Laboratory Safety Manual

The UAH Office of Environmental Health and Safety
The UAH Laboratory Safety Committee
Revised 2013

Review Dates for Laboratory Safety Manual

The UAH Laboratory Safety Committee (LSC) and the Office of Environmental Health and Safety (OEHS) is responsible for review and evaluation of this manual at least once every three years from the date of the original manual. The review dates are documented below.

Review Date	Comments	OEHS	Lab Safety Committee
2003	Original Plan	MLP	
2013	Revision 1	MLP	

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DISCLAIMER

This Laboratory Safety Manual was prepared for use by the faculty and staff at the University of Alabama in Huntsville (UAH). It is provided as a means of presenting the regulations and standards pertaining to safely performing laboratory work, and as guidelines to illustrate standard, accepted practices for conducting laboratory investigations safely. Neither the author nor the University of Alabama in Huntsville warrants its completeness or correctness. Any discrepancies noted should be brought to the attention of the UAH Office of Environmental Health and Safety.

LABORATORY SAFETY POLICY STATEMENT

The University of Alabama in Huntsville (UAH) is committed to insuring safe practices are utilized in laboratories and that safe facilities are offered to the UAH Community. Maintaining compliance with federal, state, and local laws and regulations pertaining to laboratory safety and hazardous materials management is essential to this commitment. The UAH Office of Environmental Health & Safety has overall responsibility for providing information and training concerning environmental health and safety to faculty and staff. Implementing safety and assuring students are informed and have a safe laboratory to conduct activities is the responsibility of individual colleges, departments, and or centers. Colleges, departments, centers, or other units may develop internal policies and procedures for laboratory safety but they must be at least as stringent as University guidelines and are subject to review by the Office of Environmental Health and Safety (OEHS).

The director of the OEHS is responsible for (1) developing and maintaining University policies and guidelines related to conducting research and teaching activities safely, and (2) designing and conducting training programs for University personnel regarding regulatory requirements for safely conducting activities in UAH laboratories. Schools, departments, or other units are responsible for maintaining accurate records related to departmental student training and incident/accident investigation.

The Director of Environmental Health and Safety or his/her appointee has supervisory responsibility for monitoring compliance with federal, state, and local regulations, and is responsible for identification of units within the University that may not be complying fully with regulations. The Director or his/her appointee is responsible for providing notification of non-compliance to the units involved and for providing consultation. When units fail to make necessary changes to comply with regulations, the Director is responsible for reporting such non-compliance to the Dean who has administrative responsibility over the unit involved.

PREFACE

The UAH Laboratory Safety Manual serves as a tool to provide information to the University Community on minimal safety procedures required in campus laboratories. The goal of this manual when paired with appropriate training is to obtain zero injuries, illnesses, and or destruction of University property while ensuring faculty and staff awareness of appropriate laboratory safety practices.

This manual also serves to promote the environmental health of the surrounding community. It is imperative that each member of UAH faculty and staff and UAH students involved in working in laboratories be knowledgeable in the proper procedures associated with the safe handling, storage, and disposal of laboratory chemicals and paraphernalia. Use of the guidelines herein is critical to accomplishing the UAH environmental goal.

As we work to provide accurate laboratory safety information in this manual, please remit any comments and recommendations to the OEHS at JRC 151. Our goal is to provide service of the highest quality.

EXECUTIVE SUMMARY

The Laboratory Safety Manual was compiled to ensure the University goals in environmental health and safety as they apply to laboratory activities are accomplished. Basic concepts in laboratory safety practices are covered. This Manual does not include in depth information on biological safety, radiological safety, laser safety, or general industry safety. Information on these safety topics is available from the Office of Environmental Health and Safety. In compiling this information guidelines and recommended practices were drawn from regulatory agencies such as; the National Fire Protection Agency, the Environmental Protection Agency, the National Institutes of Health, and the Occupational Safety and Health Administration. Knowledge and practice of the guidelines set forth in this manual will significantly reduce the risk of injury and facility loss and benefit the faculty, staff, and students of The University of Alabama in Huntsville.

The Laboratory Safety Manual outlines the basic safety requirements and responsibilities of faculty and staff utilizing and responsible for laboratories and laboratory facilities. The manual begins with guidelines for emergency response procedures for chemical spills followed by injury procedures. The injury procedures include the requirement to complete a standardized form during injury consultations. The form is designed to provide necessary information to the person who has been injured in a UAH laboratory and for documentation purposes. Fire and emergency evacuation procedures are also provided. Measures for best chemical hygiene practices are outlined. These measures include both requirements and information concerning chemical identification and inventorying, labeling, storage according to chemical compatibility's, general housekeeping and chemical waste disposal. The general housekeeping section includes laboratory close out procedures. Significant strides have been made at UAH in minimizing the safety and environmental hazards associated with unknown laboratory products. By adhering to the laboratory close out procedures unknown chemical products will be virtually eliminated and incoming faculty and staff will be greeted with a research-ready laboratory. The UAH Hazardous Waste Management Plan (HWMP), which was previously a stand-alone document, has been incorporated into the Laboratory Safety Manual as an appendix. The goal of the HWMP is to protect the health and safety of employees, students, and the environment while complying with the Resource Conservation and Recovery Act. The HWMP provides guidelines for the management of hazardous waste from it's point of generation to it's final disposition/destruction. Violations of RCRA regulations can result in fines as much as $32,500 per day per violation. Criminal charges may be brought against individuals who knowingly violate state, federal, or local regulations. Therefore, failure to comply with the guidelines for handling hazardous waste can have serious ramifications to individuals as well as the University. Additionally, the Laboratory Safety Manual incorporates OEHS hazard notifications through project registration and optional self-audit procedures. Notification to the OEHS is required for emergency planning, regulatory reporting, and to limit employee and University liabilities. The Laboratory Safety Manual provides information on the fixed safety and industrial hygiene equipment as well as how to get repairs for these items.

I. Introduction

The UAH Laboratory Safety Manual is for use as a general guide in safety for chemical laboratories on the UAH campus. In depth information can be obtained from the OEHS or a number of publications. Prudent Practices for Handling Hazardous Chemicals in Laboratories is a publication highly recommended for all laboratories utilizing hazardous chemicals.

II. Emergencies

Call the Office of Public Safety (OPS) for immediate assistance when chemical exposure and or injury has occurred. The OPS will immediately contact the appropriate parties. The Office of Public Safety can be reached by dialing **6911** on any campus phone. Emergency laboratory situations in which Public Safety should be notified include but are not limited to; hazardous chemical, radioisotope, and biological agent spills. Injuries and exposures should be attended to immediately and the OPS contacted as soon as possible to request an ambulance or other assistance. In all cases the OPS will immediately call the appropriate individuals for response. A laboratory sign indicating emergency phone numbers must be posted in all laboratories and is available in Appendix A.

All injury and chemical exposure cases must be reported to the OPS within 48 hours of the occurrence. This is accomplished by either a supervisory person or the injured/exposed person completing and submitting an accident/injury report at the UAH Police Station in the Physical Plant Building.

A. Hazardous Chemical/Substance Spills must be cleaned as soon as possible. If the spill exceeds five liters or is an acutely hazardous substance, as defined in Appendix B of this manual, the OPS must be contacted immediately at 6911.

General procedural guidelines to follow during a chemical spill are listed in section II C. Individual departments may develop more detailed internal procedures. Internal procedures must be at least as stringent as the UAH Laboratory Safety Manual guidelines and are subject to review by the OEHS.

1. Spill Kit Materials

Laboratories should be prepared for chemical spills by having a spill kit or materials available and supervisory personnel trained to respond. The spill kit must be in an obvious location and all persons responsible for the activities conducted in the laboratory must be knowledgeable in the use of the spill kit. Spill kits can be specialized for individual laboratories or can contain general supplies necessary to handle a variety of spills. Spill kits are commercially available or you may request a listing from the OEHS on what items must be included in a spill kit. Departments, centers or units are responsible for purchasing and refurbishing spill kit items. Recommended items for a universal chemical spill kit are:

SPILL ABSORBENTS & EQUIPMENT
1- Container of SPILL-X-A ACID NEUTRALIZER & ABSORBENT
1- Container of SPILL-X-B BASE NEUTRALIZER & ABSORBENT
1- Container of SPILL-X-S SOLVENT ABSORBENT
1- Small broom
1- Plastic dustpan
PERSONAL PROTECTIVE EQUIPMENT
Safety goggles
Chemical resistant apron or lab coat
Nitrile gloves
SPILL CONSUMABLES:
pH paper
Chemical waste disposal bags
Chemical waste labels
5 gallon pail

2. General Chemical Spill Guidelines

Determine the extent and type of spill. Contact the Office of Public Safety at 6911 if any of the following apply:

- large spill category
- release to the environment
- acutely hazardous chemical (as listed in the HWMP) spill
- no one trained in the proper procedures for cleaning chemical spills

Spill Category Table

Category	Quantity	Response	Treatment Materials
Small	Spilled material< 300 milliliters	Chemical Treatment	Neutralization or absorption spill kit
Medium	300 ml <spilled material< 5 Liters	Absorption	Absorption Spill Kit
Large	Spilled material >5 Liters	Call OPS at 6911	

1. Immediately alert area occupants and supervisor, and evacuate the area, if necessary.
2. Contact the Office of Public Safety (OPS) at 6911 in the event of a fire or when medical attention is required.
3. Attend to any people who may be contaminated. The *First Aid Manual for Chemical Accidents* is available in each laboratory building. Refer to the posted signs for location information. Contaminated clothing must be removed immediately and the skin flushed with water for at least fifteen minutes. Clothing must be laundered separate from other clothing before reuse.
4. Immediately warn everyone when a volatile flammable material is spilled. Control sources of ignition. Ventilate the area by turning on the fume hoods with the sashes completely open and open all windows.
5. Use the appropriate personal protective equipment for the hazard involved. Refer to the Material Safety Data Sheet or other available references for information.
6. The use of respiratory protection requires specialized training and medical surveillance. DO NOT enter a contaminated atmosphere without protection or use a respirator without training. Call the OPS or OEHS when respiratory protection is required and there are no trained personnel available. When respiratory protection is used for emergency purposes there must be another trained person outside the spill area. This person must have communication abilities with the person in the spill area. Contact Public Safety when no one is available for back-up.
7. Cover or block floor drains or any other route that could lead to an environmental release.
8. Use the appropriate media when cleaning spills. Begin by circling the outer edge of the spill with absorbent. Next, distribute spill control materials over the surface of the spill. This will effectively stop the liquid from spreading and minimize volatilization.
9. Place absorbed materials in an appropriate container using a brush and scoop. Small spills can be placed in polyethylene bags. Larger quantity spills may require five-gallon pails or 20-gallon drums with polyethylene liners.
10. Absorbent materials used on the chemical spill will most likely require disposal as hazardous waste. Place a completed hazardous waste label on the container. Contact the OEHS at 2352 for information concerning preparing waste for disposal and for a waste pick-up.
11. Clean the surface where the spill occurred using a mild detergent and water.
12. Immediately report all spills to your supervisor.

3. Solvent Spills

1. Apply activated charcoal to the perimeter of the spill.
2. Mix until the spill has been completely absorbed.
3. Transfer the absorbed solvent to a hazardous waste bag, tie and attach an appropriate label.
4. Contact the OEHS for pick-up.
5. Clean the area with soapy water.

4. Corrosive Spills (Acids and Bases)

Hydrofluoric acid requires special treatment. Products are commercially available for absorbing hydrofluoric acid. Purchase of hydrofluoric acid spill and personnel exposure material (see first aid kits) is mandatory for laboratories using hydrofluoric acid. Bases can be equally as harmful as

acids. Never add a strong acid to a strong base. Use the appropriate neutralizer supplied in the spill kit and follow these steps:

1. Apply neutralizer to the perimeter of the spill.
2. Mix thoroughly until evolution of gas has stopped.
3. Check the mixtures pH with pH paper.
4. Transfer the waste to a bag, fill out the appropriate waste label and call the OEHS for a pick-up.
5. Clean the spill area with soapy water.

5. Mercury Spills

Mercury is classified as a persistent bioaccumulative toxin (PBT). Additionally some forms of organic mercury readily absorb through gloves and skin. Laboratories utilizing mercury must be prepared with an appropriate cleanup kit. Kits are available through laboratory and safety supply companies.

When **more than ten milliliters** of mercury has been spilled:

1. Alert others in the area.
2. Mark off the area.
3. Contact the OEHS immediately.

Procedure for use with commercially available mercury clean-up sponge:

1. Dampen the sponge with water and wipe the contaminated area.
2. Perform the procedure slowly to insure complete absorption of mercury onto the sponge.
3. Place the sponge in its plastic bag, tie shut and fill out an appropriate waste label. Call the OEHS for disposal.

6. Radioactive Material Spills

Spills of quantities of radiological materials present at UAH cause little or no immediate external hazard. Of bigger concern, is the spread of contamination and the internal contamination of personnel. Radioactive material spills must therefore be handled in a manner that prevents this. Prevent the spread of contamination by limiting the movement of persons present in the area of the spill until they have been found free of contamination. A minor radiation spill is one that can be handled safely without the assistance of the radiation safety staff. Most spills at UAH will be small spills due to the small quantities of radioisotopes that are utilized in campus laboratories.

Small/Minor Radioactive Material Spill

A small radiation spill is one that can be handled safely without the assistance of the radiation safety staff.

