

# UAH LABORATORY SAFETY MANUAL

The UAH Laboratory Safety Committee and

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September 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.

<b>Review Date</b>	<b>Comments</b>	<b>OEHS</b>	<b>Lab Safety Committee</b>
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 UAH and the surrounding community. It is imperative that each member of UAH faculty, staff, and students who are working and leaning 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 safety and environmental goals.

As we work to provide accurate laboratory safety information in this manual, please remit any comments and recommendations to the OEHS. 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, et.al. 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. Fire and emergency evacuation procedures are also provided. The lab safety manual requires hazard notifications be made to the office of environmental health and Safety through project registrations and annual inventories. Notifications are necessary for regulatory reporting, preparedness, and knowledge. These allow us to effectively minimize risk to employees, the community, and the environment. 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 acquiring chemical waste disposal. 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.

## 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 Intermodal Facility, Room 123.

**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 The UAH Hazardous Waste Management Plan, 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*

<b>Category</b>	<b>Quantity</b>	<b>Response</b>	<b>Treatment Materials</b>
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 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 2171 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 microorganisms 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 safety data sheet (SDS). SDS 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 the applicable injury form available on the Office of Counsel web site. The information will be used to better prepare the University faculty and staff in the prevention and response of accidents and injuries.

### 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 tourniquet.
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 SDS 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](http://www.uah.edu/administration/oehs).

## **C. Radiation Safety Committee**

The Radiation Safety Committee is responsible for 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 & 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, safety data sheets (SDS) must be provided to the user. It is the

responsibility of the person requesting the purchase of the chemical to insure that the SDS have been placed in an area in which the users have access. SDS stations have been established in Wilson Hall, the Materials Science Building, and the Optics Building. Where SDS stations are not available the SDS must be placed in a labeled location in the laboratory. Copies of SDS must be retained on file at the OEHS for a minimum of 25 years.

Chemical manufacturers supply SDS to purchasing parties. Unless it is written on the purchase order, the SDS is sent to the accounts payable office. The accounts payable office forwards the SDS to the OEHS. The OEHS will make every effort to relinquish the SDS to the appropriate user. If you have not received an SDS 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](http://www.uah.edu/admin/oehs)
- Chemical manufacturer
- Vermont SIRI web site at <https://hazard.com/msds/index.php>
- [www.sigma-aldrich.com](http://www.sigma-aldrich.com)

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

### **Section 1 – Chemical Product and Company Identification**

Identifies the product and its synonyms. Gives the chemical and SDS suppliers name. Often will give the chemical abstracts service identifying number. The manufacturer's name is required to be listed on the SDS 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 SDS 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**

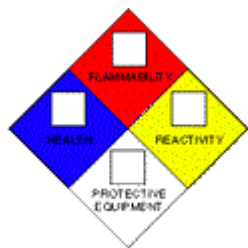
May be used to provide any additional information on regulations affecting the material.

### **Section 16 - Other information**

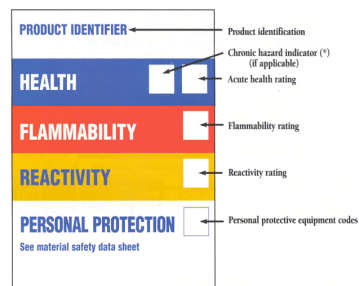
May be used to provide any additional information.

## **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. Appendix A includes a list of mandatory laboratory safety rules. Each year each student must sign a safety contract stating that he/she understands and will abide by the rules (appendix A). Laboratory Supervisors should retained the student safety contract on file.

## **B. SDS Availability**

Safety data sheets (SDS) must be readily available for each laboratory. A centralized location for SDS is permissible. SDS must be available at all times and near the hazard source. Prior to the use of a new chemical the SDS 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. Always check the SDS 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

#### 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<sub>4</sub>), 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

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

Some 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 Safety Data Sheet (SDS). The chemical label thus furnishes a quick method of determining whether the material is a fire hazard, health hazard, or reactivity hazard. The SDS 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.

<b>Group 1-A</b>	<b>Group 1-B</b>	<b>Potential Consequences</b>
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
<i>Group 2-A</i>	<i>Group 2-B</i>	<i>Potential Consequences</i>
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
<i>Group 3-A</i>	<i>Group 3-B</i>	<i>Potential Consequences</i>
Alcohols Water	Any concentrated item from Groups 1-A or 1-B Calcium Lithium Metal hydrides Potassium SO <sub>2</sub> Cl <sub>2</sub> , SOCl <sub>2</sub> , PCl <sub>3</sub> , CH <sub>3</sub> SiCl <sub>3</sub> Other water-reactives	Fire, explosion, or heat generation; generation of flammable or toxic gases
<i>Group 4-A</i>	<i>Group 4-B</i>	<i>Potential Consequences</i>
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
<i>Group 5-A</i>	<i>Group 5-B</i>	<i>Potential Consequences</i>
Cyanide and sulfide solutions	Group 1-B	Generation of toxic hydrogen cyanide or sulfide gas
<i>Group 6-A</i>	<i>Group 6-B</i>	<i>Potential Consequences</i>
Chlorates	Acetic acid and other organic acids	Fire, explosion, or violent reaction

Chlorine Chlorites Chromic acid Hypochlorites Nitrates Nitric acid, fuming Perchlorates Permanganates Peroxides Other strong oxidizers	Concentrated mineral acids Group 2-A Group 4-A Other flammable and combustible waste	
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## 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 Clean Out

All laboratories must perform an annual review of the inventory to inspect the conditions of chemical containers and to dispose of any unwanted, unusable, and or expired chemicals. This is called a Laboratory Clean Out. Unwanted but usable chemicals should be redistributed within the department or contiguous campus labs. Dispose of the chemicals that are outdated and no longer useable or desired through OEHS.

