CHEMICAL HYGIENE PLAN

THE UNIVERSITY OF ALABAMA

ENVIRONMENTAL HEALTH AND SAFETY

http://ehs.ua.edu/

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Introduction

The University of Alabama is committed to full compliance with federal, state, and local laws and regulations regarding hazardous materials. The Office of Environmental Health and Safety (EHS) is responsible for developing and implementing policies and programs for chemical safety. Additionally EHS is responsible for developing and maintaining University policies related to the purchase, receipt, storage, security, transportation, use, and disposal of all hazardous materials and for designing and conducting training programs for University personnel regarding hazardous materials management.

Colleges, schools, departments, or other units using or generating hazardous materials are responsible for maintaining accurate records to track hazardous materials from their purchase or generation through their storage or disposal and for getting proper review or approval before ordering or using these materials. Colleges, schools, departments, or other units may develop policies or procedures for dealing with hazardous materials within their units, but these policies are subject to review by the Office of Environmental Health and Safety and must be consistent with University policies.

Scope

The Chemical Hygiene Program will cover all science-related laboratories on the University of Alabama campus that present any chemical hazards in labs. Specific plans for these hazards are supplements to this plan. Please refer to the other safety manuals for more additional definitions (General Safety Manual, Biosafety, Radiation Safety, Laser Safety, Etc.)

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Definitions

A. PROGRAMREQUIREMENTS I. RESPONSIBILITIES

1. **The President of The University of Alabama** has the ultimate responsibility for enforcing the Chemical Hygiene Plan and shall, with other administrators, provide continual support for the institutional Chemical Hygiene Program. The Vice President of Research is the named Institutional Official for compliance in research activities.

2. **The Deans and Associate Deans of a college** are responsible for ensuring each department is aware of its responsibilities under the Chemical Hygiene Plan, provide continual support, and serve as liaison with EHS on matters of compliance and safety.

3. **The supervisor, chair, or other administrative unit of the department** is responsible for chemical hygiene in that unit.

4. **The Principal Investigator and/or laboratory supervisor** has overall responsibility for chemical hygiene in the laboratory, including responsibility to:

   A. Develop and implement a Lab Chemical Hygiene Plan for each lab.
   B. Ensure that workers and/or students know and follow the chemical hygiene and safety guidelines.
   C. Ensure that protective apparel and equipment are available and appropriate for the potential exposure.
   D. Ensure that appropriate training has been provided.
   E. Inform lab personnel of the permissible exposure limits (PEL) for OSHA regulated substances or recommended exposure limits for other hazardous chemicals where there is no applicable standard. If you are unsure of the necessary actions please contact EHS for further details.
   F. Ensure lab personnel exposure to OSHA regulated substances do not exceed the permissible exposure limits.
   G. Provide regular chemical hygiene, housekeeping and emergency equipment inspections.
   H. Ensure that facilities and training are adequate for the use of any material that is present in the lab.
   I. Provide appropriate training when working with hazardous chemicals developed in the lab with both known and unknown compositions.
   J. When an incident/ accident and/or near miss occurs within the lab an on the job injury report should be submitted (http://riskmanagement.ua.edu/forms/ojiform.pdf)
   K. Implement and enforce the use of safety procedures.
   L. Ensure the availability of Safety Data Sheets and relevant reference materials.

M. Consult with EHS for safety matters as they pertain to specific lab and/research aspects.
N. Report all necessary and appropriate documents to EHS.
O. Meet all requirements of the Lab Decommissioning Guidelines (http://ehs.ua.edu/forms-and-documentation/) whenever a lab is relinquished for any reason.

5. **The laboratory employee, personnel, and/or student is responsible for:**

A. Planning and conducting each operation in accordance with the Chemical Hygiene Plan and any other applicable safety guidelines.
B. Complying with all practices, procedures and policies of the chemical hygiene program.
C. Participating in training programs concerning the requirements of the chemical hygiene program and other applicable environmental, safety and health regulations.
D. Request information or training when unsure about how to handle a hazardous chemical.
E. Following all health and safety procedures.
F. Reporting all hazardous conditions to the supervisor.
G. Wearing or using prescribed personal protective equipment.
H. Reporting any job-related injuries or illnesses to supervisor immediately.

