenever an event takes place in the work area, such as a spill, leak, explosion or other occurrence resulting in the likelihood of a hazardous exposure, the affected employee shall be provided an opportunity for a medical consultation. Such consultations shall be for the purpose of determining the need for a medical examination.

- All medical consultations and examinations must be performed by or under the direct supervision of a licensed physician and must be provided without cost to the employee, without loss of pay and at a reasonable time and place.

The Department or supervisor shall provide the following information to the physician:

- The identity of the hazardous chemical(s) to which the employee may have been exposed.

- A description of the conditions surrounding the exposure, including available quantitative exposure data.

- A description of the signs and symptoms of exposure that the employee is experiencing, if any.

- A copy of the MSDS(s).

The Department shall obtain a written opinion from the examining physician which shall include the following:

- Any recommendation for further medical follow-up.

- The results of the medical examination and any associated tests.

- Any medical condition which may be revealed in the course of the examination which may place the employee at increased risk as a result of exposure to a hazardous chemical found in the workplace.

- A statement that the employee has been informed by the physician of the results of the consultation or medical examination and any medical condition that may require further examination or treatment.

- The written opinion of the physician shall not reveal specific finding of diagnoses unrelated to occupational exposure.

4.0 STANDARD LABORATORY FACILITY REQUIREMENTS

4.1 SIGNS AND INFORMATION

Labels and warning signs need to alert employees to potentially hazardous materials and allow those unfamiliar with the laboratory surroundings to identify hazardous chemical use and storage areas, safety facilities, emergency equipment and exits and assist emergency response personnel. Signs and labels are generally available from EHS.

Material Safety Data Sheets (MSDSs). A MSDS is a document containing chemical hazard identification and safe handling information and is prepared in accordance with the OSHA Hazard Communication Standard. Chemical manufacturers and distributors must provide the purchasers of hazardous chemicals an appropriate MSDS for each hazardous chemical/product purchased.

The Hazard Communication Standard requires that Departments and/or PIs keep MSDSs and that the MSDSs are readily accessible to laboratory employees. The system a laboratory uses to store MSDSs can vary from keeping them in a notebook or file cabinet to using the EHS information system. The system adopted must provide easy access to MSDSs for hazardous chemicals used in the lab.

The office of EHS is a central repository for MSDSs. If you wish to review an MSDS(s) or receive a copy of an MSDS(s), contact your supervisor, instructor or EHS during normal working hours.

Restricted Access and Designated Areas. Facilities containing certain hazards need to have warning signs posted at the designated area of the laboratory where the hazard exists, and at the entrance to the laboratory. Any areas placarded as such are restricted access, designated areas and have certain standards regarding training and use by employees. Such hazards may include:

Known carcinogens
Lasers
Strong magnetic fields
HIV and HBV research laboratories
Biological agents that require Biosafety Level 2 or higher
Radioactive materials or sealed radioactive sources
Other chemical hazards will be dealt with on a case-by-case basis, with consultation from EHS.

4.2 CONTROL MEASURES

The lab supervisor must implement control measures to reduce employee exposure to hazardous chemicals. The three types of control measures are:

- Administrative Controls: methods of controlling employee exposures to contaminants by job rotation, work assignment or time periods away from the contaminant. Examples include Standard Operating Procedures, Chemical Hygiene Plans and Safety Manuals.

- Engineering Controls: methods of controlling employee exposures by modifying the source or reducing the quantity of contaminants released into the work environment. Examples include fume hoods and biosafety cabinets.

- Personal Protective Equipment: personal safety equipment designed for secondary employee protection from hazardous chemicals. Examples include gloves and lab coats.

Note: OSHA law regarding air contaminants states that engineering controls and administrative controls shall first be determined and implemented when feasible. When such controls are not feasible to achieve full compliance, protective equipment or any other protective measures shall be used to keep the exposure of employees to air contaminants within the limits prescribed in the rule.

OSHA requires control measures when the following circumstances are met:

- Whenever employees use hazardous chemicals.
- Whenever employee exposures exceed _ the PEL and/or the TLV.
- Upon addition of new chemicals or changes in procedures.
- Other situations should be dealt with on a case-by-case basis. Consult EHS for assistance in establishing control measures.