1. Alert persons in the immediate area.
2. Distinguish the spill area with radioactive label tape. Indicate the isotope spilled.
3. Notify the laboratory manager or principle investigator.
4. Wear personal protective equipment to include, safety goggles, disposable gloves, shoe covers and long sleeve lab coat. If the substance is a beta emitter a plastic lab apron may be used to provide additional body shielding.
5. Place absorbent towels over liquid spills and dampened towels over spills of solid materials.
6. Clean the spills beginning from the outside edge and moving towards the center.
7. Place the towels in a plastic bag and put in a radiation waste container.
8. Verify the area and responder hands and shoes are free from contamination by using a survey meter or by performing wipe tests. Repeat the cleaning process until there is no contamination remaining.
9. Submit a written account to the Radiation Control Officer within 24 hours of the occurrence.

Large/Major Radioactive Material Spill

1. Attend to contaminated and injured persons and protect them from continued exposure.

2. Alert persons in the area to evacuate.
3. Keep contaminated and potentially contaminated persons in one area, (safe distance away from contamination source) until they can be monitored for exposure.
4. Call the Office of Public Safety at 6911 immediately. (They will contact the radiation safety officer.)
5. Ventilation, drafts and air currents should be controlled to prevent the spread of contamination.
6. Close the doors and prevent entrance to the contaminated area.
7. Submit a written report of the spill incident to the Radiation Control Officer within 24 hours of the occurrence.

7. Spill of Biohazardous Radioactive Material

Procedures for spill cleanup of a radioactive biological material requires emergency procedures which protect the person from exposure to the radiochemical while disinfecting the biological material.

1. Avoid inhaling airborne material, notify other room occupants, and quickly leave the area.
2. Remove all contaminated clothing by turning exposed areas inward. Place in a biohazard bag.
3. Wash all exposed skin areas with a disinfectant soap. Rinse for a minimum of 5 minutes.
4. Inform the laboratory supervisor and contact the OPS at 6911.
5. Post a spill sign and do not reenter the lab for at least 30 minutes.
6. Contact the radiation safety officer to confirm safe entry into the laboratory.
7. Utilize appropriate protective clothing and reenter the spill area. The use of respirators requires special training. Call the OEHS if a respirator trained individual is required but not available for spill cleanup.
8. Cover the area with disinfectant soaked towels. Pour the disinfectant around the perimeter of the spill area. As the spill becomes diluted with disinfectant, increase the concentration of the disinfectant. Allow 20 minutes for disinfection. **Please note that the use of bleach on iodinated material may cause the release of radioiodine gas. An alternative such as, phenolic compounds or an iodophor should be used when radioactive iodine has been spilled.**
9. Collect any broken glass with forceps and place in an appropriate broken glass collection container. To clean splashed material, spray with disinfectant solution and wipe clean or saturate a paper towel with disinfectant solution and wipe clean.
10. Personal protective equipment (PPE) must be disinfected with bleach solution and disposed of as radioactive waste. Place the used PPE on absorbent paper. Spray the PPE with 10% bleach solution and allow a 20 minutes contact time.
11. Place all decontaminated waste materials in an approved container for radiation and label appropriately. Do not autoclave the waste unless the radiation safety officer approves the procedure.
12. Wash hands and potentially exposed areas with a disinfectant.
13. Monitor laboratory occupants for contamination of radioactive materials.
14. Decontaminate under the advisement of the Radiation Safety Officer.
15. All contaminated persons must seek medical assistance after decontamination procedures have been completed.
16. Monitor the area for residual activity and handle it according to the Radiation Safety Manual guidelines.

8. Biological Spills or Exposures

A minor spill of a biological agent is defined as one that has occurred and is contained within the biological safety cabinet and which provides personnel protection. It is assumed that no one is contaminated by the spill. Most research conducted at UAH is classified as Biological Safety Level 1(BL 1). If a spill contains BL 2 agents or greater, or the spill is too dangerous or large to be safely cleaned up by laboratory personnel, the OPS must be contacted immediately. Biological

research has many safety and regulatory guidelines that must be met. Any person partaking in biological research at UAH should be familiar with the UAH Biological Safety Manual. Contact your department chairperson or the OEHS for a copy of this manual.

Biological Spill Kit

Laboratories utilizing biological materials must be prepared with a biological spill kit. Typical kits are packed in a 5-gallon plastic bucket. The bucket should be clearly labeled to indicate that it is a biological spill kit. Biological spill kits can be assembled to fit specific laboratory needs although basic kits must contain the following items:

- Concentrated household bleach
- A spray bottle for bleach solutions
- Face protection
- Utility gloves and nitrile gloves
- Paper towels or other sorbent
- Biohazard bags
- Forceps for handling sharps
- Biohazard symbol labels (for use on the bucket when the cleanup is complete)

9. Biological Spill Procedures

Blood Spills

Blood spills with low concentrations of infectious miscroorganisms must be handled in the following manner:

1. Wear at least the minimal required laboratory personal protective equipment.
2. Absorb blood with paper towels and place in a biohazard bag.
3. Collect any broken glass with forceps and place in an appropriate broken glass collection container.
4. Clean the area with a detergent.
5. Spray the area with a 10% bleach solution and allow to air dry for 15 minutes.
6. Wipe the area with disinfectant soaked paper towels.
7. Place all contaminated items in a biohazard bag, autoclave, and dispose of according to UAH guidelines.

Ethidium Bromide Spill Clean-up and Disposal:

Ethidium bromide is a potent tumorigen. When handling ethidium bromide it is imperative that no skin contact occurs and thorough hand-washing is performed after handling. In case of a small spill:

1. Absorb freestanding liquid with a compatible absorbent material.
2. Use ultraviolet light to locate the location of the spill material.
3. Prepare decontamination solution by mixing 4.2 grams of sodium nitrite and 20 mL of hypophosphorous acid (50%) in 300 mL of water.
4. Wash the spill area with a paper towel soaked in the decontamination solution. Wash the spill area five more times with paper towels that have been soaked in the decontamination solution (using fresh paper towels each time).
5. After cleaning the area put all the used towels in the decontamination solution for 1 hour.
6. Check the completeness of decontamination using an ultraviolet light.
7. When the decontamination procedure is complete, transfer all the decontamination solution to an appropriately labeled waste container. Call the OEHS for waste pick-up.

To clean **contaminated equipment**: Laboratory equipment (e.g. transilluminators, laboratory floors and countertops, etc.) contaminated with aqueous solutions of more than 10 mg/L (0.01 %) EtBr should be decontaminated using the spill clean-up procedures listed above.

10. Spill Procedures by Biological Safety Level

Biosafety Level 1 (BL1) Spill

Biosafety Level 1 is the classification that applies to agents that are not known to cause disease in healthy adults.

1. Notify other laboratory occupants.
2. Remove contaminated clothing. If necessary use the safety shower or emergency eyewash. Wash affected area with a disinfectant.
3. Wear at least the required laboratory personal protective equipment.
4. Cover the spill with paper towels. Pour disinfectant around the outside of the spill area and then add disinfectant over the spill area until the spill area has been completely covered. Allow the disinfectant at least 15 minutes to work. To clean splashed material spray with disinfectant solution and wipe clean or saturate a paper towel with disinfectant solution and wipe clean.
5. Pick up any pieces of broken glass with forceps and discard in a broken glass container.
6. All clean up materials must be placed in a biohazard bag, autoclaved and appropriately disposed.
7. Wash hands thoroughly with soap and a handwashing disinfectant.

Biosafety Level 2 (BL2) Spill

Biosafety Level 2 is the classification that applies to agents that are associated with human disease, which is rarely serious, and for which preventative or therapeutic intervention are often available.

1. Immediately notify all other persons in the laboratory, hold your breath, and evacuate.
2. Remove all personal protective equipment and turn inwards to decrease the spread of contamination.
3. Wash hands and any other potentially exposed area with soap and water for a minimum of 15 minutes.
4. Post a spill sign and do not reenter the lab for at least 30 minutes.
5. Notify the laboratory supervisor and contact the OPS.
6. Immediately seek medical assistance if exposure has occurred.
8. After allowing the aerosols to settle for 30 minutes, put on protective clothing. Only trained individuals may utilize respirators. Contact the OEHS if cleanup requires the use of a respirator.
9. Cover the spill with paper towels. Pour disinfectant around the outside of the spill area and then add disinfectant over the spill area until the spill area has been completely covered. Allow the disinfectant at least 20 minutes to work. To clean splashed material spray with disinfectant solution and wipe clean or saturate a paper towel with disinfectant solution and wipe clean.
10. Pick up any pieces of broken glass with forceps and discard in a broken glass container.
11. Spray the area with a 10% bleach solution and allow to air dry. Alternatively, spray the area with the bleach solution, allow 10 minutes for disinfection, and then wipe the area down.
12. All clean up materials and contaminated protective clothing must be placed in a biohazard bag, autoclaved and appropriately disposed.
13. Wash hands and potentially contaminated skin areas with a handwashing disinfectant or antiseptic soap and water.

Biosafety Level 3 (BL3) Spill

A Biosafety Level 3 is the category assigned to all agents with the potential for aerosol transmission and for which the disease may have serious or lethal consequences. If work with this type of agent is being conducted it is imperative to have safety controls in place prior to the onset of the work. The controls required (as recommended by the National Institutes for Health) are defined in the UAH Biological Safety Manual. The following actions are designed for spills that

have occurred outside of the biological safety cabinet that may have resulted in the aerosolization of the agent.

1. Notify others to evacuate immediately. Hold breath and leave the room.
2. Remove PPE in the access room or airlock. Turn the PPE inward and make sure to take your gloves off last.
3. Wash any potentially exposed areas with an antiseptic soap and warm water.
4. Place a biohazard spill sign on the entry door.
5. Notify the laboratory supervisor and contact the OPS.
6. Immediately seek medical assistance if exposure has occurred.
7. Do not reenter the laboratory unless it has been approved by the supervisor or the OEHS.
8. Utilizing the appropriate PPE, cover the spill area with paper towels soaked with disinfectant.
9. Beginning at the outer most edge of the spill area and working toward the center, pour concentrated disinfectant on the spill area.
10. Allow 15-20 minutes contact time.
11. Decontaminate and splashes or areas that aerosols may have settled by wiping down with a towel soaked with a 10% bleach solution.
12. Place all soiled towels in a biohazard bag.
13. Repeat the procedure. Complete by wiping all areas of contamination down with water.
14. Decontaminate any reusable item by wiping down with a disinfectant soaked towel followed by a 20-minute soak in a 10% bleach solution.
15. Remove coveralls, turn all potential exposed areas inward. Place in the biohazard bag.
16. Remove gloves.
17. Remove respiratory protection and protective facewear. Wipe down the exterior portions of reusable PPE with a disinfectant bleach solution twice.
18. Wash your hands with antiseptic soap for at least 30 seconds.
19. Autoclave all waste from the spill clean up. Use fresh gloves while transporting the materials to the autoclave, and wash hands thoroughly after removing the gloves.

B. Fires

All students must be informed at the beginning of each semester of building evacuation routes. It is the laboratory supervisor's responsibility to provide this information. In the event of a fire, immediate evacuation is essential. On the way out of the building remember these safety precautions:

- Never enter a room containing a fire.
- Never enter a room that is smoke filled.
- Never enter a room in which the top half of the door is hot to the touch.

Small Fires

1. Pull the fire alarm and call the OPS at 6911.
2. Alert people in the area to evacuate. Assist those individuals with disabilities.
3. Turn off gas main.
4. If you have been trained to use a fire extinguisher, do so while maintaining a clear exit path behind you.
5. Operate the extinguisher using the P-A-S-S method:
   - **P – Pull the pin** located on the extinguishers handle.
   - **A – Aim** the nozzle at the base of the fire.
   - **S – Squeeze** or press the handles together.
   - **S – Sweep** from side to side at the base of the fire until it is out.

Large Fires

1. Pull the fire alarm, when in a safe area, call the OPS at 6911.
2. Alert people in the area to evacuate. Assist those individuals with disabilities.
3. Turn off gas mains, only if time permits.
4. Close the doors to confine the fire.
5. Move to a designated assembly area away from and upwind from the building.
6. Persons having knowledge about the incident and location must provide this information to emergency response personnel.

C. Weather Alerts

1. When a severe weather siren is identified, immediately request all persons in the laboratory to turn off any gases, hotplates, and pressure reactive experiments.
2. Immediately leave the area in an orderly manner. Use the innermost stairway and take cover in the lowest most internal compartment of the building.

D. Responding to Injuries and Inhalation Exposures

The first line of defense for any person working or performing research in a laboratory is knowledge. Always be aware of what you and others in the surrounding area are working with and the associated hazards. This information is available on the product material safety data sheet (MSDS). MSDS must be available for review by faculty, staff, researchers and students prior to utilizing any new chemical product or procedure involving the chemical product. The publication *First Aid Manual for Chemical Accidents* is available at various locations in laboratory buildings. These locations are posted on Emergency Procedure signs in each laboratory.

Emergency responders also must have chemical information readily available. A safe laboratory will have a posted inventory at each main laboratory entrance. To insure emergency response preparedness the laboratory supervisor must submit the chemical inventory to the OEHS at JRC 150 on an annual basis.

Following an injury the person in charge of the laboratory at the time of occurrence must complete an injury consultation form (see appendix A). The injury consultation form serves as a guideline for appropriate information communication to the injured person and as a notification to the Laboratory Safety Committee Chairperson. The information will be used to better prepare the University faculty and staff in the prevention and response of accidents and injuries. Injury consultation forms are available from the Chemistry Laboratory Manager, the Laboratory Safety Chairperson, Department Chairpersons, and the OEHS.