Before calling the OEHS for pick up:

- Remove and properly label all chemical waste from the laboratory and also from storage units such as refrigerators, cold rooms, stock rooms, and waste collection areas. Contact OEHS for assistance.
- Update the laboratory inventory.
- The start and end dates of the clean-out must be recorded. There are additional spaces for this on the Chemical Waste Inventory Form (appendix B). Also the name and amount of hazardous materials removed from the lab must be included on the inventory form.
- All laboratory equipment, fume hoods, bench tops, cabinets, floors, and shelves must be cleaned and decontaminated.
- If laboratory equipment is to be discarded, all hazardous materials (e.g., batteries, mercury switches, mercury thermometers, oil, asbestos linings, radioactive sources, and CFCs from refrigerators, etc.) must be removed before disposal. Contact OEHS for assistance. To dispose of equipment (not containing hazardous materials), place a move request for waste

disposal with Facilities & Operations Grounds Management. If the equipment is reusable place a surplus request with Business Services Central Shipping and Receiving.

- OEHS will be overseeing the clean-out procedure. If necessary, OEHS will make arrangements for an environmental services contractor to do the work.

All clean-out procedures must be documented according to 40 CFR 262.213 Subpart K. The documentation must identify the laboratory being cleaned out, must identify the PI/supervisors, start and end date of the clean-out process, and the amount of hazardous material generated. OEHS must keep all the documentation a minimum of three years from the date clean-out ends. The OEHS will maintain paper documentation in PPB 115 A and electronic copies on the Central Files located on the PPB server. OEHS must remove all the unwanted material generated during the clean-out process from the lab within 10 days of the end of the clean-out.

## 5. 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.

### A. Close Out 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 waste inventory must be completed and submitted to the OEHS. The inventory and is provided in Appendix B. Upon receipt of the inventory 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 inventoried 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 inventoried 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.

#### 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

#### 1. 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.

#### 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.

#### Variable Air Volume 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 is 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.

#### 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 Liquefied Flammable Gases in *Sprinklered* Laboratory Units Outside of Approved Storage Cabinets (Table 1)

Lab Unit Fire Haz Class	Flammable Combustible Liq. Class	Excluding Quantities in Storage Cabinets or Safety Cans				Including Quantities in Storage Cabinets or Safety Cans			
		Max. Quant. per 100 ft <sup>2</sup> of Lab Unit		Max Quant per Lab Unit		Max Quant. per 100 ft <sup>2</sup> 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 liquefied flammable gases.

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

Lab Unit Fire Haz Class	Flammable Combustible Liq. Class	Excluding Quantities in Storage Cabinets <sup>1</sup> or Safety Cans				Including Quantities in Storage Cabinets <sup>1</sup> or Safety Cans			
		Max. Quant. per 100 ft <sup>2</sup> of Lab Unit		Max Quant per Lab Unit		Max Quant. per 100 ft <sup>2</sup> of Lab Unit		Max. Quant per Lab Unit	
		L	gal	L	gal	L	gal	L	gal
A	I <sup>#</sup>	<i>Not Permitted</i>		<i>Not Permitted</i>		<i>Not Permitted</i>		<i>Not Permitted</i>	
	I <sup>#</sup> , II, IIIA	<i>Not Permitted</i>		<i>Not Permitted</i>		<i>Not Permitted</i>		<i>Not Permitted</i>	
B	I <sup>#</sup>	<i>Not Permitted</i>		<i>Not Permitted</i>		<i>Not Permitted</i>		<i>Not Permitted</i>	
	I <sup>#</sup> , II, IIIA	<i>Not Permitted</i>		<i>Not Permitted</i>		<i>Not Permitted</i>		<i>Not Permitted</i>	
C	I <sup>#</sup>	7.5	2	284	75	15	4	570	150
	I <sup>#</sup> , II, IIIA	15	4	380	100	30	8	760	200
D	I <sup>#</sup>	4	1.1	140	37	7.5	2	284	75
	I <sup>#</sup> , II, IIIA	4	1.1	140	37	7.5	2	284	75

<sup>1</sup>This category includes Class I flammable liquids and liquefied flammable gases.

<sup>#</sup>This category includes Class I flammable liquids and liquefied 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.

### 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 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 chemical waste are available in the UAH Hazardous Waste Management Plan found on the OEHS web site. Appropriate labeling of all chemicals 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.

Protective measures are outlined on most safety data sheets and should be taken when handling chemicals. Call the Office of Environmental Health & Safety at 2171 for guidance when unsure of the hazard status or handling procedures for chemicals and wastes.

### C. Unknown Chemicals

Unknown chemicals are those that cannot be identified. The generation of unknown chemicals can be eliminated by ensuring proper labeling and laboratory close-outs are performed. 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. Laboratory materials that cannot be identified are subject to a hazard characterization procedure prior to disposal. The characterization is used to determine how to handle and properly dispose of the waste.