6. **The Office of Environmental Health and Safety is responsible for:**

A. Working with administrators, faculty and laboratory personnel to develop and implement appropriate chemical hygiene policies and practices.
B. Monitoring procurement, use, storage, and disposal of laboratory chemicals.
C. Ensuring that adequate documentation is maintained by the individual departments.
D. Conducting laboratory safety surveys.
E. Assisting with training programs as needed or requested.
F. Providing assistance to departments, administrators, laboratory personnel or students and the campus community as needed.
G. Providing industrial hygiene monitoring and services as needed.
H. Serving as the University subject matter experts, providing a record of required documentation and serving as an information source.

7. **Lab Safety Committee (LSC)**

The Laboratory Safety Committee (LSC) is charged with providing consultation to the Lab Safety Program of EHS regarding the impact of safety and environmental regulations on academic and/or research activities at The University of Alabama. The committee will provide information to their colleagues and serve to represent their departments in discussions regarding new and changing regulations. They will assist EHS by collecting information or providing feedback that can be utilized in formulating University responses to specific issues. The LSC can serve as subject matter experts and provide guidance and assistance with assessing extremely hazardous materials if needed. They will review lab accidents or incidents and may make recommendations for changes to policies or procedures as a result of such reviews.

This committee will meet quarterly, more often if needed.

II. TRAINING

1. Initial training sessions related to the UA Chemical Hygiene Plan and General Lab Safety will be required for all employees, lab personnel and students working in UA labs. Refresher training on lab safety is required annually. EHS provides online and in person trainings annually and as requested. A complete list of online trainings is located at http://ehs.ua.edu/training/list-of-training-courses/ Training may be requested through the EHS website specifically through the training information page located at http://ehs.ua.edu/training/. Questions regarding specific online and/or in person trainings offered may be submitted via this website.

2. The P.I./Lab Supervisor will be responsible for training/informing lab workers regarding the following matters:

   a) Content of Lab CHP.

   b) Availability and location of the OSHA Lab Standard and the University's CHP as well as any other departmental CHP.

   c) Availability of reference material describing laboratory hazards.

   d) Location and proper use of specific emergency equipment.

   e) Response to a fire, including evacuation plan and use of emergency equipment, emergency plans for each area, as well as be familiar with the signs and symptoms of exposure for the materials utilized in the lab/research.

3. Employees, lab personnel and/or students shall receive initial training prior to any assignment that places them in a laboratory covered by the chemical hygiene program.

4. Prior to working in the lab the P.I., Lab Supervisor, or EHS shall provide the affected personnel and/or students with appropriate information and/or training for lab specific chemical usage procedures, Safety Data Sheet (SDS) information, hazard related training, etc.

5. Additional training shall be provided by the laboratory or the departmental representative whenever procedures, conditions, chemical usage, facilities, etc. change in a manner that may alter the chemical hygiene plan.

6. EHS shall assist in the initial and annual training sessions and provide training information and further assistance as requested.

III. VISITORS/MINORS IN LAB

Visitor Access Policy for Laboratories and Workshops Where Hazardous Chemicals, Physical Agents, Biological Agents, Radiation, Radioactive materials or any Hazardous Processes are used as follows:

Access to University of Alabama laboratories, workshops, and other areas housing hazardous chemicals, physical agents, or machinery is limited to trained and authorized faculty, staff and students of the UA. It is the obligation and responsibility of personnel who arrange for visits to hazardous or potentially hazardous areas to contact the individual or department in charge of the space prior to entry. The person responsible for visitors must ensure that those entering any of these areas are adequately protected from hazards and are informed about the safety and emergency procedures relevant to their activities.

Other persons, in particular children under the age of 16, are not permitted in hazardous work areas such as laboratories, with the exception of University sanctioned tours and visits or visits authorized by a Department. In these instances, careful supervision must be exercised by the tour leader or other knowledgeable personnel.

Exceptions to the foregoing, such as cooperative use of UA facilities and equipment by university and corporate researchers or use of university facilities and equipment by visiting scholars, must be approved by appropriate college and university officials, and must be documented by such things as written agreements, MOA (Memorandum of Agreement), Sponsored Research Agreement, etc., signed by an authorized UA official.

If visitors will be performing lab work or will be working within a lab space they should receive training. Please contact the EHS office or submit a training request online at http://ehs.ua.edu/training/.

IV. BASIC RULES

1. Avoid skin and eye contact with all chemicals.

2. Minimize all chemical exposures.

3. Assume that all chemicals of unknown toxicity are highly toxic.

4. Post warning signs when unusual hazards, hazardous materials, hazardous equipment, or other special conditions are present.