1. First Aid Kits

First aid kits are available in all undergraduate chemistry laboratories and the chemistry stockroom in Wilson Hall. It is highly advised for each department to provide and maintain first aid kits in a centralized location. Typical first aid kits will contain a variety of prepackaged items. Upon each use immediately replenish the first aid kit items.

2. Inhalation of a Biological Material

When a biological material has been spilled take care to minimize aerosolization of the material. Take the following steps if the spill has resulted in aerosolization:

1. Immediately notify all other persons in the laboratory, hold your breath, and evacuate.
2. Remove all personal protective equipment by turning it inwards to decrease the spread of contamination.
3. Wash hands and any other potentially exposed area with soap and water for a minimum of 15 minutes.
4. Post a spill sign and do not reenter the lab for at least 30 minutes.
5. Notify the laboratory supervisor and the OPS at 6911.
6. Immediately seek medical assistance.

3. Needlesticks and Puncture Wounds

1. Wash well with disinfectant or antiseptic soap (preferably a type with iodine)and water for 15 minutes.
2. Squeeze around affected area to encourage bleeding.

3. Notify the laboratory supervisor.
4. Seek medical assistance immediately.

Needlestick Wounds With the Potential for BL3 Exposure

1. Wash the affected area with disinfectant, antiseptic soap and warm water for 15 minutes.
2. Squeeze around the area to encourage flow of blood out of the wound.
3. Notify the laboratory supervisor.
4. Immediately seek medical attention.

4. Chemical Injury or Exposure Response

When an injury has occurred general response guidelines are as follows:

1. Protect yourself from exposure and stabilize the injured person. When possible wash your hands prior to and after giving first aid. Use gloves whenever possible. The *First Aid Manual for Chemical Accidents* is available in the Chemistry Stockroom, WH 317.
2. Call 6911 when emergency medical attention is required or when not sure how to respond.
3. Utilize the safety shower available in the laboratory when appropriate. Clothing must be removed to prevent prolonged chemical contact with the skin. Rinse the exposed area for at least 15 minutes.
4. Use the emergency eyewash stations to rinse harmful chemicals from the eyes when appropriate. Eyes must be rinsed for a minimum of 15 minutes.
5. Offer the injured person medical attention. Contact 6911 immediately if he or she desires medical attention by an emergency room physician. Contact a family member to transport the injured person during non-emergency situations.
6. Contact Public Safety at 6594 to report all injuries and complete an accident report. An accident report must be completed within 24 hours of the incident.
7. Report all accidents involving injuries to the Office of Environmental Health & Safety at 2171 within 24 hours of the incident. The OEHS will contact the Laboratory Safety Committee chairperson. The laboratory chairperson will contact the departmental chairperson and follow-up on the status of the persons injury.

5. Wounds

Small Cuts and Scratches

1. Clean the area with soap and water.
2. Apply a clean dressing over the wounded area.

Significant Bleeding

1. Immediately call the OPS at 6911.
2. Reassure the injured person.
3. Lay the injured person down.
4. **Do not** remove any objects that may have impaled the person.
5. Place direct pressure on the wound with a clean cloth or sterile bandage. Do not apply a torniquet.
6. If the pressure does not slow the bleeding, elevate the wound above the heart.
7. If the bleeding is severe, elevate the persons legs approximately 12 inches.

Thermal Burns

First degree burns are characterized by pain, redness and swelling.

1. Run cool water over the burn or soak it for a minimum of 10 to 15 minutes.
2. Cover the burn with a sterile bandage or clean cloth.
3. Do not apply any ointments, salves, or sprays.

Second and third degree burns are characterized by red mottled skin and blisters. White or charred skin is indicative of a third degree burn.

1. Call the OPS at 6911.
2. Do not remove any burnt clothing.
3. Cover the burns with dry sterile, or clean bandages.
4. Do not apply ointments, salves, or sprays.

Chemical Burns

When necessary, use the eyewash or safety shower as instructed in the procedures below. Insure your own safety by wearing the appropriate personal protective equipment.

Chemical Burns to the Skin

1. Remove the victim's clothes, including his/her shoes.
2. Rinse the area for a minimum of 15 minutes.
3. Do not apply burn ointments to injured areas.
4. Call the OPS at 6911, when the burn is large.

Chemical Burns to the Eyes

1. Forcibly open the eyelids to insure all of the chemical is removed.
2. Wash from the nose to the ear to insure the chemical does not wash back into the eye.
3. The wash must continue for a minimum of 15 minutes.
4. Cover the injured person's eye's with a clean or sterile gauze.
5. Call the OPS at 6911.

Responding to Hydrofluoric Acid Burns

UAH requires persons having responsibility for laboratories that use or store hydrofluoric acid (HF) to maintain a commercially prepared gel of calcium gluconate in the laboratory area. The gel is used for immediate treatment of skin exposures to HF. HF causes serious damage to tissues and bones. The faster the treatment the smaller the chance of serious injury. In the event of a burn caused from HF, the following steps must be immediately taken:

1. The skin must be copiously washed, beginning immediately after exposure.
2. Apply a bulky dressing soaked in a commercially prepared quaternary ammonia compound, calcium gluconate or magnesium oxide topical ointment. Always follow the manufacturers directions supplied with the HF burn ointment/solution if they differ from these.
3. Seek immediate medical attention.

6. Ingestion of Chemicals

1. Immediately call the OPS at 6911.
2. Use the *First Aid Manual for Chemical Accidents* or refer to the MSDS to effectively treat the injured person.
3. If the injured person, is unconscious, turn his/her head or entire body onto the left side. Be cautious about performing CPR. This could potentially poison you from the mouth-to-mouth contact. If available, use a mouth-to-mouth resuscitator.

7. Inhalation of Chemicals

1. Evacuate the area and move the victim to fresh air.
2. Immediately call the OPS at 6911.
3. When the victim is not breathing, perform CPR. Be cautious as the mouth-to-mouth contact can result in the responder becoming poisoned. Where available use a mouth-to-mouth resuscitator.
4. When the victim is breathing, loosen his/her clothing and maintain the airway.
5. Place one hand under the injured person's neck and gently lift.

6. Rotate the injured person's head back to obtain maximum extension of the neck by pressing down on his/her forehead with your free hand.
7. If additional airway extension is necessary, pull the injured person's lower jaw into a jutting-out position.
8. Treat the person for chemical burns of the eyes and skin.

E. Reporting Injuries

Any person who responds to a laboratory injury is required to complete an injury consultation form. This form serves as a record, provides standardized procedures for the responder, and provides the Laboratory Safety Committee information that will assist in the detection and prevention of injuries in UAH laboratories. A copy of the injury consultation form must be submitted to the OEHS, one retained for the departmental files, and one submitted to the Department Chairperson. Upon receipt of the form the OEHS will make copies and send them to the Chairperson of the Laboratory Safety Committee and members of the Environmental Health and Safety Committee. Please note that the injury consultation form does not take the place of the accident report required to be submitted at the Office of Public Safety (due within 48 hours of the incident). The accident report is filed with the University Legal Counsel and remitted to the OEHS for review and accident investigation.

III. University Environmental Health & Safety Committees

A. University Environmental Health and Safety Committee

The President of the University appoints the Environmental Health and Safety Committee membership. This committee meets biannually and ensures campus-wide compliance with the applicable federal and state environmental health and safety requirements. This committee addresses environmental health and safety issues and concerns affecting UAH faculty, staff, and students. The Committee provides recommendations to address deficiencies and reports the results to the President. The Committee implements and/or monitors recommendations as directed by the President, and is responsible for any other tasks relating to environmental health and safety as may be assigned to it by the President.

B. Laboratory Safety Committee

The role of the Laboratory Safety Committee is to assess and review potential hazards related to the handling, use, and management of hazardous chemicals, materials, and operations on UAH properties. The committee will accomplish this through quarterly meetings in which safety audit results are discussed. The committee will ensure that the safety deficiencies are amended in a timely manner. Laboratory injury reports will be reviewed at the quarterly meetings and recommendations for the prevention of similar accidents are approved. Committee recommendations are submitted to the OEHS and to the University Environmental Health and Safety Committee.

The Provost appoints the members of the Laboratory Safety Committee. The members are faculty and staff from areas of teaching and research that most often utilize hazardous materials, chemicals, and or conduct hazardous operations. Membership is reassigned every third year. A current membership list can be attained from the OEHS web site at www.uah.edu/administration/oehs.

C. Radiation Safety Committee

The Radiation Safety Committee is responsible for to insuring University compliance with all state and federal regulations pertaining to the use of ionizing radiation sources. The Radiation Safety Committee meets twice per year and as required.

IV. Identification of Chemical Hazards

A. Project Registration

A project registration form must be completed prior to conducting new research in which hazards can be expected. This provides information that allows the OEHS to assist researchers in maintaining regulatory compliance when using hazardous materials. The form is provided in Appendix E of the Laboratory Safety Manual and at http://www.uah.edu/oehs/forms . The project registration form is distributed through the Office of Sponsored Programs upon award of research funding. Principal Investigators receiving external funding must also submit this form to the OEHS prior to the receipt of funding.

B. Right-To-Know & Material Safety Data Sheets

OSHA mandates that users of hazardous chemicals be informed of the hazards of the material they are working with prior to use of the material. This is commonly called Right- To-Know. To accomplish this, material safety data sheets (MSDS) must be provided to the user. It is the responsibility of the person requesting the purchase of the chemical to insure that the MSDS have been placed in an area in which the users have access. MSDS stations have been established in Wilson Hall, the Materials Science Building, and the Optics Building. Where MSDS stations are not available the MSDS must be placed in a labeled location in the laboratory. Copies of MSDS must be retained on file at the OEHS for a minimum of 25 years.

Chemical manufacturers supply MSDS to purchasing parties. Unless it is written on the purchase order, the MSDS is sent to the accounts payable office. The accounts payable office forwards the MSDS to the OEHS. The OEHS will make every effort to relinquish the MSDS to the appropriate user. If you have not received an MSDS prior to initial use of a chemical, the following sources can be used to locate one:

- OEHS at 6875 or www.uah.edu/admin/oehs
- Chemical manufacturer
- Vermont SIRI web site at http://hazard.com/MSDS/
- www.sigma-aldrich.com

MSDS provide a variety of information to the chemical user. The American National Standards Institute (ANSI) recommends that MSDS have 16 sections. A description of each of these sections is outlined below.

Section 1 – Chemical Product and Company Identification

Identifies the product and it's synonyms. Gives the chemical and MSDS suppliers name. Often will give the chemical abstracts service identifying number. The manufacturer's name is required to be listed on the MSDS by OSHA.

Section 2 – Composition or Ingredients

Lists hazardous components as specified by the Occupational Safety and Health Act (OSHA) in their relative concentrations. Often significant non-hazardous components are listed. May also include other information related to the chemicals such as personal exposure limits and time weighted averages.

Section 3 - Hazards Identification and Emergency Procedures Overview

Provides an overview of emergency procedures. Lists information on the potential adverse human health effects and symptoms that may result from exposure to the material.

Section 4 - First Aid Measures

Provides instructions to be taken if accidental exposure requires immediate treatment. May also include instructions to medical professionals. Always provide an MSDS to the emergency medical care provider.

Section 5 - Fire fighting measures

Provides basic fire fighting guidance, including appropriate extinguishing media. Describes other fire and explosive properties useful for avoiding and fighting fires involving the material, such as flash point or explosive limits.

Section 6 - Accidental release measures

Describes actions to be taken to minimize the adverse effects of an accidental spill, leak or release of the material.

Section 7 - Handling and storage

Provides information on appropriate practices for safe handling and storage.

Section 8 - Exposure controls/personal protection

Provides information on practices, or equipment, or both, that are useful in minimizing worker exposure. May also include exposure guidelines. Provides guidance on personal protective equipment.
[Comment: Good example: "When spraying this paint outside in open areas wear a dust mask. Indoors in well ventilated areas wear a respirator with organic vapor cartridge. In poorly ventilated areas you must wear a supplied air respirator."

Section 9 - Physical and chemical properties

Provides additional data that can be used to help characterize the material and design safe work practices.

Section 10 - Stability and reactivity

Describes the conditions to be avoided or other materials that may cause a reaction that would change the intrinsic stability of the material.

Section 11 - Toxicological information

May be used to provide background toxicological information on the material, its compounds, or both.

Section 12 - Ecological information

May be used to provide information on the effects the material may have on plants or animals and on the material's environmental fate.

Section 13 - Disposal considerations

May provide information that is useful in determining appropriate disposal measures.

Section 14 - Shipping information

May provide basic shipping classification information.

Section 15 - Regulatory information

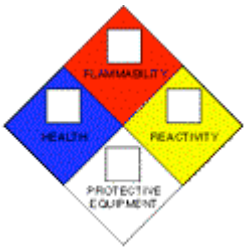
May be used to proved any additional information on regulations affecting the material.

Section 16 - Other information

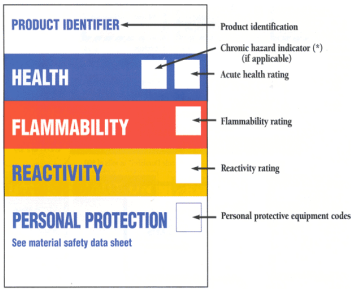
May be used to provide any additional information.

C. Product Labels

The product label is likely to have information that provides useful information concerning the hazardous properties of the product. Manufacturers may place the primary hazard code on the container in the form of a pictograph, e.g. a skull and crossbones denoting poisons, a flame for flammable, etc. While other manufacturers will include a fire diamond or bar graph on hazardous materials containers. The fire diamond and bar type hazard indicators on hazardous material labels provide the same information in different formats. They each have four squares, in the case of the fire diamond it is a square on point. Each square is indicative of either flammability, health effects, reactivity, and special hazard conditions.