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 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.

**Unknown chemical procedures:**

1. Contact OEHS immediately to inform about the existence of the material.
2. Gather as much information as possible about the waste and how it was generated.
3. Contact people who may have information about the material including those who left the university is recommended.
4. Do not move the material from your laboratory or work area. OEHS or the waste contractor will remove the material from your laboratory.

**DO NOT**

- dump unknown chemicals down the drain
- mix unknown chemicals with any other chemicals for consolidation
- bring unknown chemicals to a regular waste pickup unless instructed by OEHS to do so

Avoid generating unknown chemicals by following these basic rules:

1. Label all chemicals and secondary containers the moment it comes to the lab.
2. Do not use abbreviations.
3. Dispose of unwanted and unusable chemicals promptly.

**D. 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.

#### **E. Requesting a Chemical Waste Pick-up**

To request a chemical waste pick up, complete and fax a chemical waste inventory (see appendix B) to 2341, phone 2171, or email [greenm@uah.edu](mailto:greenm@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 Chemical Hygiene Officer 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 pneumatically driven and may cause injury as the sample is ejected.

## B. 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 E.

## C. 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.

## 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. <https://hazard.com/msds/index.php>
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. INOVA Installation Planning Manual.



## Appendix A

1. **Emergency Information Sign**
2. **Student Laboratory Safety Contract**



# CAUTION

## Admittance to Authorized Personnel Only

Location:

Room No:



No Food/Drink    Eye Protection Required    Lab Coat and Gloves Required

Contact	Name	Location	Phone
Emergency Contact 1			
Emergency contact 2			
OEHS	Rani Jacob	PPB Room # 113B	(256) 824-2352



## UAH STUDENT - LAB SAFETY AGREEMENT

Student Name: \_\_\_\_\_

Instructor Name: \_\_\_\_\_

Dept: \_\_\_\_\_ Course No.: \_\_\_\_\_

**This safety contract states the lab-safety rules that are to be executed by everyone involved in order to ensure the safety of work place for everyone (TA's, students, faculty and staff). Two copies should be signed and one returned to the TA, the other to be used by the student as a safety guide and should be present in the lab-notebook at all times.**

### GENERAL RULES

1. Students are required to practice disciplined and responsible conduct at all times when present in the laboratory. (Playing around in the laboratory, sitting or leaning on the lab benches, disorderly behaviors are not permitted at all times. Be alert and proceed with caution at all times in the lab).
2. Pre-lab reading assignments are to be completed prior to entering the laboratory. Thoroughly read all experimental procedures prior to entering the laboratory.
3. Use of food/drink (beverages, chewing gum, tobacco, etc.) and cosmetics in the laboratory is prohibited.
4. Use of cell phones, radios, MP3 players, or headphones is prohibited in the lab. Store these with your personal items in designated areas.
5. Observe good housekeeping practices. Work areas should be kept clean and tidy at all times. Bring only your lab manual, lab book and other necessary materials to the work area. All backpacks, coats, and other personal items must be stored away from benches, fume hoods, all chemicals, and out of aisles. Keep aisles clear.
6. All written and verbal instructions are to be followed carefully. If you do not understand a direction or part of a procedure, ask the TA or the supervising figure before proceeding.
7. Unsupervised presence of students in the lab is prohibited. Persons not participating in the course are not allowed in the lab without approval.
8. Execution of experiments authorized by the course instructor and supervised by the TA are the only experiments permitted.
9. Chemicals and equipment may NOT be removed from the laboratory under any circumstance. Authorization / supervision by the Principal Investigator or Professor responsible for the lab is required to remove any item from the lab.
10. Fume hood sashes must be closed when not in use. Fume hood sashes are not to be opened beyond the 18" mark when in use. Never stick your head into the fume hood.
11. Each student must execute experiments only in the work space designated to them and personally monitor their experiments in progress. Do not move the equipment/glassware for personal preference unless approved.
12. Hands and pens/pencils are to be kept away from face, eyes, and mouth while using chemicals or equipment. Hands are to be washed with soap and water after performing all experiments, especially before going to the restroom or leaving the lab for any reason.
13. All work surfaces and apparatus are to be cleaned each day by the student at the end of the experiment. Inventory and return of all equipment/glassware (clean and in working order) to the proper location is required. Broken or missing items must be replaced through the Stockroom with a replacement piece.
14. Proper disposal of all chemical waste is a must. Check the label on the waste container thoroughly before adding chemical waste to the container. Waste containers are not to be over filled. When the container is 85% full notify the supervisor.
15. Sinks are to be used only for water and solutions that are permitted by the TA. Mixing of chemicals in sinks is not allowed. Solid chemicals, metals, matches, filter paper, and all other insoluble materials are to be disposed of in their proper waste containers (not in the sink).

16. Do not attempt lab work if you are on a new medicine that could interfere with your ability to function safely in the lab.