The following general control measures are recommended for use in most situations requiring the use of hazardous chemicals:

Use the following primary methods for detecting exposures:

- Determine the source of exposure.
- Determine the path the contaminant follows to reach the employee.
- Determine the employee's work pattern and use of personal protective equipment.
- Change one or more of the above pathways to reduce or eliminate exposure.

- Substitute less harmful chemicals for more harmful chemicals whenever possible.
- Change or alter processes to minimize exposure.
- Isolate or enclose a process or work operation to reduce the number of employees exposed (for example, use a fume hood).
- Use wet methods to reduce the generation of dust.
- Use local exhaust ventilation (hoods) at point of generation or dispersion of contaminants and use dilution (general) ventilation to reduce air contaminants.
- Practice good housekeeping procedures to reduce unnecessary exposures.
- Use training and education as primary administrative controls for reducing exposures.
- Use special control methods such as shielding and continuous monitoring devices to control exposures in special situations.

4.3 PERSONAL PROTECTIVE EQUIPMENT

The University policy on the use and selection of Personal Protective Equipment (PPE) must be followed. However the following is some basic information on PPE commonly found in laboratories. PPE must be provided to employees under the appropriate circumstances. Employees need to be trained on the proper use of any PPE issued to them and employees have the responsibility of properly using such equipment.

The MSDS may be consulted for information on PPE and safety procedures recommended for a given chemical, though the MSDS may not provide sufficient information concerning the specific type of safety equipment required (for example, it may say "use gloves" but not list the best glove to use). EHS should be contacted if more information is needed. The EHS web page also contains additional information on the use and selection of personal protective equipment.

OSHA has adopted the American National Standards Institute (ANSI) consensus standards for eye protection and emergency shower and eyewash facilities.

Eye Protection. Eye protection must be made available to all employees or visitors to laboratories where chemicals are used and stored. Protective eye and face equipment must be used where there is a reasonable probability of injury from hazardous chemicals that can be prevented from such equipment. The minimum acceptable requirements are for hardened glass or plastic safety spectacles. The PI or laboratory supervisor should establish the level of eye protection needed per laboratory activity. Specialized types of eye protection, such as ultraviolet light restricting safety glasses, are available. The following types of eye protection are recommended for use in the laboratory by ANSI:

All eye protective devices must be stamped with "Z87" by the manufacturer if they meet ANSI standards. If the eye protection is not marked, it may not be the most effective protection available.

- Safety glasses with side shields offer minimal protection against flying fragments, chips, particles, sand and dirt. When a splash hazard exists, other protective eye equipment need to be worn.

- Safety goggles (impact goggles) offer adequate protection against flying particles. These need to be worn when working with glassware under reduced or elevated pressure or with drill presses or other similar conditions.

- Chemical splash goggles (acid goggles) have indirect venting for splash proof sides, which provide adequate protection against splashes. Chemical splash goggles offer the best eye protection from chemical splashes. Impact goggles should not be worn when danger of a splash exists.

- Faceshields protect the face and neck from flying particles and splashes. Always wear additional eye protection under faceshields. Ultraviolet light faceshields should be worn when working around UV light sources.

Protection of Skin and Body. Skin and body protection involves the use of protective clothing to protect individuals from chemical exposure. Determine clothing needed for the chemical being used, as protective garments are not equally effective for every hazardous chemical. Some chemicals will permeate a garment in a very short time, whereas others will not. The basic and most effective forms of protection are gloves and lab coats.

Protect exposed skin surfaces when there is a reasonable anticipation of a splash. Open-toed shoes, sandals, shorts, etc. are not permitted when working in University laboratories.

Even when there is minimal danger of skin contact with an extremely hazardous substance, lab coats, coveralls, aprons, or protective suits should be utilized. These garments should not leave the work site.

Exposures to strong acids and acid gases, organic chemicals and strong oxidizing agents, carcinogens, and mutagens require the use of specialized protective equipment that prevents skin contamination. Impervious protective equipment must be utilized. Examples include: appropriate gloves, aprons, boots and protective suits.