Fire Diamond



Bar Type Hazard Indicator

Each square will have a number from zero to four. The following information explains these numbers.

The health indicator is on the far left and is normally blue in color. It indicates the short-term degree of hazard.
0 = represents ordinary combustible hazards in a fire
1 = slightly hazardous
2 = hazardous
3 = extreme danger
4 = deadly

The flammability rating is on the top, is red, and indicates the propensity of the material to burn.
0 = will not burn
1 = will ignite if preheated
2 = will ignite if moderately heated
3 = will ignite at normal room temperature; will burn quickly
4 = will burn easily and rapidly at room temperature/pressure; or will ignite spontaneously when exposed to air

The far right position indicates the reactive nature (instability) of the material and the energy released if the material is burned, decomposed or mixed. It is denoted with a yellow color.
0 = stable and not reactive with water
1 = unstable if heated; changes or decomposes on exposure to air, light or moisture
2 = violent chemical change; reacts violently with water or forms potentially explosive mixtures with water
3 = shock and heat may detonate; reacts explosively with water without heating or confinement
4 = may detonate

The bottom position is white and contains special hazard symbols.
OX = oxidizer = may not burn itself but, may ignite and intensify burning of combustible materials.
A W with a line drawn horizontally through the center = Use no water. The material reacts with water; may become explosive, may produce a flammable or poisonous material, may produce excessive heat.

V. Chemical Inventories and Labeling

A. Inventories

A dated inventory of incoming chemicals and their quantities must be kept in each laboratory. Upon complete use of the material or transfer to another lab, the material must be removed from the list. Many researchers prefer to keep a copy of the inventory on the laboratory door. This is an excellent method of alerting emergency responders of the chemicals stored and in use in the laboratory. The OEHS will request a copy of the chemical inventory annually. The OEHS copy is used in creating a master list of hazardous chemicals required for maintaining compliance with the Emergency Planning and Community Right to Know Act (EPCRA).

B. Labeling

All chemical containers (including laboratory solutions and mixtures) used in the laboratory must have labels indicating what they are. Labels must indicate the components, their quantities, and a date. Containers without appropriate labeling will be treated as an unknown chemical. Unknown chemicals and wastes present safety, environmental, regulatory, and monetary concerns. Therefore, it is of utmost importance that all chemical containers are appropriately labeled. Chemical waste labeling is discussed later in this manual.

VI. Personal Safety

A. Training

The Office of Environmental Health and Safety has the responsibility for training faculty and staff. Training courses are offered at the beginning of fall and spring semesters. The training provides an overview of federal, local, and state guidelines and University policy related to laboratory safety and environmental hygiene. Persons with primary responsibility for laboratories are responsible for training students in the safe handling of hazardous materials and laboratory technique.

B. MSDS Availability

Material safety data sheets (MSDS) must be readily available for each laboratory. A centralized location for MSDS is permissible. MSDS must be available at all times and near the hazard source. Prior to the use of a new chemical the MSDS must be provided for review to the chemical user and those persons in the lab.

C. Safe Use of Laboratory Equipment

Laboratory equipment must be used according to manufacturer guidelines. All best practices and procedures to minimize exposure must be followed. Appropriate training is the responsibility of the department in charge of the lab. Facilities and Operations, Maintenance Department is responsible for the maintenance of equipment installed by the University as part of the facility, e.g., fume hoods, safety showers, eyewashes, sinks, etc.

D. Equipment Inspection

All equipment must be inspected prior to use to insure, electrical cords are not damaged, safety interlocks have not been compromised and no chemicals have been spilled in the chambers of the equipment.

E. Laboratory Doors

It is a good practice to keep laboratory doors closed and unlocked while occupied. Laboratory doors must remain closed to insure that any hazardous materials spills will be isolated to that laboratory/area. The last person out should follow a laboratory shutdown checklist and lock the door on his/her way out. The safety checklist should include items such as; turn off gas and heat sources, turn off water supply and equipment, ensure signage is posted on unattended experiments, return all chemicals to appropriate storage, ensure all chemicals and solutions or mixtures are labeled, turn off lights and lock the door(s).

Frequently, laboratory door windows are covered with paper or aluminum foil. This practice is strongly discouraged. Emergencies can be detected much faster when the windows are not covered.

F. Personal Protective Equipment (PPE)

PPE is required in all laboratories with chemical hazards. The minimal PPE is chemical resistant gloves or gloves appropriate to the hazard, lab jacket or apron, goggles, and closed- toed shoes. The use of respiratory protection must be cleared through the OEHS. Appendix A includes a list of mandatory laboratory safety rules. These rules must be distributed to all students, signed and retained on file. Always check the MSDS to verify that the correct PPE is being used.

G. Eating in the Lab and Food Storage

Eating, drinking, gum chewing, the use of tobacco, and the application of cosmetics is not allowed in laboratories. These actions may cause contamination of individuals partaking in them. Food storage is not allowed in laboratories. Other actions that may result in contamination that should be noticed and avoided

are; pencil chewing, touching the face, adjusting eyeglasses, scratching, etc. Lab jackets must not be worn into eating and food preparation areas.

H. Hair

Long hair must be tied back to prevent possible contamination and injury.

I. Pipetting

Pipetting by mouth is not allowed. Use mechanical pipetting devices only.

J. Laundry

Lab jackets and potentially contaminated clothing must be washed separate from other laundry items.

K. Hand Washing

Hands and forearms must be washed prior to leaving the laboratory.

L. Experiment Identification

Identification must be posted on unattended experiments. The identification must provide a point of contact, what the hazard is and in what quantity, and when the experiment will be discontinued, and any instrument settings that must be maintained.

M. Lockout Tagout

Insure instrumentation that requires repair is not usable by disconnecting critical operating points and switches and labeling as broken.

VII. Housekeeping

Working laboratories often become cluttered with empty and partially full containers, glassware, and other apparatus. Floors and countertops can also become contaminated due to unattended spills. It is important for the safety of those persons utilizing and maintaining UAH facilities that the laboratory is not contaminated or present a fire hazard. Maintaining a good state of order in laboratory facilities will significantly decrease risk.

A. Elements of Good Housekeeping

1. Chemical Storage

The failure to store chemicals according to their properties poses a risk to personnel, to property, and possibly to intellectual value of accumulated research data files. For these reasons, hazardous chemicals must be stored according to compatibility and in chemical safety cabinets or in the ventilated base cabinet of the fume hood. Fisher and Mallinckrodt chemicals are color coded for ease of segregation. Non-hazardous chemicals may be kept on lab benches.

The following general suggestions for safe storage of chemicals in the laboratory should be implemented.

- The quantities of chemicals that are stored within a laboratory should be minimized, as specified by NFPA 45 and OSHA. Many authorities recommend that the NFPA guidelines for maximum quantities and sizes of containers should be reduced to one-half or even one-third of the recommended values. (NFPA guidelines are provided in the fire prevention section.)
- Bulk quantities of chemicals (i.e., larger than one-gallon) must be stored in a separate storage area. Transfer of flammable liquid from 5 gallon or larger metal containers may not be done in the laboratory.
- Chemicals must be stored at an appropriate temperature and humidity level. This can be especially problematic in hot, humid climates. As a rule, chemicals should not be stored near heat sources, such as steam pipes or laboratory ovens. Chemicals should never be stored in direct sunlight.

- Chemicals should be dated when received and when opened. If the chemical is one that degrades in quality or becomes unsafe after prolonged storage, the shelf-life expiration date should also be included.
- Storing peroxide-formers:
  Peroxides are very unstable and some chemicals that form peroxides are commonly used in laboratories. This makes peroxide-forming materials some of the most hazardous substances found in a lab. Peroxide-forming materials are chemicals that react with air, moisture, or impurities to form peroxides. The tendency to form peroxides by most of these materials is greatly increased by evaporation or distillation. Organic peroxides are extremely sensitive to shock, sparks, heat, friction, impact, and light. Many peroxides formed from materials used in laboratories are more shock sensitive than TNT. Just the friction from unscrewing the cap of a container of an ether that has peroxides in it can provide enough energy to cause a severe explosion.
  1. Do not open the chemical container if peroxide formation is suspected. The act of opening the container could be sufficient to cause a severe explosion. Visually inspect liquid peroxide-forming materials for crystals or unusual viscosity before opening. Pay special attention to the area around the cap. Peroxides usually form upon evaporation, so they will most likely be formed on the threads under the cap. If it is deemed safe to open the container, peroxide papers may be used for a quick determination of peroxide concentration. Peroxide papers are commercially available from laboratory supply companies.
  2. Date all peroxide forming materials with the date received, and the expected shelf life. Chemicals such as diisopropyl ether, divinyl acetylene, sodium amide, and vinylidene chloride should be discarded after three months. Chemicals such as dioxane, diethyl ether, and tetrahydrofuran should be disposed after one year.
  3. Store all peroxide-forming materials away from heat, sunlight, and sources of ignition. Sunlight accelerates the formation of peroxides.
  4. Secure the lids and caps on these containers to discourage the evaporation and concentration of these chemicals.
  5. Never store peroxide-forming materials in glass containers with screw cap lids or glass stoppers. Friction and grinding must be avoided. Also, never store these chemicals in a clear glass bottle where they would be exposed to light.
  6. Contamination of an ether by peroxides or hydroperoxides can be detected simply by mixing the ether with 10% (wt/wt) aqueous potassium iodide solution - a yellow color change due to the oxidation of iodide to iodine confirms the presence of peroxides. Small amounts of peroxides can be removed from contaminated ethers via distillation from lithium aluminum hydride (LiAlH-4-), which both reduces the peroxide and removes contaminating water and alcohols. However, if you suspect that peroxides may be present, it would be wise to call the OEHS for disposal. If you notice crystal formation in the container or around the cap, do not attempt to open or move the container. Call the OEHS for proper disposal.
  7. Never distill an ether unless it is known to be free of peroxides.

- Visual inspection of the material and its container should be conducted routinely. Indications for disposal include:
  Cloudiness in liquids
  Material changing color
  Evidence of liquids in solids or solids in liquids
  "Puddling" of material around outside of container
  Pressure build-up within bottle
  Obvious deterioration of container
- Chemicals should not be routinely stored on the bench top. In such locations they are unprotected from exposure and in a fire situation are more readily knocked over. Each chemical should have a specific storage area and be returned there after use. Large quantities of flammable materials should not be stored in the laboratory. Only the amounts needed should be kept on bench top, the remainder should be kept in flammable storage cabinets.

- Laboratory shelves should have a raised lip along the outer edge to prevent containers from falling. Never allow the container to hang off the edge of the shelf. Liquid or corrosive chemicals should never be stored on shelves above eye-level. Glass containers should not touch each other on the shelves. Secondary containers or trays should be used for chemical storage whenever possible to minimize the flow of material should a spill or rupture occur. Round bottom flasks should always be supported properly in cork rings or by other means to keep them from tipping.
- Adequate security must be provided so that unauthorized personnel do not have access to hazardous materials.
- Chemicals must never be stored on the floor, not even temporarily.
- Chemicals that are no longer to be used for research purposes should be properly disposed of or given to another research group that has a use for it.
- Flammable materials must never be stored in domestic-type refrigerators. Only explosion-proof or flammable material refrigerators should be used for storage of these chemicals within a laboratory environment.
- All containers stored within the refrigerator should be tightly capped to keep vapors from interacting with each other and to alleviate "smell" problems. Flasks with cork, rubber or glass stoppers should be avoided because of the potential for leaking. All containers stored in the refrigerator must be properly labeled.
- Inventory the materials in your refrigerator frequently to avoid overcrowding with materials that have long since been forgotten. Also make it a point to defrost your refrigerator occasionally so that chemicals do not become trapped in unique ice formations!
- Before flammable materials are stored in a refrigerator, it should be determined if keeping the material chilled will serve any purpose. No benefit is derived from refrigerating a chemical that has a flash point below the temperature of the refrigerator. Never store peroxide formers (i.e., ether) in a refrigerator!
- Fume hoods should not be used as general storage area for chemicals. This may seriously impair the ventilating capacity of the hood.
- Gas cylinders must be securely strapped to a permanent structure (wall, lab bench, etc.). When they are not in use they should be capped off. When they are empty they must be labeled as such.
- Upon termination, graduation or transfer of any laboratory personnel, all hazardous materials must be properly disposed of through the OEHS, or arrangements made to transfer them to the laboratory supervisor
- Segregation based on hazard classes in addition to general safe storage practices is a must. As a minimum, laboratories should separate chemicals according to similar hazards, such as flammability, corrosivity, sensitivity to water or air, and toxicity. Segregation of the following major categories of chemicals, each of which will be discussed in greater detail, is strongly recommended:
    - Flammables
    - Oxidizers
    - Corrosives
    - Highly Reactives
    - Extremely Toxic (Acutely Hazardous)
    - Other Regulated Materials
    - Low Hazard

  Below, you will find a few potential problems that arise with the general segregation of chemicals.

1. **The actual identification of the hazards themselves**. Recent legislation has made this task somewhat easier since all chemical manufacturers are now required to list all hazards on outgoing chemical containers and each chemical must be accompanied by a Material Safety Data Sheet (MSDS). The chemical label thus furnishes a quick method of determining whether the material is a fire hazard, health hazard, or reactivity hazard. The MSDS furnishes more detailed information regarding toxicity exposure levels, flashpoints, required safety equipment and recommended procedures for spill containment.