### **PERSONAL PROTECTIVE EQUIPMENT**

17. Approved chemical splash goggles **MUST** be worn at all times when in the lab. The goggles must seal around the face and have no open holes. **NO EXCEPTIONS.**
18. Contact lenses *should* be replaced with prescription glasses.
19. Dress properly for lab. Clothing must cover the body from the shoulders down to toes. Lab coats are mandatory when the experiment requires them.
  - a. NO bare midribs or ankles
  - b. NO tank tops or low-cut tops
  - c. NO shorts, skirts, or cropped pants
  - d. **SHOES** must be closed-toed and completely cover the heel and top of the foot. **NO sandals.**
20. Long hair, hanging items (jewelry, hoodie strings etc), and loose or baggy clothes must be secured.
21. Gloves are available for use when needed and must be removed before leaving lab. Do not handle personal items such as pens with the gloves on.

### **HANDLING CHEMICALS**

22. All chemicals in the lab are to be considered dangerous and used with caution. Chemicals are not to be touched, tasted, or smelled. Only "wafting" method of smelling chemicals should be practiced (if needed) after undergoing proper demonstration by the TA.
23. Label on the reagent/chemical bottles must be checked thoroughly prior to use or transfer.
24. Only directed amount should be used /transferred. Unused chemicals must not be returned to their original container.
25. Proper disposal in the waste containers must be practiced.
26. All reagent bottles and waste containers must be capped when not in use. Reagent bottles must not be removed from their designated dispensing area.
27. Flammable solvents must not be used anywhere near flame.
28. Acids must be handled with care and as per directed by the TA. Always add acid to water, not water to acid.
29. Secured and careful transport of acids and other chemicals from one part of the lab to another must be practiced.
30. Any spills must be promptly notified to the TA or any supervising figure present. As directed by the supervising authority, Clean-up of small spills should be performed immediately.

### **HANDLING GLASSWARE AND EQUIPMENT**

31. Never handle broken glass with your bare hands. Use the dust pan and broom provided to clean up the broken glass. Place the broken glass in the containers marked "broken glass". Go to the stockroom and replace the piece of glassware.
32. Examine glassware before each use. Never use chipped or cracked glassware. Never use dirty glassware.
33. Fill wash bottles **ONLY** with distilled water and use it only as intended, e.g., rinsing glassware and equipment, or adding water to a container. Indicate contents of wash bottles with labels.
34. Unplug hotplates when not in use. When removing an electrical plug from its socket, grasp the plug, not the electrical cord.
35. Hands must be completely dry before touching the plug or switch.
36. Report damaged electrical equipment immediately. Look for things such as frayed cords, exposed wires, and loose connections. Do not use damaged electrical equipment.
37. Do not use a piece of equipment until its proper use is demonstrated by the TA.

### **ACCIDENTS and INJURIES**

38. Report any accident (spill, breakage, etc.) or injury (cut, bum, etc.) to the TA immediately, no matter

how trivial.

39. Report fires to the TA immediately.
40. If a chemical splashes in your eye(s) or on your skin, immediately flush with running water from the eyewash station or safety shower for at least 15 minutes. Notify the TA immediately.
41. Know the location of the following safety equipment:
  - a. Fire extinguisher
  - b. Safety shower
  - c. Eye wash
  - d. First aid kit
  - e. Chemical spill kit

### **EMERGENCY PROCEDURES**

In the event of a fire alarm (a continuous sounding bell) while you are working in the laboratory, immediately turn off any Bunsen burners or hotplates you are using and leave the building by the shortest route as designated by your TA. DO NOT use the elevators. Proceed to the assembly area with your TA. You must remain with your TA until you have been dismissed by supervising personnel.

In the event of a serious injury or someone becomes ill, immediately turn off any burners or hotplates and evacuate to the hallway until supervising personnel give you additional instructions. DO NOT leave until you have been dismissed by supervising personnel.

### **STATEMENT OF AGREEMENT**

I have read and agree to the safety rules set forth in the chemistry lab safety contract. I realize that I must obey these rules in order to insure my own safety, as well as the safety of others. I am aware that any violations of the contract can result in my removal from the laboratory and loss of credit for the experiment. I also understand that I can be held financially responsible for the laboratory equipment used in this course if I break or destroy an item due to carelessness, neglect, or misuse.

STUDENT SIGNATURE \_\_\_\_\_ DATE \_\_\_\_\_

## **Appendix B**

### **1. Chemical Waste Inventory Form**

## CHEMICAL WASTE INVENTORY

Begin Date:

End Date:

Chemical Name	Number of Containers	Size of Containers	Chemical Suitable for Reuse/Exchange YES/NO	Special hazards
<b>Total number of containers on page:</b>				

Add extra pages if needed

**Principal Investigator:** \_\_\_\_\_ **Phone No.:** \_\_\_\_\_

**email:** \_\_\_\_\_

**Lab Contact:** \_\_\_\_\_ **Phone No.:** \_\_\_\_\_

**Department:** \_\_\_\_\_ **Building and Room:** \_\_\_\_\_

**PI Certification:** The materials listed are identified and properly labeled for disposal or re-use.

**Printed Name:** \_\_\_\_\_

**Signature:** \_\_\_\_\_ **Date:** \_\_\_\_\_

**Appendix C**

**3. Laboratory Audit Form**

<b>A. LABORATORY INFORMATION</b>		
Building Name:		Room #:
Department:		Biosafety Level
Laboratory Supervisor		
Principal investigators & other Researchers located in the Laboratory		Number of personnel in lab:
Inspector:		
Objectives of the Laboratory:		
Types of Hazards Present:		
Does the laboratory work with BBPs?	HUMAN SOURCE Fluids and Tissues <input type="checkbox"/> Other Biohazards:	
Inspection Date:		