5. Avoid distracting or startling persons working in the laboratory.

6. Use equipment only for its designated purpose.

7. Combine reagents in their appropriate order.

8. Avoid adding solids to hot liquids.

9. A continued emphasis should be placed by all laboratory personnel on safety and chemical hygiene at all times.

10. Never leave containers of chemicals open.

11. All containers must have appropriate labels. Unlabeled chemicals should never be used.

12. Labels on incoming containers must not be removed or defaced.

13. Do not taste or intentionally sniff chemicals.

14. Never consume and/or store food or beverages or apply cosmetics in areas where hazardous chemicals are used or stored.

15. Mouth suction for pipetting or starting a siphon shall not be used.

16. Wash exposed areas of the skin prior to leaving the laboratory.

17. Long hair and loose clothing must be pulled back and secured from entanglement or potential capture.

18. Safety glasses should be worn in any area where chemicals are used or stored. They should also be worn any time there is a chance of splashes or particulates to enter the eye. (Please see the latest version of ANSI Z87-1 standard for approved eyewear).

19. Closed toe shoes shall be worn at all times in the laboratory. Perforated shoes or sandals are not considered appropriate.

20. Determine the potential hazards and appropriate safety precautions before beginning any work.

21. Procedures should be developed which minimize the formation and dispersion of aerosols.

22. If an unknown chemical is produced in the laboratory, the material should be considered hazardous.

23. Do not pour chemicals down drains. Do NOT utilize the sewer for chemical waste disposal.

24. Keep all sink traps (including cup sink traps) filled with water by running water down the drain at least monthly.

25. Do not utilize fume hoods for evaporations and disposal of volatile solvents.

26. Perform work with hazardous chemicals in a properly working fume hood to reduce potential exposures.

27. Avoid working alone in a building; do not work alone in a laboratory if the procedures being conducted are hazardous. Should be consistent with work alone policy

28. The OSHA Permissible Exposure Limits (PEL) and the Threshold Limit Values (TLV) as established by the American Conference of Governmental Industrial Hygienist (ACGIH) shall be observed in all areas. If lab personnel know or suspect the PEL is or could be exceeded please contact EHS immediately to establish monitoring.

29. Each PI/Lab Supervisor must develop and have readily available a Lab Chemical Hygiene Plan (CHP) for each laboratory he/she supervises, and shall review and update it at least annually. (SOP template located at http://ehs.ua.edu/compliance/chemicalsafety/sops/sop-library/).

30. Access to a laboratories and support areas such as stockrooms, specialized laboratories etc. should be limited to approved personnel only.

31. All equipment should be regularly inspected for wear or deterioration.

32. Equipment should be maintained according to manufacturer's requirements and records of certification, maintenance, or repairs should be maintained for the life of the equipment.

V. EMERGENCY RESPONSE

1. There must be a posted evacuation diagram, indicating routes of egress.

2. All lab workers must be trained on the evacuation procedure, and this training must be documented.

3. Immediate evacuation is necessary upon activation of the fire alarm, notification by authorized personnel, or an immediate threat to life and health.

4. If evacuation is necessary, stop all work.

5. Extinguish all flames and heat sources.

6. Proceed to the nearest exit.

7. Do not use elevators.

8. If conditions permit, supervisors should check to determine if the area is vacated.

9. Do not re-enter until instructed to do so by authorized personnel.

B. BUILDING AND/OR LAB DESIGN AND SAFETY FEATURES

I. VENTILATION

1. General ventilation of each lab room should have a performance level of at least six (6) room air changes per hour.

2. General ventilation provides a source of air for breathing and makeup air for local ventilation devices; it must not be relied upon for protection from toxic substances released into the laboratory.

3. General air flow should not be turbulent and should be relatively uniform throughout the laboratory.

4. Quality and quantity of general ventilation should be evaluated when equipment is installed, whenever a change in the local or general ventilation is made, whenever significant structural modifications are made in the laboratory, and at least annually.

5. Ventilation system alterations shall only be made if testing and analysis indicates that worker protection from toxic contaminants will continue to be adequate.

6. A laboratory hood with 2.5 linear feet of hood space per person shall be provided for every two workers or students if they spend most of their time working with chemicals.