2. **Multiple hazards for chemicals**. Most chemicals have multiple hazards and a decision must be made as to which storage area would be most appropriate for each specific chemical. Determine the priority of each hazard and which provides the highest risk.

a. When establishing a storage scheme, the number one consideration should be the flammability characteristics of the material. If the material is flammable, it should be stored in a flammable cabinet.

b. If the material will contribute significantly to a fire (i.e., oxidizers), it should be isolated from the flammables. If a fire occurs in the lab and response to the fire with water would exaggerate the situation, isolate the water reactive material away from contact with water.

c. Next look at the corrosivity of the material, and store accordingly.

d. Finally, consider the toxicity of the material, with particular attention paid to regulated materials. In some cases, this may mean that certain chemicals will be isolated within a storage area, for instance, a material that is an extreme poison but is also flammable, should be locked away in the flammable storage area to protect it against accidental release. There will always be some chemicals that will not fit neatly in one category or another, but with careful consideration of the hazards involved, most of these cases can be handled in a reasonable fashion. For the safety of all personnel and to protect the integrity of the facilities, hazardous materials must be segregated.

EPA Compatibility Table

To use the table, choose the group that the chemical belongs. Group A and B on the same row are not compatible with each other. The third column provides information on the hazard of mixing Groups A and B of the same row.

Group 1-A	**Group 1-B**	**Potential Consequences**
Acetylene sludge Alkaline caustic liquids Alkaline cleaner Alkaline corrosive liquids Alkaline corrosive battery fluid Caustic wastewater Lime sludge & other corrosive alkalis Lime wastewater Lime and water Caustic	Acid sludge Acid and water Battery acid Chemical cleaners Electrolyte, acid Etching acid liquid or solvent Pickling liquor and other corrosive acids Acid, including mixtures of acids and sulfuric acid	Heat generation; violent reaction
Group 2-A	**Group 2-B**	**Potential Consequences**
Aluminum Beryllium Calcium Lithium Magnesium Potassium Sodium Zinc powder Other reactive metals and metal hydrides	Any Group 1-A or 1-B	Fire explosion; generation of flammable hydrogen gas
Group 3-A	**Group 3-B**	**Potential Consequences**
Alcohols Water	Any concentrated item from Groups 1-A or 1-B Calcium Lithium Metal hydrides Potassium SO_2Cl_2, $SOCl_2$, PCl_3, CH_3SiCl_3 Other water-reactives	Fire, explosion, or heat generation; generation of flammable or toxic gases
Group 4-A	**Group 4-B**	**Potential Consequences**
Alcohols Aldehydes Halogenated hydrocarbons Nitrated hydrocarbons Unsaturated hydrocarbons Other reactive organic compounds and solvents	Concentrated Group 1-A or 1-B Group 2-A	Fire, explosion, or violent reaction
Group 5-A	**Group 5-B**	**Potential Consequences**
Cyanide and sulfide solutions	Group 1-B	Generation of toxic hydrogen cyanide or sulfide gas
Group 6-A	**Group 6-B**	**Potential Consequences**
Chlorates Chlorine Chlorites Chromic acid Hypochlorites Nitrates Nitric acid, fuming Perchlorates Permanganates Peroxides Other strong oxidizers	Acetic acid and other organic acids Concentrated mineral acids Group 2-A Group 4-A Other flammable and combustible waste	Fire, explosion, or violent reaction

2. Glassware Cleansing

It is highly recommended that detergents be used to clean glassware rather than chromate and sulfuric acid. Hexavalent chromium is a carcinogen and chromic acid mixtures are expensive to dispose of as hazardous waste.

3. Work Surfaces and Floors

Dry sweeping laboratories must be avoided. Floors can be cleaned with a vacuum equipped with a high efficiency particulate air (HEPA) filter or by wet mopping. Protect work surfaces with disposable bench paper. Change the bench paper regularly and dispose of immediately after a spill. It is a good practice to decontaminate glassware prior to washing. Fume hood surfaces may be wiped down with dilute detergent and water solution, after all spills have been appropriately cleaned.

4. Laboratory Close Out

Occasionally laboratories cease operations. This may be due to a change of directors, supervisors, or researchers, or due to a change in research opportunities. When this happens, it is mandatory to contact the OEHS for laboratory clearance one month prior to out-processing. One month seems long but it is necessary in case there are unknown chemicals that require identification, hazardous waste that must be removed, contaminated equipment to be decontaminated, or chemical materials and laboratory equipment that must be surplused. Failure to appropriately clear a laboratory may result in the collection of fees for services provided by the OEHS or withholding of the employees final paycheck.

During laboratory close out it is important to be thorough and investigate all areas and equipment including; autoclaves, refrigerators, incubators, centrifuges, ovens, cabinets, freezers, cold rooms, stock rooms, fume hoods, etc. Mishandling of regulated materials may result in the assessment of fines and or the loss of the right to use these materials. It is therefore of utmost importance that close out procedures be implemented and strictly adhered to within each department.

The following are guidelines for use when faculty and staff members responsible for laboratory facilities are leaving the University or transferring to a new laboratory. Additionally, a laboratory clearance checklist is provided in Appendix D.

B. Closeout Procedures for Hazardous Material Labs

Chemicals

- All containers of chemicals must be securely closed and appropriately labeled. All laboratory glassware containing residues or chemicals must be emptied and disposed of appropriately. Please remember that UAH has a "No Drain" policy for chemical wastes. Insure all areas of the lab have been inspected for chemical wastes. Wastes must be segregated, prepared and labeled according to the Lab Safety Manual and the Hazardous Waste Management Plan. A chemical disposal manifest must be completed and submitted to the OEHS. The manifest and instructions are provided in Appendix D. Upon receipt of the manifest the OEHS will schedule a pick-up.
- Chemicals that will be transferred to other laboratories must be segregated. The chemicals must be packed according to compatibility and safe-handling techniques must be utilized. Contact the OEHS staff for more information. The laboratory supervisor receiving the chemicals must provide an updated chemical inventory to the OEHS.
- Fume hoods and countertops must be washed.

Gas Cylinders

- Cylinders must be disconnected, their valve caps replaced and must be returned to suppliers.
- Non-returnable cylinders must be manifested for submission to the OEHS as hazardous waste. When empty, it is imperative to label all non-returnable cylinders as empty.

Animal and Human Tissue

- Animal tissue must be separated from liquid. The liquid must be manifested and submitted to the OEHS.
- All waste must be placed in appropriate biohazard bags and containers.

Microorganisms and Cultures

- Inventory the area and decontaminate non-regulated microorganisms.
- If samples must be saved notify your department head and insure that another faculty or staff member takes responsibility for the samples.
- Decontaminate any samples as required.
- Contact the OEHS for disposal of any biohazardous waste.

Radioactive Materials

- The close-out of laboratories containing radioactive materials must be completed in collaboration with the radiation safety officer. Transfer of radioactive materials must be approved by the Radiation Control Officer.
- Requests for removal of radioactive materials and wastes must be directed to the Radiation Control Technician at 2352.
- The area must have a complete survey upon removal of radioactive materials. All equipment including items for surplus must be surveyed, when necessary additional decontamination procedures must be completed until the survey proves the instrumentation/equipment has no activity more than two times background activity. Survey records must be submitted to and maintained by the Radiation Control Technician.

Equipment

- All lab equipment must be cleaned and decontaminated when necessary. Contact Facilities and Operations when ventilation systems have been utilized with highly hazardous substances or organisms.
- Mercury and mercury containing devices or equipment must be transferred or turned into the OEHS.
- Lasers must be locked out and transferred to either surplus, a new user, or securely stored. The transfer of lasers to new users requires a project registration and the submission of a laser safety plan.

VIII. Standard Laboratory Containment Equipment

Areas utilized at UAH for chemical laboratories must minimally be equipped with a drench hose, safety shower and/or eyewash and if chemicals having a primary or secondary hazard of flammability, combustibility or toxic a fume hood must be available. It is strongly recommended to perform all chemical manipulations in a fume hood. Additionally, all laboratories are equipped with a fire extinguisher and most are equipped with telephones. Fire/Emergency pull stations are located in each building and conform to applicable codes.

A. Fume Hoods

A fume hood is one of the most important pieces of laboratory safety equipment the University can afford faculty, researchers, staff, and students. A fume hood prevents the inhalation of potentially harmful substances, deters uncontrolled splashes and spills from entering the lab environment, and removes flammable vapors from the indoor atmosphere.

1. When to Use a Chemical Fume Hood

A chemical fume hood is a necessary part of your laboratory procedure when:

- Working with hazardous or suspect hazardous chemicals
- Working with chemicals having unknown properties
- Pouring, mixing, weighing and dispensing chemicals

2. Common Fume Hood Terms & Definitions

Airfoil – Shaped or streamlined member at hood entrance designed to enhance air movement into the hood. The airfoils are designed to keep a minimal disturbance in the airflow pattern entering into the fume hood. This disturbance is called turbulence. Turbulence in the fume hood can negatively affect the containment of chemical fumes.
Air Volume – Rate of airflow, normally expressed in cubic feet per minute (cfm).
Auxiliary Air – Supply or make-up air delivered external to the chamber of a fume hood to reduce air consumption.
Baffle – Panels located across the back of hood interior that control pattern of air moving through the hood.
Blower – Air-moving device (or fan) consisting of a motor, impeller and scroll.
Combination Sash – Moveable horizontal front panels in a vertically rising frame.
Damper – Device installed in duct to control airflow volume.
Duct – Round, square or rectangular tube used to enclose moving air.
Exhaust Volume – Quantity of air exhausted by the fume hood. The exhaust volume is dependent upon the blower size and is expressed in cubic feet per minute (cfm).
Face Velocity – Speed of air moving into the fume hood through the face opening (sash), measured in feet per minute (fpm).
Fume Hood – Five-sided ventilated enclosure used in laboratories to collect, confine and exhaust contaminants.
Lintel – Portion of fume hood front located above access opening.
Louvers – Slit-like openings in the lintel that allow bypass air to enter the hood when the sash is closed.
Manometer – Device used to measure air pressure differential.
Sash – Sliding glass panel set in the fume hood face that protects the user's eyes, nose, mouth and breathing area from contact with dangerous chemicals and fumes inside the hood.
Variable Air Volume – Type of fume hood exhaust system that typically maintains constant fume hood face velocity by adjusting blower motor speed or a balance damper in response to changes in sash position.
Velometer – Instrument used to measure airflow velocity.

3. How Fume Hoods Work

Fume hoods are minimally equipped with a blower, cabinet, and exhaust ductwork. The cabinet is designed to contain hazardous chemicals. The blower is designed to pull air away from the front of the cabinet and keep the hazardous chemicals from reaching the indoor environment and user. The exhaust ductwork is independent from other indoor air ductwork and is used to transport any hazardous chemical fumes, gases, vapors, or aerosols to the outside environment.

Baffles are located across the inside rear of the hood. They assist in controlling the airflow pattern through the hood. Baffles can be adjusted to minimize hazards caused by the different characteristics of chemicals being utilized in the hood system. For normal use, the top, bottom, center and side slots are all adjusted to the open position to provide an even airflow. Gases or fumes that are heavier-than-air require the baffles to be adjusted for the maximum airflow at the bottom of the hood. Close the top slot. Arrange the center, bottom, and side slots in the open position. Gases or fumes that are lighter-than-air require a maximum airflow at the top of the hood. Open the top baffles to their maximum position. Maintain the side and center baffles in their normal position and completely close the bottom slot.

A fume hood must have a face velocity sufficient to pull the air away from the user. The American National Standards Institute (ANSI) recommends that laboratory fume hood face velocity be between 80 to 120 feet per minute (fpm) for optimal safety. 100 fpm is approximately the same as three miles per hour, which feels like the air going past somebody who is walking briskly. In traditional systems, the user does not have control over the face velocity or exhaust rate of the hood. Exhaust rates in newer fume hoods are often controlled by a variable air volume system.

Variable air volume technology allows for the maintenance of a constant face velocity while varying exhaust volume in response to changes in the sash position. The exhaust volume is varied in response to a series of sensors that receive and send signals to the exhaust valve. Annual calibration of the VAV system is necessary to ensure the appropriate flow is being afforded the user. The point of optimal flow is established through calibration of the equipment. When the sash is opened above or below the optimal flow point the face velocity will decrease.

The exhaust capacity of each fume hood in Materials Science Building is controlled by a variable air volume (VAV) exhaust system. The hoods in MSB are calibrated to have the maximum exhaust when the sash is opened approximately 14 inches from the airfoil. This is the optimal operating height. Identification of this point is provided with labels.

- **Survivair Fume Hood Operation**

The following are descriptions of fume hood monitor controls. The controls are necessary to alert the user to situations that do not provide the optimal protection.

The **Power light** is green and indicates that power is being applied to the system.

The **Flow Alarm light** is red and indicates that a low-flow situation has been detected. The flow alarm light and the caution LED warning are identical in function.

The **Energy Use Meter** indicates the relative energy use of the fume hood. While it does not indicate the airflow it is directly related to the exhaust airflow velocity. (Typically, the airflow increases with the increase in energy use.)

The **System Normal LED** is a green LED that indicates all systems are functioning. When this light is not on and no other LED's are on, then the power to the fume hood system has been lost. There is no exhaust flow. *Do not* use the fume hood and report the failure to Facilities and Operations (6482) immediately.

The **Caution LED or Flow Alarm** is a red LED that comes on when the flow is below what is considered a safe level. A slipping or broken belt, a motor fault or overload, a drive failure, a severe brownout, or a severely blocked duct can cause an alarm. The flow alarm is disabled for 45 seconds when the sash is moved or the system is powered up.