Respirators. The use of respirators in laboratories is strongly discouraged. The use of respirators is only allowed where engineering controls are not feasible or where they are being installed. Any individual that uses a respirator as part of his or her work at the University must be enrolled in the respirator program. Prior to using a respirator for the first time or for a new activity, employees must receive a medical exam from a physician, attend an EHS respiratory training session and be fit tested. Please contact the EHS at 6-6485 for a copy of the University Respiratory Protection Program. It can also be found on the EHS web page.

Laundry Contaminated with Potentially Infectious Material. All laundry that is contaminated with potentially infectious material shall be bagged at the location where it was used and shall not be sorted or rinsed in the location where it was originally used. Contaminated laundry shall be placed and transported in bags or containers labeled with the Universal Biohazard symbol. Whenever contaminated laundry is wet and presents a reasonable likelihood of soak-through of or leakage from the bag or container, the laundry shall be placed and transported in bags or containers which prevent soak-through and/or leakage of fluids to the exterior. In addition, when a Department ships contaminated laundry off-site for laundering they must ensure that the laundry is in bags or containers labeled with the Universal Biohazard symbol. The cost of offsite laundering is the responsibility of the employee's Department.

4.4 SAFETY EQUIPMENT

Safety Showers. Safety showers provide an immediate water drench of an affected person. The EHS recommends the following ANSI standards for location, design and maintenance of safety showers:

- Showers shall be located within 25 feet of areas where chemicals with a pH of 2.0 or 12.5 are used.

- Showers shall be located within 100 feet of areas where chemicals with a pH of > 2 and < 4 or 9 and < 12.5 are used.

- The location of the shower should be clearly marked, well lighted and free from obstacles, closed doorways or turns.

- Safety showers are checked and flushed biannually by EHS.

Eye Wash Facilities. Eye wash facilities should be within 25 feet or 10 seconds travel of laboratories where injurious or corrosive chemicals are used or stored.

- Optimally, those affected must have both hands free to hold open the eye to ensure an effective wash behind the lids. This means providing eye

wash facilities that are operated by a quick release system and simultaneously drench both eyes.

- Eye wash facilities must provide the minimum of a 15 minute water supply at no less than 0.4 gallons per minute.

- Eye wash facilities must not exceed 25 pounds per square inch (PSI).

- Eye wash facilities need to be flushed out for five minutes at a time, once per week.

Contact EHS regarding specific designs for eye wash facilities.

4.5 VENTILATION CONTROLS

Ventilation controls are those controls intended to minimize employee exposure to hazardous chemicals by removing air contaminants from the work site. There are two main types of ventilation controls:

- General (Dilution) Exhaust: a room or building-wide system which brings in air from outside and ventilates within. Laboratory air must be continually replaced, preventing the increase of air concentration of toxic substances during the workday. General exhaust systems are not recommended for the use of most hazardous chemicals.

- Local Exhaust: a ventilated, enclosed work space intended to capture, contain and exhaust harmful or dangerous fumes, vapors and particulate matter generated by procedures conducted with hazardous chemicals i.e. fumehood.

To determine ventilation requirements, assess the MSDS. Some MSDS terminology, as listed below, may indicate a need for special ventilation considerations beyond general exhaust ventilation:

- Use with adequate ventilation
- Avoid vapor inhalation
- Use in a fume hood
- Provide local exhaust ventilation

Proper Use of Local Ventilation Systems. Once a local ventilation system is installed in a work area, it must be used properly to be effective. For use of hazardous chemicals warranting local ventilation controls, the following guidelines should be observed:

Conduct all operations which may generate air contaminants at or above the appropriate PEL or TLV inside a fume hood.

Keep all apparatus at least 6 inches back from the face of the hood and keep the slots in the hood baffle free of obstruction by apparatus or containers. Large equipment should be elevated at least two inches off the base of the fume hood, to allow for the passage of air underneath the apparatus.

Do not use the hood as a waste disposal mechanism.

Minimize storage of chemicals or apparatus in the hood.

Keep the hood sash closed at all times except when the hood is in use.

Minimize foot traffic and other forms of potential air disturbances past the face of the hood.

Do not have sources of ignition inside the hood when flammable liquids or gases are present.

Use the sash as a safety shield when boiling liquids or conducting an experiment with reactive chemicals.