7. Each hood should have a device which continuously monitors hood performance. Do not disable alarms. Know what they mean, act on what they indicate, and report the discrepancy for corrective maintenance. (http://ehs.ua.edu/compliance/laboratoryventilation/)

8. Fume hoods will function according to the Fume Hood Management Plan. (http://ehs.ua.edu/wp-content/uploads/2014/02/UA-Fume-Hood-MgmtPlan02102014.pdf)

9. Fume hoods that will not be in use for more than three months can be hibernated. (http://ehs.ua.edu/wp-content/uploads/2014/02/UA-Fume-Hood-MgmtPlan02102014.pdf)

10. Vertical hood sash should be as low as practical during use and should be closed when not in use. Combination sashes should be closed; and the horizontal windows, stacked in front of the user.

11. Hoods which are used to store chemicals temporarily shall operate continuously. Hoods shall not be used as permanent storage cabinets for chemicals and equipment. If a hood is too crowded, it will not function properly.

12. Ventilated storage cabinets and canopy hoods should be provided as needed. Canopy hoods are designed to address odors and heat exhaust, not hazardous materials.

13. Exhaust air from glove boxes and isolation chambers shall be passed through scrubbers, filtration or adsorption media prior to release.

14. The general ventilation system shall be designed to avoid the intake of contaminated air.

15. Do not start a laboratory procedure if you suspect the ventilation system cannot handle the chemical emissions.

16. Apparati such as vacuum pumps, distillation columns, chromatographs, etc. which may discharge toxic amounts of hazardous chemicals, shall be vented into a local exhaust, snorkel exhaust or hood system.

17. Glove boxes and gloves shall be inspected prior to each use.

18. Negative pressure glove boxes must have a ventilation rate of at least 2 volume changes per hour.

19. EHS should be contacted immediately anytime the ventilation systems are not operating properly. (http://ehs.ua.edu/fume-hood-service-request/)

20. Nonemergency reports of fume hood issues may be submitted electronically through ehs.ua.edu

II. FIRE SAFETY

1. EHS will inspect extinguishers at least once per month.

2. If an extinguisher has been discharged, notify EHS.

3. Dry sand and/or other applicable materials should be present for pyrophoric metals in case of fire.

4. Before using an open flame, make sure there are not flammable vapors in the area.

5. Gas burner tubing should be examined periodically for wear.

6. All laboratory users must be knowledgeable of the operation of fire safety equipment.

7. When transferring flammable liquids from one metal container to another, containers shall be bonded and grounded.

III. EMERGENCY SAFETY EQUIPMENT

All laboratory personnel shall have access to emergency equipment, a fire alarm, and a telephone for use in an emergency. Personnel should be familiar with the safety facilities and procedures in the lab. All lab workers are expected to know where the fire alarm pulls, safety showers, eye washes, spill clean-up kits, and emergency exits are located.

1. Approved eyewash stations shall be available in each laboratory that utilizes hazardous chemicals or materials/equipment that might cause a significant eye injury.

2. Safety showers shall be provided in each laboratory that utilizes hazardous chemicals or materials/equipment that might require drenching to remove the hazard from an individual.

3. Safety shower and eyewash stations should be located within a 10 seconds travel distance; this is generally accepted to be no more than 75 feet and only with one obstruction such as a door.

4. The only exception is in the event that the overall hazard of the laboratory would be increased by the presence of a shower unit coupled with existing instrumentation (i.e. electrical shock hazard due to the presence of instrumentation, etc.). In this case, a shower in an adjacent area shall be designated for use by the occupants of the affected laboratory.

5. Fire extinguishers must be available, charged, and hung in a location that is immediately accessible, generally in a hallway. IF DISCHARGED, contact EHS to get the extinguisher serviced and returned.

6. All laboratory safety equipment, such as showers, eyewashes, and hoods, shall be inspected at least annually by the EHS and at least monthly by the responsible laboratory supervisor.

7. Written documentation of all inspections shall be maintained by the responsible department performing inspections.

IV. SIGNS AND LABELING

1. Emergency signs shall be conspicuously posted in each area where hazardous chemicals are used or stored.

2. All signage should designate personnel restrictions or requirements for entry.

3. All containers, receptacles, etc. must be labeled with contents and hazard information.

4. Safety showers, eyewashes, fire equipment, respiratory equipment, emergency telephones, etc. should be designated by signage.

5. Laboratories or areas with unusual hazards such as a magnetic field, radioactivity, biological hazards, heat, cold, molten metals, high electrical energy, etc. shall have warning signs posted at each entrance.

6. Laboratories or areas where solvents or other flammable fire risk materials are used shall have signs posted at each stating the flammability hazard.