The **Emergency Exhaust Switch** is a button that enables the user to reset or set the emergency exhaust mode. When in this mode the blower is at its maximum speed. Depressing the button once will set the mode and turn on the red SET LED. Depressing the button a second time will unlatch the SET and turns off the emergency exhaust mode. Once the emergency exhaust has been activated, the button must be depressed twice to reset the system to its normal operating mode. The emergency exhaust mode can be activated by both the user and internally by the Phoenix Controls system. The emergency exhaust mode can be activated internally by the remote energy exhaust switch, thermostat, gas sensor or other monitor. A red LED indicates when the emergency exhaust in being utilized.

The **Night Waste LED** is activated when the lights are turned off and the sash is left 6 inches above the constant flow position. This serves as an energy saving and safety device.

The **Mute Switch** is a button that will silence the audible alarm when depressed. After all conditions causing the audible alarm have been corrected the mute mode is disabled.

4. Fume Hood Safety Practices

A chemical fume hood cannot provide complete safety against all hazards. A functioning fume hood and appropriate laboratory ventilation will provide adequate protection during standard laboratory manipulations. The fume hood should be used in conjunction with other safety equipment when toxic chemicals having exposure limits in the low parts per billion ranges are being utilized. More stringent safety requirements are left to the discretion of laboratory supervisors. The following list is mandatory laboratory safety practices.

1. Keep all apparatus at least 6 inches from the face of the hood.
2. Do not put your head in the hood when contaminants are being generated.
3. Do not use the hood to evacuate containers of volatile waste chemicals.
4. Minimize the quantity of chemicals and apparatus being used in the hood. Excessive storage of items in the fume hood will impair its performance.
5. All operations that may generate air contaminants above their exposure limits must be conducted inside a fume hood.
6. Do not use a fume hood if it is not working appropriately. Test the airflow periodically. If a flow meter is not available, a kimwipe placed at the base of the hood will be gently lifted when appropriate airflow is provided. The kimwipe should not be pulled into the exhaust. This indicates the airflow is too high.
7. Maintain the slots in the hood baffle free from obstructions.
8. Minimize traffic in front of the hood while in use.
9. Keep laboratory doors and windows closed unless specifically designed for opened doors.
10. Do not remove the hood sash, panels or sensors. Keep all wiring between hood electronics and sensors in tact.
11. The laboratory supervisor must approve the use of hazardous solids (powders). (Many potential problems arise when the solid is fine enough to become airborne.)
12. Do not place receptacles or other sources of sparks inside the hood when flammable liquids or gases are present.
13. Use an appropriate barricade if an explosion or other violent reaction is possible.
14. Do not remove hood labels that indicate the maximum safe operating level of the sash.
15. Use only specially designed fume hoods for operations that heat perchloric acid above ambient temperature.
16. Ensure all fume hoods have a spill protection lip.

B. Biological Safety Cabinets

Biological safety cabinets should be used during handling of biological organisms. Consult the Biological Safety Manual for more information in the requirements to use the different classes of biological safety cabinets.

C. Laminar Flow Hoods

The differentiating feature of laminar-flow vs. fume hood is that there is no contaminated positive air plenum. Work with organic solvents, concentrated carcinogens, and with toxic or corrosive contaminants should be performed in a fume hood.

D. Snorkel Hoods

Snorkel hoods must be used with equipment generating fumes during operation. Most snorkels are equipped with a turnkey that opens and closes a valve allowing or disallowing air flow. Check equipment manufacturer guidelines when determining the correct airflow for laboratory instrumentation.

E. Hood/Cabinet Maintenance and Repairs

It is highly recommended that all hood/cabinet flows be checked monthly by the person utilizing the laboratory. An anemometer or magnehelic gauge will verify the hood has negative pressure. Typically chemical fume hoods should operate at a flow of 80 – 120 feet per minute for optimum user safety. A record of this safety check should be kept. Inner surfaces of fume hoods may be cleansed using a dilute solution of soapy water, provided all spills have been cleaned appropriately. Minimally, gloves, goggles,

and a lab coat must be worn during cleaning procedures. All fume hood repairs must be completed or approved by the UAH Facilities and Operations Department. Immediately report fume hood malfunctions to 824-6482. Annually, the OEHS verifies the face velocity of campus fume hoods and labels them with a yellow sticker denoting the maximum safe operating height. The sticker is placed at the point at which the fume hood face velocity is 100 feet per minute. Questions or requests for assistance in the evaluation of fume hoods may be directed to Environmental Health & Safety at 824-2352.

IX. Emergency Equipment

A. Eyewashes and Safety Showers

Emergency eyewashes are mandatory for chemical laboratories. Laboratory facilities at UAH should be equipped with an eyewash station or drench hose. Safety showers must be within 10 seconds of hazardous chemical areas. Facilities & Operations Maintenance must be contacted to install eyewash stations and safety showers when necessary. Optionally, portable eyewash station and showers may be purchased.

The OEHS checks campus safety showers and emergency eyewashes biannually to verify that they function appropriately. Those persons responsible for laboratory areas are responsible for insuring eyewashes are flushed weekly and showers are flushed monthly. This will effectively flush the lines of any debris and potential microbial growth. Due to the nature of the work conducted in biological laboratories, a periodic wipe down of the safety shower with a commercially available disinfectant or a one-part bleach to ten-part water solution is highly recommended.

X. Fire Prevention

Preventing fires in the lab can be largely achieved by close adherence to; the National Fire Protection Association (NFPA) guidelines for storage of flammable materials, attention to chemical incompatibilities, care in the use of flammable materials and chemical reactions, appropriate maintenance of equipment, and good housekeeping. All fires require a fuel source, an ignition source, and oxygen to burn. Minimizing any one of these will decrease the risk of fire.

A. Common Laboratory Ignition and Fuel Sources

Ignition sources must be located away from flammable and combustible materials. Always use heating apparatus, bunsen burners, and flammable and combustible chemicals in the fume hood. There are many potential ignition and fuel sources in laboratories. The most common are:

Bunsen burners
Hot plates and heating mantles
Peroxides and peroxide formers
Damaged electrical cords and extension cords
Class III and IV lasers
Flammable and combustible chemicals

B. Fire Safety Equipment

Fire extinguishers must be available in all chemical laboratories. Fire extinguishers must be checked monthly to ensure they are adequately charged. Contact the OEHS at 2352 for any information concerning fire extinguishers, or to request a repair or recharge.

C. Fire Risk Minimization

Minimize the risk of fire in laboratories by utilizing the following practices.

- Purchase small amounts of flammables
- Store flammable materials in flammable chemical storage cabinets and segregate from incompatible materials. Adhere to the guidelines for storage of flammable materials as found in NFPA 45 and 30. These guidelines are provided below.
- Ethers must be inhibited. Use ethers before they expire. Contact the OEHS immediately upon discovery of expired ethers.

- Electrical and extension cords must double insulated or grounded. Extension cords must not be used as permanent wiring and must be suitable for the environment in which they are used.

D. NFPA 45 – (Standard on Fire Protection for Laboratories Using Chemicals)

Terms

Laboratory Unit Fire Hazard Classification:
Class A: High fire hazard
Class B: Moderate fire hazard
Class C: Low fire hazard
Class D: Minimal fire hazard

Flammable Liquid: Any liquid that has a closed-cup flash point below 100°F. Flammable liquids are classified as Class I liquids as follows:
Class I Liquid – any liquid that has a closed cup flash point below 100°F and a Reid vapor pressure not exceeding 40 psia at 100°F.
Class IA Liquids – those liquids that have flash points below 73°F and boiling points below 100°F.
Class IB Liquids – those liquids that have flash points below 73°F and boiling points at or above 100°F.
Class IC Liquids – those liquids that have a flash point at or above 73°F but below 100°F.

Combustible Liquid: Any liquid that has a closed-cup flash point at or above 100°F. Combustible liquids are further classified as follows:
Class II Liquids – any liquid that has a flash point at or above 100°F and below 140°F.
Class IIIA Liquids – any liquid that has a flash point at or above 140°F but below 200°F.
Class IIIB Liquids – any liquid that has a flash point at or above 200°F.

Maximum Allowable Quantities of Flammable and Combustible Liquids and Liquified Flammable Gases in *Sprinklered* Laboratory Units Outside of Approved Storage Cabinets (Table 1)

		Excluding Quantities in Storage Cabinets or Safety Cans				**Including Quantities in Storage Cabinets or Safety Cans**			
Lab Unit Fire Haz Class	**Flammable Combustible Liq. Class**	**Max. Quant. per 100 ft^2 of Lab Unit**		**Max Quant per Lab Unit**		**Max Quant. per 100 ft^2 of Lab Unit**		**Max. Quant per Lab Unit**	
		L	**gal**	**L**	**gal**	**L**	**gal**	**L**	**gal**
A	**I**	**38**	**10**	**2270**	**600**	**76**	**20**	**4540**	**1200**
	I, II, IIIA	**76**	**20**	**3028**	**800**	**150**	**40**	**6060**	**1600**
B	**I**	**20**	**5**	**1136**	**300**	**38**	**10**	**2270**	**600**
	I, II, IIIA	**38**	**10**	**1515**	**400**	**76**	**20**	**3028**	**800**
C	**I**	**7.5**	**2**	**570**	**150**	**15**	**4**	**1136**	**300**
	I,II, IIIA	**15**	**4**	**757**	**200**	**30**	**8**	**1515**	**400**
D	**I**	**4**	**1.1**	**284**	**75**	**7.5**	**2**	**570**	**150**
	I, II, IIIA	**4**	**1.1**	**284**	**75**	**7.5**	**2**	**570**	**150**

This category includes Class I flammable liquids and liquified flammable gases.

Maximum Allowable Quantities of Flammable and Combustible Liquids and Liquified Flammable Gases in *Non-Sprinklered* Laboratory Units Outside of Approved Storage Cabinets (Table 2)

		Excluding Quantities in Storage Cabinets[r] or Safety Cans				Including Quantities in Storage Cabinets[r] or Safety Cans			
Lab Unit Fire Haz Class	Flammable Combustible Liq. Class	Max. Quant. per 100 ft^2 of Lab Unit		Max Quant per Lab Unit		Max Quant. per 100 ft^2 of Lab Unit		Max. Quant per Lab Unit	
		L	gal	L	gal	L	gal	L	gal
A	I[#]	*Not Permitted*		*Not Permitted*		*Not Permitted*		*Not Permitted*	
	I[#], II, IIIA	*Not Permitted*		*Not Permitted*		*Not Permitted*		*Not Permitted*	
B	I[#]	*Not Permitted*		*Not Permitted*		*Not Permitted*		*Not Permitted*	
	I[#], II, IIIA	*Not Permitted*		*Not Permitted*		*Not Permitted*		*Not Permitted*	
C	I[#]	7.5	2	284	75	15	4	570	150
	I[#], II, IIIA	15	4	380	100	30	8	760	200
D	I[#]	4	1.1	140	37	7.5	2	284	75
	I[#], II, IIIA	4	1.1	140	37	7.5	2	284	75

[r]**This category includes Class I flammable liquids and liquified flammable gases.**
[#]**This category includes Class I flammable liquids and liquified flammable gases.**

X. Chemical and Hazardous Waste Identification and Disposal

For a complete guide to handling hazardous waste refer to The UAH Hazardous Waste Management Plan in Appendix C.

A. Chemical Waste Minimization

The U.S. Congress has made waste minimization a national policy and it must be incorporated as a goal of each chemical waste generator. As a generator of chemical waste you have the responsibility to minimize the waste you generate. Waste minimization has benefits such as decreasing your exposure to hazardous substances, protection of the environment, and decreasing the cost of purchase and disposal. Waste minimization should be considered at all times. Waste minimization begins in the research and education planning stages. The following are suggestions for minimizing waste.

- Purchase only the quantity of chemical that you need. Hazardous waste often is a result of outdated and or unused chemicals. Hazardous waste costs much more to dispose of than the cost of purchasing smaller quantities of chemicals.
- Substitute less or non-hazardous materials for hazardous materials.
- Use dilute rather than concentrated solutions.
- Use micro or semi-micro techniques.

B. Chemical and Hazardous Waste Identification

UAH laboratories fall under the federal regulations outlined in the Resource Conservation and Recovery Act (RCRA), and at the state level as outlined in the Alabama Department of Environmental Management (ADEM) Division 14 regulations. Both specify the requirements for handling hazardous materials from "cradle to grave". Complete guidelines for handling chemical waste can be acquired from and the UAH Hazardous Waste Management Plan (Appendix C) via the OEHS or it's web site. The following UAH guidelines will assist laboratory users in determining what is a hazardous chemical waste and how to appropriately label them. Appropriate labeling of hazardous chemical wastes will assist in accomplishing University goals of maintaining safety within laboratories, protecting the environment, and supporting regulatory compliance. A major obstacle in minimizing the quantity of unknown chemical waste is the performance of laboratory closeout procedures prior to faculty or staff relocating. Refer to laboratory close

out procedures in the Housekeeping section for appropriate procedures when research is completed or when laboratories change responsible parties.

UAH has a strict "NO DRAIN" policy that disallows pouring chemicals down drains in UAH facilities. Pouring chemicals into the sanitary sewer system requires a permit and continuous monitoring. Failure to follow the "NO DRAIN" policy could result in injury to human health and environmental degradation.