<b>B. GENERAL INFORMATION</b>	<b>YES</b>	<b>NO</b>	<b>N/A</b>	<b>Comments</b>
1. Does the Principal Investigator control access to the laboratory?				6 CFR 27 42 CFR 73.16
2. Do phones have emergency stickers on them?				40 CFR 262
3. Are after hour's contacts phone numbers posted on exterior laboratory doors and near laboratory Telephones				NFPA 45
4. Are hazard warning stickers, and restricted access signs posted, and legible?				NFPA 45,13.1, 29 CFR 1910.1450
5. Are lab shutdown procedures posted?				NFPA 45, Section 4.6.3.1
6. Are all doors to the laboratory closed when work is in progress?				NFPA-101, Section 7.2.1.8, NFPA 45,
7. Are stairways, corridors and aisles clear of equipment and other objects?				NFPA 45, IFC 605.3, 29CFR 1910.22(a)(2), 1910 .22(b)(1), 29CFR 1910 Subpart D, E, J
8. Are there clear markings for exits?				NFPA 45, 29CFR 1910.1200
9. Are all means of egress clear?				NFPA 1, Section 14.4.1, CFR1910.37(a)(3), 29CFR 1910 Subpart E
10. Are emergency evacuation routes and assembly points posted in each lab?				NFPA 45, Section 4.6.3.1



<b>C. PPE/PERSONAL HYGIENE PRACTICE</b>	<b>YES</b>	<b>NO</b>	<b>N/A</b>	<b>Comments</b>
1. Is appropriate personal protective equipment available (i.e., gloves face shields, goggles, safety glasses, etc.)?				29CFR 1910.1450, 29CFR 1910.132, 1910.132(a), 132(h) 29 CFR 1910.138(a), 1910.133(a)(2), 1910.133(a)(1)
2. Are laboratory coats and gloves used by all personnel working in the lab?				29 CFR 1910 Subpart 1
3. Are safety glasses worn in the laboratory all the time?				29CFR 1910.133
4. Are goggles or face shields available for splash hazards?				29CFR 1910.133
5. Is proper attire worn (i.e. no sandals or shorts)?				29CFR 1910.1450
6. Is eating or drinking prohibited in the laboratory?				29CFR 1910.141(q)(2), 29CFR 1910.1450 App A., Prudent Practice in the Laboratory 4.E.2,
7. If respirators are required in the lab, are they worn properly?				29CFR1910.134
8. Persons wash their hands: (i) after handling materials involving microorganisms or organisms containing recombinant DNA molecules and animals (ii) when exiting the laboratory.				29CFR 1910.1030, 29 CFR 1910. 1450 App A, 29CFR 1910.1030 (d) (2) (iii); OSHA 29CFR 1910.1450 (f) (4) (c)

<b>D. LABORATORY EQUIPMENT</b>	<b>YES</b>	<b>NO</b>	<b>N/A</b>	<b>Comments</b>
1. Is equipment maintained in good condition?				29 CFR 2910.212
2. Are guards in place where they are required on equipment?				29 CFR 1910 Subpart O, 1910.212
3. Are flammable storage refrigerators used to store flammable chemicals?				NFPA 45
4. Are refrigerators labeled “do not store food or drink” compliant?				29CFR 1910.1450 App A, 29CFR 1910.141(g)(4)
5. Do personnel follow the” no mouth pipetting” rule?				29CFR 1910.1030 (d) (2) (xii), 29CFR 1910.1450 App A
6 Are there hazardous chemicals/equipment scattered on the floor?				NFPA 45

<b>E. EMERGENCY EQUIPMENT</b>	<b>YES</b>	<b>NO</b>	<b>N/A</b>	<b>Comments</b>
1. Are eyewashes and showers accessible?				29CFR 1910.1048(i)(3), 29 CFR 1910.151(c)), (ANSI Z358.1-2004)
2. Is there a weekly eyewashes testing log available in the lab?				29 CFR 1910.151(c),
3. Have showers been tested in the last 90 days?				29 CFR 1910.151(c), ANSI Z358.1-2004), ANSI Z358.1
4. Is eyewash and shower located within ten seconds of travel time from the laboratory work area?				29 CFR 1910.151(c), (ANSI Z358.1-2004)
5. Is spill clean-up material available?				General Duty Clause of OSHA Act
6. Is a first-aid kit available? Is it fully stocked?				29 CFR 1910.151, General Duty Clause of the OSHA Act, OSHA Best Practice Guide
7. Are fire extinguishers charged and within their 30-day inspection date?				29 CFR 1910.157(e)(2), NFPA 10

<b>F. LABORATORY VENTILATION</b>	<b>YES</b>	<b>NO</b>	<b>N/A</b>	<b>Comments</b>
1. Is the hood inspection sticker visible and within its annual inspection date?				NFPA 45 ,8.12.2, 29CFR 1910.1450, 1450(e)(3)(iii)
2. Is the sash kept at the designated height when working inside the hood?				NFPA 45 8.8.3.1, 29CFR 1910.1450(3)(iii)
3. Are hoods used properly (i.e., no heated perchloric acid)?				NFPA 45 8.11
4. Is the hood clear of large pieces of equipment?				29CFR1910.1450(e)(3)(iii)
5. Is BSC within certification date?				29CFR.1030(e)(2)
6. Are biological safety cabinets (Class I or II) or other appropriate personal protective or physical containment devices (centrifuge) used whenever procedures with a high potential for creating aerosols are conducted?				General Duty Clause, 29 CFR 1910.1030, 1910.1030(d)(2)(i), 29 CFR 1910.1450, App A.,