7. All laboratories shall be posted with signs documenting required PPE and restricting food consumption.

V. LAB RENOVATION, MODIFICATION, DESIGN

1. Contact EHS when considering renovations to an existing lab facility.

2. Lab ventilation must be addressed according to Lab Ventilation Management Plan (http://ehs.ua.edu/wp-content/uploads/2014/02/UA-Fume-Hood-MgmtPlan02102014.pdf).

3. Ventilation equipment must be certified when installed and decommissioned if removed.

4. Major renovations will require submitting of a Project Initiation Request (PIR http://www.uafacilities.ua.edu/pages/project-initiation.html).

5. Lab designs should be according to current requirements and standards.

C. GENERAL LAB PRACTICES
I. HOUSEKEEPING

1. Work areas shall be kept clean and free of obstructions.

2. Waste shall be deposited in appropriate receptacles. All lab personnel must be instructed about the different kinds of waste generated and appropriate methods for disposal.

3. Sharps such as needles, scalpels, broken glass, etc. shall be placed in approved sharps containers prior to disposal. When the container is ready for disposal, it is the responsibility of the Lab personnel to secure the container and remove it from the lab. (Please visit our hazardous waste page for more information http://ehs.ua.edu/operations/hazardous-materials/)

4. Surfaces should be kept clean of spills. Chemicals of any form (liquid, powders, etc)

5. Access to exits, emergency equipment, utility controls and other safety equipment must never be blocked and a three feet clearance for access must be maintained.

6. Hallways and stairways must not be used as storage areas.

7. Chemicals, especially liquids, should never be stored on the floor. Large bottles (2.5L or larger) or heavy items (greater than 5 lbs) should never be stored above the bench top (over 6 feet).

7. Work areas shall be cleaned at the end of the operation and/or at the end of each work day.

8. Reagents, solutions, glassware, or other materials shall not be permanently stored in hoods.

II. PERSONAL PROTECTIVE EQUIPMENT (PPE)

1. Personal protective equipment (PPE) including coveralls, eye protection, gloves, respirators, etc., appropriate for the degree of hazard present in the laboratory shall be worn at all times. The PI/Lab Supervisor must perform risk assessment for the proper selection of PPE and is responsible for the proper selection and maintenance of PPE.

2. All personnel shall be informed of PPE requirements and trained in the proper use of PPE.

3. All PPE shall be regularly checked for integrity and maintained in clean, functional order.

4. PPE shall be readily available for use at all times. If it is stored in an enclosed area, then the area must be designated by signs or labels.

5. Respirator use shall be consistent with the University of Alabama's Respiratory Protection Program. Contact EHS and the respiratory protection program via the website at http://ehs.ua.edu/operations/occupational-safety/respiratory-protection/

6. Eye protection shall be worn at all times by personnel and students in laboratories a) where hazardous chemicals are used or stored and b) where, because of the materials used or processes utilized, a significant potential for eye injury exists.

7. If you have questions or concerns regarding your PPE please contact EHS at (205) 348-5905 or http://ehs.ua.edu/contact-us/

III. SAFETY DATA SHEETS

1. Safety Data Sheets (SDS), previously known as Material Safety Data Sheets (MSDS) must be available for each chemical stored or used. UA maintains SDS information via the Chemical Safety Software .http://chemicalsafety.com/sds-search/

2. Chemical Safety Software Safety Data Sheet Search may be accessed through the EHS website or http://ehs.ua.edu/safety-data-sheets-and-ghs-labels/

3. Safety Data Sheets shall be made available to any employee, lab personnel or student who must work with or in the immediate vicinity of chemicals.

4. Along with a copy of the SDS, employees, lab personnel and students shall receive an explanation covering the information on the SDS for each chemical used, prior to initial use.

5. In addition to the Chemical Safety Software system, manufacturers must provide SDS with each shipment. Manufacturer's specific MSDS/SDS are the preferred version. Also, for generic SDS information, there are multiple sites on the Internet that are excellent resources for SDS's. If you have questions or concerns regarding your PPE please contact EHS at (205) 348-5905 or http://ehs.ua.edu/contact-us/

IV. STANDARD OPERATING PROCEDURES

1. The UA Chemical Hygiene Plan will address generic procedures relevant to safety and health considerations to be followed when laboratory work involves the use of hazardous chemicals.

2. The PI/Lab Supervisor is responsible for developing written standard operating procedures for any work with hazardous chemicals in laboratories including work with explosives, peroxide formers, and/or pyrophoric materials.