According to RCRA, the two types of regulated hazardous waste are "listed" and "characteristic". An outline of listed chemical wastes can be found in the appendices of the UAH Hazardous Waste Management Plan (HWMP). Hazardous chemicals that are not listed may fall under the definition of a RCRA characteristic hazardous waste. The four RCRA classifications of characteristic hazardous waste are defined in the HWMP and below. Chemical wastes that do not exhibit any of the four characteristics of hazardous waste and are not listed are not considered hazardous waste. This does not mean that the chemical does not have dangerous properties. Protective measures are outlined in most material safety data sheets and should be taken when handling chemicals. Call the Office of Environmental Health & Safety at 6875 for guidance when unsure of the hazard status or handling procedures for chemicals and wastes.

- **Characteristic Hazardous Waste**

1. **Corrosive:** Aqueous and has a pH less than or equal to 2 (acidic) or greater than or equal to 12.5 (basic).
2. **Flammable:** Any material that has a flash point of 140 ˚F or less.
3. **Reactive:** Any waste having one or more of the following criteria is considered reactive.
    - Normally unstable and readily undergoes violent change without detonating, e.g., propargyl alcohol
    - Reacts violently with water, e.g., sodium metal
    - Forms potentially explosive mixtures with water, e.g., trichlorosilane
    - When mixed with water it generates toxic gases, fumes, or vapors in a quantity sufficient to present a danger to human health or the environment, e.g., phosphorous pentachloride
    - Sulfide or cyanide bearing waste that when exposed to pH conditions *between* 2 and 12.5, can generate toxic gases, vapors or fumes in a quantity sufficient to present a danger to human health or the environment, e.g., calcium cyanide
    - Capable of detonation or explosive reaction if it is subjected to a strong initiating source or if heated under confinement, e.g., 1,4-dioxane
    - Readily capable of detonation or, explosive decomposition, or explosive reaction at standard temperature and pressure, e.g., diborane
    - DOT forbidden explosive, e.g. trinitrotoluene.
4. **Toxic**: Toxic chemicals are listed as "D wastes" in RCRA and a listing is also provided in the HWMP. Common toxic metals as listed by EPA are arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver. Common toxic organic compounds are pyridine, benzene, carbon tetrachloride, dichlorobenzene, and methyl ethyl ketone. These chemicals have regulatory limits on the quantities that are considered hazardous waste. The concentration should be noted on any solutions containing toxic chemicals.

- **Chemical Waste Categories Requiring Mention**

Organic Solvents

Aqueous organic solvents must be segregated as chlorinated and non-chlorinated and waste accumulated in solvent safety cans. Chlorinated solvents are typically not flammable and are more expensive to treat. Non-chlorinated solvents are typically flammable and are less expensive to treat. Labels should be placed opposite of the pour spout. Ensure that all components are specified on the label, e.g., sulfuric acid, basic (NaOH), reactive (CN, S), toxic chemicals (mercury, lead), etc.

Peroxide Forming Compounds

All peroxide forming chemicals turned into the OEHS for disposal must have dates corresponding to when the bottle was received and first opened. Additionally, the date and results of testing to determine the concentration of peroxides must be included on the label. Without this information peroxide forming chemicals are treated as highly reactive. Highly reactive chemicals significantly increase the cost of disposal for the University.

Deactivation and Disposal of Ethidium Bromide

General Information: Ethidium Bromide (EtBr) is used as a stain in the visualization of nucleic acids in agarose gels. It is not regulated as a listed hazardous waste although, the mutagenic properties may present a hazard when not managed properly in the laboratory.

Wear a lab coat a lab coat, nitrile gloves, and chemical splash goggles when handling EtBr. When using an ultraviolet (UV) light source on your cultures stained with EtBr ensure that skin and eye protection are employed. Avoid exposing unprotected skin and eyes to intense UV sources. Wear a face shield if the UV source is pointing upwards. Also, when working with a UV source for a long time, wrap up lab coat sleeves with tape or other means where the wrist could be exposed.

Electrophoresis gels containing less than 0.1% EtBr do not pose a serious hazard and can be discarded in the trash if properly bagged and secured. (Please note that this only applies to electrophoresis gels and not EtBr solutions.) Place gels that contain *more than* 0.1% EtBr in an appropriate container and dispose of as hazardous waste.

Ethidium bromide is mutagenic and should be handled carefully. The disposal of ethidium bromide solutions can be managed in one of several ways.

1.) Request a pick-up from the OEHS by contacting 2352. Ensure the container is appropriately labeled.
2.) Commercial funnel filter kits that remove ethidium bromide from solutions are available. The filters supplied with the kits are packets of activated carbon. The kits are available through Schleicher and Schuell (S&S), Sargent Welch, and BIO101. The ethidium bromide removal kits are called The Extractor. When ordering from S&S the product number is 10448030. When ordering from Sargent Welch there are two kits to choose from one containing 2 units, with a product number 28165-500 or a 6 unit kit. The 6 unit kit product number is 28165-502. After using the kit the filtered buffer solution may be poured down the drain. The filters must be containerized and labeled as hazardous waste. Contact the OEHS for a pick up.

3.) The Lunn and Sansone method (below) may be used to neutralize the EtBr. Neutralization with bleach is not completely effective in removing the mutagenic properties of the solution and is not recommended.

The following procedure must be carried out in a laboratory fume hood utilizing all necessary personal protective equipment and following safety protocol. It is imperative that the reagents are fresh.

Lunn and Sansone Method

Reagents:

5% Hypophosphorous acid
0.5 M Sodium Nitrate solution
Sodium bicarbonate
pH paper

1. Dilute the solution to a concentration of <0.05% (50mg/100ml).
2. For each 100 ml of ethidium bromide (EtBr) solution, add 20 ml of 5% hypophosphorous acid and 12 ml of 0.5 M Sodium nitrate solution. Make sure the pH is less than 3.0. Stir the solution briefly.

3. The solution must react for a minimum of 20 hours. After the reaction is complete, neutralize with sodium bicarbonate (pH 4-9), and rinse down the sanitary sewer with copious amounts of water.

Deactivation of EtBr may be confirmed by using UV light to detect fluorescence.

EtBr contaminated debris includes gloves, bench paper and other non-labware items. Place contaminated debris into an appropriate container for hazardous waste disposal. All containers used for collection must have a secure cover. Label all hazardous waste and contact the OEHS when the material is ready for disposal. Double-bagging is an acceptable packaging method for waste EtBr contaminated debris only when the bag is tightly sealed.

Disposing of EtBr Contaminated Labware

Needles, scalpels, Pasteur pipettes, and other sharps contaminated with EtBr must be disposed of directly into a sharps container. These will be disposed of in the same manner as other waste sharps. Volumetric or transfer pipettes, and other disposable glassware contaminated with EtBr must be disposed of in a sharps container. Grossly/visibly contaminated glassware should be washed with bleach before disposal in a sharps container. Test tubes and centrifuge tubes contaminated with EtBr must first be emptied, with the liquid disposed of according to the procedures given above. Empty incidentally contaminated tubes may be disposed of in the trash. Grossly contaminated (visibly contaminated) tubes should be collected with other laboratory debris, labeled and disposed of as a hazardous waste. Most other disposable labware (e.g. sample vials, disposable beakers, etc.) incidentally contaminated with EtBr may be disposed of in the normal trash. Grossly contaminated (visibly contaminated) disposable labware should be labeled and managed as a hazardous waste.

C. Unknown Chemical Waste

Unknown chemical waste is any chemical that can not be identified. Disposal of unknown wastes can be difficult and extremely expensive. In the event an unknown chemical waste is found, the OEHS requests that you utilize the UAH Procedures for Characterizing Unknown Chemical Waste (Appendix B) prior to turning the waste in to the OEHS for disposal. The procedures are simple and provide enough information to transport and treat the waste in a safe manner. Chemical waste characterization tags are available from the OEHS for proper labeling of unknown chemical waste. Alternatively, you may request the OEHS to characterize the waste at a cost of $40.00 per sample.

D. Characterizing Unknown Chemical Wastes

Unknown chemical wastes are those chemical wastes that cannot be identified. “Unknowns” present safety, disposal, and regulatory compliance issues that must be avoided whenever possible. Minimizing unknowns generated on campus can be accomplished by labeling all chemical containers upon receipt or production (see UAH Guidelines for Labeling Chemical Wastes). Laboratory waste that cannot be identified is subject to a hazard characterization procedure prior to disposal. The characterization is used to determine how to handle and properly dispose of the waste. Unknowns may be turned in to the OEHS for hazard characterization or the procedure may be conducted within the department that generates the waste. The OEHS assesses a fee of $40 per unknown sample for chemical characterization. Contact the OEHS to request this service. If the University hazardous waste disposal contractor is required to characterize an unknown, the associated cost of analysis will be much higher and will be charged to the generating department.

Please note that there is danger involved with handling chemical unknowns. If the sample displays physical characteristics indicative of potentially reactive or peroxide forming chemicals (as listed below), or is suspected to be radioactive, contain biological materials, or pose any other unreasonable risk, **discontinue or stop** the characterization procedure and contact the OEHS immediately. Specialized equipment and handling practices may be required.

Potentially reactive chemical characteristics:

- solid materials under liquids
- bi-layered or multi-layered
- bulging, pressurized, or leaking containers
- corroded, rusted, or deteriorating caps

Peroxide forming compound characteristics:

- cloudy liquid
- crystals forming in bottles and around lids of partially or completely evaporated liquids

Note: Potential peroxide containing compounds must be labeled as "Possible Peroxide".

Minimal precautionary measures to be taken while handling all unknowns must include:

- Do not work alone.
- Handle the sample under a functioning fume hood with the sash pulled to the lowest level possible.
- Wear chemical resistant gloves, lab jacket or apron, goggles, and a face shield.
- Insure that a safety shower and eye wash station is within reasonable distance.
- Insure an ABC fire extinguisher is readily available.

Procedures for departmental characterization of unknown chemical wastes are outlined in Appendix B. Undergraduate students are not allowed to perform unknown hazardous waste analysis. It is recommended that all physical and chemical tests and observations be recorded in a permanent logbook for future reference. Characterized unknown waste must be appropriately labeled, regardless of its hazard status, and submitted to the OEHS for disposal. Characterization labels are available from the OEHS.

E. Labeling Chemical Waste

The UAH guidelines for labeling chemical waste are derived from EPA regulations. Each chemical waste label must contain the word waste, followed by an accurate description of the waste and a date. An accurate description includes each chemical component and its corresponding concentration. Ex: Waste 30% hydrogen peroxide, Waste 2M sulfuric acid, 500 mg/l lead oxide, 300 PPM barium oxalate, Waste Flammable liquid (30% acetone, 50% acetonitrile, 20% methanol), etc. The date listed must correspond to the date the chemical was determined to be a waste.

F. Requesting a Chemical Waste Pick-up

To request a chemical waste pick up, send a chemical waste manifest (see appendix B) to JRC 159, contact the OEHS by phone at 6875, or by email at hintonm@email.uah.edu.

XI. OEHS Safety Audits

The Hazardous Materials Specialist conducts annual safety audits of laboratories containing chemical materials and lasers to offer guidance and information in maintaining safer laboratory facilities and regulatory compliance. The Hazardous Materials Technician will identify safety issues that may effect personal safety, indoor air quality, building safety, and environmental degradation. One standardized form is used during the audit. This form is available in Appendix C. The procedures the Hazardous Materials Specialist will follow to notify faculty and staff of the audit results are:

1.) When the laboratory meets and exceeds laboratory safety protocol a memo will be drafted to inform the responsible person that the area was inspected and all guidelines have been met or exceeded. When deficiencies are noted, a copy of the audit is sent to the person in charge of the laboratory. This serves as the notice of deficiency. It outlines the hazards found in the laboratory and requests the responsible person to remedy the hazard and or contact the auditor prior to her return. A follow-up audit is scheduled for one month after the first audit.

2.) When deficiencies remain upon the completion of the first follow-up, a second notice of deficiency is drafted and sent to the person in charge of the laboratory. A memo referencing the notice of deficiency is

sent to the department chairperson and the Laboratory Safety Committee Chairperson. A copy of this memo is sent to the person responsible for the laboratory. A second follow-up audit is scheduled for two weeks after the first follow-up.

3.) Upon the completion of the second follow-up audit, any remaining safety hazards will result in a third notice of deficiency that is sent to the person in charge of the laboratory. A memo is drafted and sent to notify the appropriate dean. This memo is copied to the department chairperson, the Laboratory Safety Committee Chairperson, and the person in charge of the laboratory.

Information collected during laboratory safety audits is posted on the OEHS web site. To access this information: from the UAH home page, go to "Administration", then select "The Office of Environmental Health and Safety".

A. OEHS Safety Audit Schedule

The most current safety audit schedule can be reviewed on the OEHS web site.

B. Optional Self Audits

Departments have the option and are encouraged to conduct internal audits of their laboratory facilities. OEHS audit forms are available for this purpose. Alternatively, departmental audit forms can be developed. Departments choosing this option must have a departmental person designated as safety officer. The departmental procedures must be at least as stringent as the OEHS guidelines and copies of the audits must be remitted to the OEHS. Departmental audits are subject to review by the OEHS.

XII. Miscellaneous

A. Nuclear Magnetic Resonance (NMR)

The NMR facility is adjacent to the Materials Science and Optics Building Connector. NMR uses a powerful electromagnet in the identification process of chemical compounds. Due to the strong magnetic field certain precautions must be taken. Persons with pacemakers must not enter the NMR facility. The following are guidelines for safely working in and with the NMR.