Periodically check the airflow in the hood using a continuous monitoring device or another source of visible airflow indicator. If airflow has changed, contact EHS for an inspection or Physical Plant (3-6200) for repair.

Never work with hazardous chemicals if the required ventilation system is not working.

EHS performs hood inspections annually. After an inspection, hoods are passed or failed for use based on the following criteria:

- The face velocity of air being drawn into the hood with sash open is measured quantitatively in feet per minute (fpm). One measurement is taken per square foot of face space and averaged. Hoods must have an average face velocity of 80-120 fpm, depending on their design, with 100 fpm being the ideal average face velocity with the sash full open.

- If the exhaust system does not pass the face velocity test, the lab supervisor will be informed by the inspector. EHS will contact Physical Plant to have repairs initiated.

- If the exhaust system does pass, the inspector will post the date of inspection and will mark the hood to indicate proper sash position for optimum hood performance. The hood sash should be set at this point for procedures which could generate toxic aerosols, gases or vapors. In general, the sash height should be set at a level where the operator is shielded to some degree from any explosions or violent reactions which could occur and where optimum airflow dynamics are achieved. If a fume hood has no markings regarding sash height or inspection dates, please contact EHS to arrange for an inspection 6-6485.

Certain types of local exhaust systems are not designed for the use of hazardous chemicals. If a local exhaust system's capabilities are not fully understood, check the manufacturers specifications or call EHS before using hazardous chemicals in the system.

5.0 STANDARD REPAIR / CLOSE-OUT / DECOMMISSIONING PROCEDURES

5.1 DECONTAMINATION OF EQUIPMENT

Prior to repairing or moving equipment any chemical, biological or radioactive contaminants must be properly decontaminated. Follow decontamination procedures outlined in the following section.

5.2 INSTRUCTIONS FOR PREPARING A LABORATORY FOR RENOVATION WORK

In order to protect construction workers and University personnel from hazards associated with laboratory work, the following procedures must be followed when work is to be performed in an area which has contained hazardous chemicals, biological hazards and/or radioactive materials.

- Chemical Hazard: any surface which a hazardous chemical has come in contact with must be wiped down with a solution of warm soap and water. This applies only to areas that construction workers would be exposed to in the normal course of their work. For example, fumehoods (inside and out), laboratory bench tops, floors, refrigerators and sinks must be cleaned. Chemical containers must be moved and stored away from where renovation work is to be performed in the laboratory.

- Biological Hazard: Any surface which a biological hazard has come in contact with must be decontaminated. A solution of 1:10 household bleach (i.e., 5.25% sodium hypochlorite) can be used to inactivate most infectious agents. The lab supervisor is responsible for verifying that this has been performed and that sodium hypochlorite was the appropriate material to use to inactivate the agent. This applies only to areas that construction workers would be exposed to in the normal course of their work. For example, laboratory bench tops, floors, biological safety cabinets and clean benches, centrifuges, and refrigerators/freezers must be decontaminated. Biological safety cabinets must be decontaminated prior to being moved or serviced. The cabinet then must be re-certified when it is installed in its new location. Please contact EHS to determine how the cabinet needs to be decontaminated well in advance of the planned move.

- Radiological Hazards: Contact the Radiation Safety Officer, Dr. Elichia Venso, 3-6499, for information and instructions.

All clean-up procedures must be performed using appropriate personal protective equipment (PPE).

5.3 USE OF FORMALDEHYDE IN LABORATORY OPERATIONS

Any laboratory using formaldehyde in quantities that may exceed the Occupational Safety and Health Administration's (OSHA) Short Term Exposure Limit (STEL) of 2.0 ppm or Action Level of 0.5 ppm has the potential of being covered under OSHA's Formaldehyde Standard. The Formaldehyde Standard has the following requirements:

- Development of a sampling strategy for determining employee exposure to formaldehyde;
- Periodic personal monitoring;
- Providing and ensuring the use of appropriate personal protective equipment;
- Medical surveillance;
- Development of a written hazard communication program for formaldehyde; and
- Providing information and training to employees on the hazards of working with formaldehyde.

If a laboratory is using formaldehyde and would like an exposure assessment to determine if they are covered under OSHA's Formaldehyde Standard they should contact the EHS at x6-6485.