<b>G. GLASSWARE</b>	<b>YES</b>	<b>NO</b>	<b>N/A</b>	<b>Comments</b>
1. Is broken glass box available?				Alabama Administrative Code Divisions 13 and 14
2. Is the broken glassware container is more than 3/4 full?				Alabama Administrative Code Divisions 13 and 14
3. Are there liquids or unclean glassware in the broken glass container?				Alabama Administrative Code Divisions 13 and 14
4. Is glassware handled and stored properly?				General Duty Clause
5. Is evaporated glassware apparatus shielded properly?				General Duty Clause

<b>H. HOUSEKEEPING</b>	<b>YES</b>	<b>NO</b>	<b>N/A</b>	<b>Comments</b>
1. Are all walkways, work areas, and equipment areas clean and free from clutter and chemicals?				NFPA 45 7-2.3.1, 29 CFR 1910.1030 (d)(4), 29CFR 1910.22(b)(1), 29CFR 1910 Subpart D, E, J
2. Are floors clean?				29CFR 1910.22(a)(2), 22(a)(1)
3. Are bench tops and fume hood surfaces clean?				29CFR 1910 Subpart D, E, J
4. Are work surfaces decontaminated at least once a day and after any spill of viable material?				29CFR 1910 Subpart D, E, J
5. Are all culture stocks, slants, contaminated liquid or solid wastes decontaminated before disposal?				Alabama Administrative Code Divisions 13 and 14
6. Are contaminated materials and wastes that are to be decontaminated at a site away from the laboratory placed in a durable leak-proof container which is closed before being removed from the laboratory?				NIH Guidelines, BMBL
7. Are all reusable lab glassware and accessories decontaminated after each use?				NIH Guidelines, BMBL

<b>I. CHEMICAL STORAGE</b>	<b>YES</b>	<b>NO</b>	<b>N/A</b>	<b>Comments</b>
1. Are chemical inventory sheets used and kept current?				EPCRA Section 3.9, NFPA 45, Section 7.2.3.3, 29 CFR 1910.1200
2. a. Do chemicals show date received and opened? b. Are there any expired peroxide forming chemicals in the lab?				NFPA 45, Section 7.2.3.5, NFPA 45 9.2.3.4
3. Are labels in good condition?				NFPA 45, 13.3, 1910.1200(b)(3)(i)
4. Are temporary use containers properly labeled?				NFPA 45 (2004) 9.2.3, 29 CFR 1910.1450 App. A (D)(2), 29 CFR 1910.1200
5. Are chemicals stored according to hazard class?				NFPA 45, Section 7.2.3.4

6. Are the storage areas adequately identified and have warning signs if necessary?				NFPA 45
7. If chemicals are stored above eye-level are guards present?				General Duty
8. Are carboys stored below eye-level?				General Duty
9. Are all chemicals stored off the floor?				NFPA 45
10. Are spill trays used?				40 CFR 264.175
11. Are bottles kept clean?				NFPA 45 (2004) 9.2.3, 29 CFR 1910.1450 App. A (D)(2)
12. Are flammable liquids (not under immediate use) stored in flammable storage cabinets?				Uniform Fire Code 79.201
13. Are highly reactive chemicals stored in chemical-safe refrigerators when recommended?				29 CFR 1910.1450
14. Are large flammable liquid containers used for pouring more than 5 gal., properly bonded and grounded?				Code(s) Uniform Fire Code - Division IV, Section 80.402 (b)(2)(F):
15. Are highly toxic chemicals including, carcinogens, mutagens, and teratogens, kept in secondary containers in a secure, appropriately labeled location?				29 CFR 1910.1003
16. Are vacuum pumps, ovens and other ignition sources segregated from flammable liquids?				General Duty Clause

<b>J. COMPRESSED GASES</b>	<b>YES</b>	<b>NO</b>	<b>N/A</b>	<b>Comments</b>
1. Are all gases secured properly?				29CFR 1910. 101, P-1-1965, C-6 1968 and C-8 1962, NFPA 45
2. Are all the gases capped or have regulators on them?				29 CFR 1910.101, NFPA 45
3. Are flammable gases (H <sub>2</sub> , acetylene, etc.) separated from oxidizers (O <sub>2</sub> , Cl <sub>2</sub> . Etc.) by 25ft?				NFPA 55, NFPA 45
4. Are alarms installed if 5 or more cylinders of simple asphyxiants are used in an unventilated space? (Ar, CO <sub>2</sub> , N <sub>2</sub> , He)?				NFPA 55, NFPA 45
5. If cryogenics are used, is PPE available?				General Duty Clause