- Permission to enter the facility is required. To obtain permission, contact the Director of the NMR facility. The Director will brief persons obtaining permission to enter the NMR facility on the appropriate safety precautions.
- The 10-gauss perimeter must be demarcated in the facility. Persons with implanted or attached medical devices such as prosthetic parts and stints must remain outside of the 10-gauss perimeter from the centerline of the magnet.
- All metal objects e.g., ordinary tools, electronic equipment, compressed gas cylinders, steel chairs, and steel carts, must be outside the 10-gauss perimeter from the centerline of the magnet. These objects can suddenly fly towards the magnet, possibly causing injury or damage to the equipment and facility.
- Cards with magnetic strips (credit, check, Charger cards) will be erased of information under the presence of the magnetic field. These types of cards must not be taken within the 10-gauss perimeter from the centerline of the magnet.
- Computer monitors and TV screens may be distorted by fringe magnetic field. Appropriate shielding is necessary.
- Only qualified maintenance personnel shall remove equipment covers or make internal adjustments. Dangerous high voltages that can kill or injure exist inside the instrument. Before working inside the cabinet, turn off the main power switch located on the back of the console, then disconnect the AC power cord.
- Do not substitute parts or modify the instrument. Any unauthorized modification could injure personnel or damage equipment.
- Do not operate in the presence of flammable gases or fumes. Operation with flammable gases or fumes present creates the risk of injury or death from toxic fumes, explosion, or fire.
- Leave the area immediately in the event of a magnet quench (sudden appearance of gases from the top of the dewar). This could result in an oxygen deficient atmosphere.
- Avoid liquid helium or nitrogen contact with any part of the body. The cause damage similar to a burn.

- Do not look down the upper barrel. Unless the probe is removed from the magnet, never look down the upper barrel as it is pnuematically driven and may cause injury as the sample is ejected.

B. Machine Shop Safety Practices

Machine shops are found in several locations on the UAH campus. Engineering and art shops are well equipped with machinery that may cause significant injury and or facility damage if not operated appropriately and under close supervision. Each department must institute policies for supervision, training, and personal protective equipment for those individuals conducting activities in UAH machine shops. It is highly recommended for students to enroll in the UAH Selected Topics Machine Shop course MAE 398 01 prior to unsupervised use of the machine shop equipment. Industrial machine shop operations fall under a myriad of Occupational Safety and Health Act regulations. General guidelines when utilizing woodworking and machine shop equipment are listed below. Specific information can be attained from the OEHS at 824-2352.

- Machines designed for a fixed location must be anchored securely.
- Personal protective equipment must minimally include hearing protection, eye protection, and closed toed shoes (preferably steel toed boots).
- Loose fitting clothing (including ties), jewelry, and accessories such as belts should not be worn while using machines.
- Eating, drinking, and tobacco products are not allowed in machine shops.
- Power controls must be clearly visible and labeled and accessible from the point of operation. The operator must not reach over the machine to access the power switch.
- Housekeeping is essential to minimize slips, trips, or falls and other hazards associated with clutter and metal filings, and wood dust and chips on the floor. Rubber mats should be used whenever necessary and possible.
- Safeguards must be used whenever possible, unless the guard poses a threat.
- Minimal training must include:
  (1) a description and identification of the hazards associated with particular machines
  (2) the safeguards, how they provide protection, and the hazards for which they are intended
  (3) how and why to use the safeguards
  (4) how and under what circumstances safeguards can be removed, and by whom, and
  (5) what to do if a safeguard is damaged, missing, or unable to provide adequate protection.

C. Children in labs

Special guidelines apply to some individuals under the age of 18 who may be involved with utilizing laboratories in UAH or under the control of UAH faculty. Applicability and guidelines for these persons can be found in Appendix F.

D. After Hours Experiments

After hours experiments must be approved through department chairpersons. Individual departments must implement policies concerning after hours experiments and laboratory access. A phone must be accessible to all after hours non-supervised laboratory users. Additionally, students are not allowed to work alone in the laboratory.

E. Available Safety Manuals

Contact the OEHS at 2352 or access the OEHS web site to receive a copy of any of the listed UAH safety manuals.

Biohazard Safety Manual
Hazardous Waste Management Plan
Radiation Safety Manual
Respiratory Protection Manual
Laser Safety Manual
Physical Plant Safety Manual

References

1. http://www.healthsafe.uab.edu
2. http://www.yale.edu/oehs
3. http:www-vcba.ucsd.edu/EHS/home.htm
4. http://www.ehs.neu.edu/
5. http://htf-curricula.mit.edu/bccourse/fumehood/survey-program.htm
6. http://www.hazard.com/MSDS
7. Prudent Practices for Handling Hazardous Chemicals in Laboratories, National Academic Press.
8. American National Standards Institute Z358.1 Compliance Checklist. Guardian Equipment, Emergency Eye wash and Shower Equipment, 1999.
9. SafeAire Laboratory Fume Hoods. Fisher Hamilton Product Specification Catalog, 2000.
10. American National Standard for Laboratory Ventilation Institute Z9.5. American National Standards Institute, 2001.
11. Phoenix Controls, Operations and Maintenance Manual. Revision A. Phoenix Controls Corporation, 1991.
12. Genium's Handbook of Safety, Health, and Environmental Data for Common Hazardous Substances, Genium Publishing Corporation, McGraw Hill 1999.
13. Unity INOVA Installation Planning Manual.

Appendix A

1. **Emergency Contact Sign**
2. **Injury Consultation Form**

UAH Emergency Phone Numbers

Hazardous Chemical/Substance Spill **6911**

Personal Injury **Contact Supervisor or call** **6911**
Employees and students must complete injury report
Available from the Office of Public Safety (OPS)
Return the form to the OPS

Personal Exposure **Contact Supervisor or call** **6911**
An incident where a person has been exposed to a hazardous material or biological agent that is an inhalation or skin absorption hazard and no immediate physical indications are noted.

Radioisotope spills **6911**

Biological spills **6911**

Material Safety Data Sheets (MSDS's)
Available in the lab or retrieve from www.uah.edu/admin/Fac/oehs

Office of Environmental Health and Safety **2352**

Office of Environmental Health and Safety
Johnson Research Center room 150
The University of Alabama in Huntsville
824-2352 fax 824-6668
oehs@email.uah.edu

UAH Laboratory Injury Consultation

After administering first aid, refer to the material safety data sheet (MSDS) or other chemical hazard information source and explain to the student the potential symptoms resulting from exposure to the chemical. Explain to the student that it is his/her responsibility to immediately seek emergency medical attention if the condition worsens and or he/she experiences any of the listed symptoms. If the student desires immediate medical attention but does not require an ambulance notify his/her emergency contact to transport the student.

Additional Instructions or Comments:

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

I understand that it is my responsibility to notify the instructor if the status of my injury sustained during the course of teaching lab _____ (course number) on _____ (date) worsens.

I have been informed of the potential side effects from this chemical exposure and I understand that if the status of the injury worsens, or the injury impairs my daily activity I must seek immediate medical attention.

Signature: _____ Date: _____
Student

Signature: _____ Date: _____
Teaching Assistant

Upon completion of this form:

1. *The pink copy must be given to the student.*
2. *A yellow copy must be sent to the Office of Environmental Health & Safety.*
3. *The original/white copy must be attached to the OPS accident form*.

Appendix B

1. **Hazardous Waste Management Plan**
   Appendix A – Listed Hazardous Wastes
   Appendix B – Non-Hazardous Chemical Waste
2. **Guidelines for Categorizing Unknown Liquid Chemical Wastes**
3. **Guidelines for Categorizing Unknown Solid Chemical Wastes**

Appendix C

1. Laboratory Environmental Health and Safety Audit Form

Appendix D

3. Laboratory Close Out Checklist

2. Instructions for Completion of the UAH Chemical Waste Manifest

Information concerning chemical disposal services can be found in the UAH Hazardous Waste Management Plan.

1. Generator Name: Print the first and last name of the principal investigator, the lab director or person who is responsible for and knows the hazards of the waste that is generated
2. Generator Number: Number that is assigned by the Office of Environmental Health and Safety (OEHS) which corresponds to the generator's building and room.
3. Building and Room: Building and room where waste will be picked up.
4. Department: The department generating the waste.
5. Telephone: The telephone number of the Generator
6. Date: The date the manifest was prepared for shipment.
7. Person Completing Manifest: The name of the person completing the manifest and preparing the waste for OEHS pickup
8. Chemical Compound: Identity of the compound or components of a mixture. Use one line for each waste substance. If the material is part of a waste mixture, draw brackets on the left of the first mixture component and after the last component. For example: [methanol, water, acetic acid].
9. Percent: Amount of this component in a mixture (estimate as closely as possible).
10. Physical Form: Liquid, gas, solid or aerosol.
11. Container Size: Record the size of container. Use the metric system units. Solids in grams (one pound = 454 g), liquids in liters (1.06 quarts = 1 liter).
12. ContainerType: Glass bottle, plastic carboy, metal can, etc.
13. Number of containers: How many.
14. Chemical Hazard Code (FOR OEHS USE ONLY): Code utilized by the OEHS in categorizing waste
15. Control Number (FOR OEHS USE ONLY): To be assigned by the OEHS.
16. Generator Signature: Signature of the responsible party.

General Information:
One copy of the manifest must be placed on the outside of each box of waste components.
To have materials picked up, send the original copy of the manifest to the OEHS. Keep a second copy as your record of waste disposal.

NOTE: Shock sensitive and water reactive materials require special handling. Call the OEHS at 2352 for instructions

Appendix E

1. Project Registration

Appendix F

1. **Guidelines for Minors in the Laboratory**
2. **Laboratory Project Registration for Minor Students**
3. **Parental Consent Form and Emergency Contact Information**

The University of Alabama in Huntsville
Guidelines for Minors in the Laboratory

These guidelines apply to persons who meet each of the following criteria:

- Persons between the ages of 14 and 18

(Persons under the age of 14 are not allowed in laboratories, special cases will be considered individually.)

- Persons participating in an outreach program on the UAH campus
- Persons performing laboratory experimentation

These guidelines do not apply to:

- Traditional undergraduate/graduate students
- Persons observing laboratory experimentation

Persons meeting the above criteria are referred to in the remainder of the guidelines as "covered persons".

These guidelines must be utilized to insure that covered persons are informed of laboratory hazards and receive appropriate safety training prior to beginning activities in UAH laboratories.

1. All covered persons must have a UAH faculty sponsor. The acceptable ratio of faculty sponsor to covered persons in the laboratory is 1:6. The faculty sponsor is responsible for insuring that safety training is obtained, that safety rules are followed, that the covered person's activities are monitored, and that all protective equipment necessary to prevent injury is utilized. Covered persons **cannot** handle the following classifications of materials.
    - radioactive
    - infectious agents
    - class 4 lasers
2. Under direct supervision by the faculty sponsor, covered persons **may** handle the following classifications of materials/devices:
    - corrosive
    - toxic
    - flammable
    - class 3 lasers
3. Prior to the commencement of activities, the covered person's legal guardian must complete the parental consent form and submit it to the faculty sponsor. The covered person may not begin laboratory activities until the faculty sponsor has received a written approval to proceed from the Office of Environmental Health and Safety. To obtain such approval the faculty sponsor must:
    - Submit Parental Consent Form and Project Registration Form for Minors Conducting Laboratory Experimentation to the Laboratory Safety Committee for review and approval at OEHS, JRC 151. The review and approval process will take approximately 1 week.
    - Upon review, the project is approved or modification(s) and resubmission is requested. The resubmission approval process will take approximately 2 working days.
    - Upon project approval, the OEHS will make arrangements with the faculty sponsor for covered persons to receive safety training.
    - The OEHS will transmit an approval to proceed notification to the faculty sponsor. The notification indicates the Parental Consent Form and Project Registration has been approved by the Laboratory Safety Committee, and that the covered person has been scheduled to receive laboratory safety training prior to the commencement of laboratory experimentation.

The University of Alabama in Huntsville
Parental Consent Form & Emergency Contact Information

The undersigned parent/legal guardian of _____ understands, consents, and agrees as follows:
My child has my permission to participate in laboratory activities at the University of Alabama in Huntsville in the following laboratory:

Name of Faculty Sponsor/
Laboratory Location _____

Dates of Laboratory Activities _____

I understand that laboratories are specialized environments in which instrumentation, equipment, chemicals, and biological materials may be used. I understand that even under ideal laboratory conditions, the use of these items involves greater risk when used improperly. My child will attend a laboratory safety training session, and will be taught how to appropriately handle such instrumentation and materials to reduce risk. Additionally, my child will be supervised in the laboratory at all times.

Knowing the circumstances and risks described above, and in consideration of permission for my child to participate in learning activities in the above referenced laboratory, I agree to my child's participation in laboratory activities conducted at the University of Alabama in Huntsville.

I grant my permission to The University of Alabama in Huntsville, members of it's faculty, agents, and employees to provide emergency care and treatments, as in their judgment may be deemed necessary or advisable in the event that my child should require emergency care while acting in the course of activities at the University. I assume the cost of the emergency care and treatment, if any. I accept responsibility for any treatment or care required by my child beyond the emergency status, and understand that I shall be liable for all costs and charges incurred on his or her behalf.

Date: _____ Witness: _____

Signed (parent/guardian): _____

Insurance Information

Policy Holder's Name: _____

Insurance Carrier: _____

Carrier Group Number: _____

Policy Number: _____

Medical Emergency Contact Information

Person to contact first

Name:_____

Relation to Student:_____

Daytime Phone:_____

Evening Phone: _____

Secondary Contact

Name:_____

Relation to Student:_____

Daytime Phone:_____

Evening Phone:_____