<b>K. ELECTRICAL HAZARDS</b>	<b>YES</b>	<b>NO</b>	<b>N/A</b>	<b>Comments</b>
1. Are equipment cords in good condition?				NFPA 45, 29CFR.1910.303, 29CFR 1910 Subpart S
2. Are extension cords used only for temporary wiring?				NFPA 45, 29CFR.191022(a)(2),
3. Are multi-outlet connectors (power strips) secured and not overloaded?				29CFR 1910.303(b)(1)
4. Is equipment cord insulation intact; i.e., not cracked or frayed?				29CFR 1910.303(b)(1)
5. Are ground fault circuit interrupters used where shock hazards (moisture, water, steam) are present?				29CFR 1910.303
6. Are electrical outlets grounded?				29CFR 1910.303(b)(1)
7. Are cords used appropriately (not near water or under rugs)?				29 CFR 1910.303

<b>L. CHEMICAL WASTE MANAGEMENT</b>	<b>YES</b>	<b>NO</b>	<b>N/A</b>	<b>Comments</b>
1. Are bottles containing waste clearly marked?				40 CFR 260-272,

				ADEM Admin. Code ch. 335-14-3
2. Is the waste accumulation site clearly marked?				ADEM Admin. Code ch. 335-14-3
3. Is waste picked up regularly?				40 CFR 262, Subpart K
4. Are waste bottles stored off the floor?				
5. Is a copy of the Waste Management guide available?				40CFR 262, Subpart K

<b>M. BIOLOGICAL HAZARDS</b>	<b>YES</b>	<b>NO</b>	<b>N/A</b>	<b>Comments</b>
1. Are human tissues, fluids, blood or blood products, used in the lab?				29CFR1910.1030
2. Are any risk group 2 organisms used in the lab? (HIV, HBV, Bordetella, E. coli, Staphylococcus, Streptococcus, Adenovirus)				NIH Guidelines, BMBL, 42 CFR 73.16
3. Are biohazard signs posted on the door?				29 CFR 1910.1030 (d)(4);, 1910.1030
4. Is medical waste handled and stored properly and are sharps containers present where needed?				29 CFR 1910.1030, 1910.1030(d)(2)(viii). 1910.1030(d)(4)(ii)(E)
5. Is a copy of the Biosafety Manual available?				29 CFR 1910.1200
6. Are safety devices being used on retracting sharps (shielding)?				29 CFR 1910.1030(d)(2)(viii), 1910.1030(d)(4)(ii)(E)
7. Does the lab have access to an autoclave for decontamination?				29 CFR 1910. 1030
8. Is there an inventory for pathogens in the lab?				29 CFR 1910.1200
9. Are stock pathogens kept locked?				42 CFR 73.16, NIH Guidelines, BMBL

<b>N. SPECIAL PRACTICES</b>	<b>YES</b>	<b>NO</b>	<b>N/A</b>	<b>Comments</b>
1. An approved disinfectant known to be effective against the organisms in use is present in the laboratory				29CFR1910.1030
2. Laboratory coats, gowns, smocks, or uniforms are worn while in the laboratory. Before exiting the laboratory for non-laboratory areas (e.g., cafeteria, library, administrative offices), this protective clothing is removed and left in the laboratory or covered with a clean coat not used in the laboratory.				29CFR1910.1030, 29 CFR 1910.1030(d)(3)(i)].
3. Animals not involved in the work being performed are not permitted in the laboratory.				29 CFR 1910 Subpart I
4. Special care is taken to avoid skin contamination with organisms containing recombinant DNA molecules; gloves should be worn when handling experimental animals.				NIH "Guidelines for R-DNA Activities, 1996" 29 CFR 1910.1030(d)(3)(i)].
5. All wastes from laboratories and animal rooms are appropriately decontaminated before disposal.				29 CFR 1910.1030, 29 CFR 1910 Subpart I

<b>O. CONTAINMENT EQUIPMENT (BSL2)</b>	<b>YES</b>	<b>NO</b>	<b>N/A</b>	<b>Comments</b>
1. All Specimens / Cultures are <u>secured</u> from general access by non-laboratory associated individuals in freezers and / or incubators? (Lock and key access?)				42 CFR 73.16, NIH Guidelines, BMBL

<b>P. LAB PERSONNEL TRAINING (BSL-2/3)</b>	<b>YES</b>	<b>NO</b>	<b>N/A</b>	<b>Comments</b>
1. Have personnel been trained in the hazards associated with and instructed in safe-handling methods for the biological agent(s) used in the lab?				29CFR1910.1030, 29 CFR 1910.1200
2. Do all lab Personnel possess adequate experience and training for BSL-2 related research?				29CFR1910.1030
3. All Personnel have access to and have read appropriate sections of the CDC-NIH's " <i>Biosafety in Microbiological and Biomedical Laboratories</i> , 4 <sup>th</sup> or 5 <sup>th</sup> editions?				29CFR1910.1030, 29CFR 1910.1200
4. For laboratories working with organisms containing recombinant DNA molecules, have all persons read and become familiar with the requirements of the <i>NIH Guidelines</i> , specifically section III, Reporting Requirements for Recombinant DNA Activities?				29 FR 1910.1200
5. Is Bloodborne pathogen training provided?				29CFR 1910.1030

<b>Q. RADIOLOGICAL SAFETY</b>	<b>YES</b>	<b>NO</b>	<b>N/A</b>	<b>Comments</b>
1. Are radioactive materials used in the lab?				ADPH Chap 420-3-26- Part 2
2. Are appropriate radiation signs posted on the door?				10 CFR.20.1905, ADPH Chap 420-3-26 Part 10
3. Are bench tops covered with appropriate bench covering where RM is used?				10 CFR.20.1905, ADPH Regs
4. Are areas where radioactive materials are used or stored properly identified?				29 CFR. 1910.1200, ADPH Regs
5. Is radioactive material labeled properly?				10 CFR.20.1905,
6. Absorbents available for RM spills				40 CFR
7. Is the door kept locked when the lab is unattended?				10 CFR.20.1905,
8. Are lasers being used in the lab? List class.				ANSI Z136, OSHA Tech Manual Chap 6
9. Are laser hazard signs posted on outside entrance and at location of operation?				ANSI Z136, OSHA Tech Manual Chap 6
10. Is laser PPE available, used, and in good condition?				10 CFR.20.1905, 29 CR 1910

<b>R. ANIMAL SAFETY/IACUC</b>	<b>YES</b>	<b>NO</b>	<b>N/A</b>	<b>Comments</b>
1. Are animals used in the lab?				BMBL
2. Are they infected with biological agents?				BMBL, NIH Guidelines
3. Are PPE requirements posted and worn?				29 CFR 1910.1030
4. Are nonhuman primates used?				BMBL, NIH Guidelines
5. Are animal/bite scratch procedures posted?				BMBL, NIH Guidelines
6. Are animal restraining devices available and used?				BMBL, NIH Guidelines

<b>S. RECORDKEEPING</b>	<b>YES</b>	<b>NO</b>	<b>N/A</b>	<b>Comments</b>
1. Is a copy of CHP/ Laboratory Safety Manual available?				29 CFR 1910.1450 (e)(4)
2. Are SDS available and up-to-date for each chemical used in the laboratory?				1910.1200(b)(3)(ii),29 CFR 1910.1450(h)(1)(ii)
3. Are lab-specific SOPs written available for review by all occupants?				29CFR 1910.1450
Employee Training				1910.1200(b)(3)(iii), 29 CFR 1910.1450 (f)

Chemical Hygiene Officer Signature:  
Comments:

Date:

I have read and I understand the contents of the inspection report. I am also aware that it is my responsibility to correct all identified deficiencies within 2 weeks, and or provide a plan of action to the OEHS describing the steps taken to resolve the deficiency and a time line for these actions.

Print Name: \_\_\_\_\_

Signed: \_\_\_\_\_ Date: \_\_\_\_\_

Comments:

If you have further questions, contact:  
The Office of Environmental Health & Safety at 256-824-2171

## Appendix D

### 1. Project Registration

The University of Alabama in Huntsville  
Office of Environmental Health and Safety  
PROJECT REGISTRATION

1

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**Instructions:** Contact the OEHS at 824-6053 or 824-2171 for any questions associated with this registration. Submit a scanned completed and signed hard copy to the Office of Environmental Health & Safety at [greenm@uah.edu](mailto:greenm@uah.edu). A notification of receipt will be sent to the address indicated in Section I.

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**I Name (Principal Investigator/Title):** \_\_\_\_\_  
**email address:** \_\_\_\_\_  
**Title of Project:** \_\_\_\_\_

**Campus/Business Phone No.:** \_\_\_\_\_

**Location of Project (Building and Room):** \_\_\_\_\_

**UAH Department, Center or Institute:** \_\_\_\_\_

**Is this an addition or change to original form?**  Yes  No

**Please indicate original project title and date:** \_\_\_\_\_

\_\_\_\_\_

**Personnel involved in project:** \_\_\_\_\_

\_\_\_\_\_

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**II Instructions:** Respond to all questions in this section by checking yes, no, or NA and completing the appropriate information. A chemical inventory must be provided with this form if answering yes to numbers 2 - 6. The inventory must include the chemical name, manufacturer and chemical container size.

**Does this project involve:**

1. Radioisotopes or x-ray generating equipment  Yes  No

List the radioisotopes and their chemical form to be used and or the x-ray generating instrumentation utilized:

How will the radioisotope or equipment be used: \_\_\_\_\_

Has the Radiation Safety Committee approved this use?  Yes  No

If yes, date approved: \_\_\_\_\_

Authorized User: \_\_\_\_\_ Phone No.: \_\_\_\_\_

2. Provide a list of carcinogenic/mutagenic/teratogenic chemicals that will be used or generated:  NA
3. Provide a list of the highly toxic chemicals that will be used or generated:  NA
4. Provide a list of toxins or toxic products that will be used or generated:  NA
5. Provide a list of pressurized gases that will be used or generated:  NA
6. Provide a list of other (not previously listed) hazardous chemicals that will be used or generated:  NA

\_\_\_\_\_

7. List the classification, type and intensity of the laser(s) that will be used or produced:  NA

\_\_\_\_\_

\_\_\_\_\_



## Appendix E

- 1. Guidelines for Minors in the Laboratory**
- 2. Parental Consent Form for Minors in the Lab**

## 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 for minors conducting laboratory experimentation to the Laboratory Safety Committee for review and approval at OEHS, PPB 114. 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 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 for Laboratory Use & 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 its 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

Secondary Contact

Name: \_\_\_\_\_

Name: \_\_\_\_\_

Relation to Student: \_\_\_\_\_

Relation to Student: \_\_\_\_\_

Daytime Phone: \_\_\_\_\_

Daytime Phone: \_\_\_\_\_

Evening Phone: \_\_\_\_\_

Evening Phone: \_\_\_\_\_