3. Training on standard operating procedures must be provided to affected employees and lab personnel.

4. EHS will review and keep on file all submitted SOPs. EHS provides an SOP library.

5. EHS will also provide guidelines for composing and creating SOPs for individual laboratory-specific chemical hygiene plans.

6. Standard operating procedures should include the following provisions:

   A. circumstance of use
   B. potential hazards
   C. engineering controls
   D. work practice controls
   E. Personnel protective equipment (PPE)
   F. Transportation and storage
   G. Unwanted chemical/waste disposal
   H. Spill procedure
   I. Training of personnel
   J. Signature and date space

V. FLAMMABLE HAZARDS

1. Do not use an open flame to heat a flammable liquid or to carry out a distillation process under reduced pressure.

2. Use an open flame only when necessary and extinguish it when no longer needed.

3. Prior to lighting a flame, remove all flammable substances from the immediate area.

4. Store flammable materials in an appropriate flammable cabinet.

5. When volatile materials are present, use only non-sparking explosion-proof electrical equipment such as explosion-proof refrigerators.

6. Laboratory desks and furniture should be constructed of fire-retardant materials.

VI. GLASSWARE

1. Broken glass is glass that is simply broken but not contaminated or is not broken but is in need of disposal. Broken glass should be disposed of in a puncture resistant container labeled “sharps” or “broken glass.”

2. Each laboratory shall have a specified container for broken glass/sharps.

3. To dispose of broken glass containers, please label the container, seal, and carry to the dumpster. Disposal of broken glass is the individual lab’s responsibility.

4. Tubing should be fire polished or rounded and lubricated prior to insertion into rubber stoppers.

5. Only glassware designed for vacuum work shall be used for that purpose.

6. Glass vacuum dewars shall be wrapped with the appropriate materials.

7. Hand protection should be used when picking up broken glass.

8. Glassware with small chips should be discarded.

9. Conventional laboratory glassware must never be pressurized.

VI. UNATTENDED EXPERIMENTS

If lab workers initiate equipment or experimentation that is potentially dangerous, and must leave it unattended for a long period of time or even overnight, then generally acceptable safety procedures should be met. These are:

1. **Any necessary arrangements must be finalized prior to experimentation** – Someone should check the lab periodically. If the procedure involves continuous utilities such as water, power, etc. then confirm that your department has not received any notices from Maintenance regarding cut-offs.

2. **Observe all fire precautions -** No open flames should be left unattended. Over temperature cutoff devices should be used on heated oil baths that run unattended.

3. **Post a notice on or near the experiment** – the notice should clearly communicate the emergency shutoff procedures and the nature of the hazards and contact information.

4. **Place an appropriate warning sign** on the door (listing the nature of the experiment in progress, and include the name and phone number of the person responsible for the experiment.).

5. **Provide items appropriate for the containment of toxic substances** in the event of failure of a utility service (such as cooling water) to an unattended operation.

6. **Whenever possible, use automatic shutoff devices for** long term or unattended operations. Please be mindful of potential situations such as the loss of cooling water and overheating, etc.

7. **Be aware -** If alarms or safety equipment or systems are activated due to an unattended experiment malfunction the department and/or Principal Investigator responsible for the experiment could be responsible for damages to the building, lab spaces, furniture etc.

VII. SPILL POLICY

1. Spills of a potentially hazardous nature should be reported immediately to EHS, extension 8-5905, or extension 8-5454 after hours, on weekends, or during holidays.

2. Chemical spills of 4 L or more may require materials, protective equipment, or special handling that could make it unsafe for cleanup by laboratory workers themselves. Lab workers should contact EHS personnel to evaluate how to proceed with spill cleanup.

3. EHS personnel will determine the need for any further action, such as ventilation of the area, summoning the fire department, or evacuation.

4. If the spill is of such a nature as to be life threatening, evacuation should take place immediately.

5. Each laboratory shall maintain a spill containment kit that is to be used when it is deemed inadvisable to wait for EHS personnel.

6. The chemical spill kit should contain at minimum: sodium bicarbonate or commercial acid neutralizer; vermiculite; citric acid or commercial caustics neutralizer, rubber gloves, pH papers, safety glasses/goggles, foot protection and several "area closed" signs. Containment pillows and/or socks may be substituted for use in spill containment.

7. For labs with biological agents, a basic biological spill kit should include disinfectant, absorbent material, waste containers, PPE, and mechanical tools.

8. If a lab has the potential for a radiological spill, then a radiation decontaminant, such as Rad Con, should be available for decontamination.

9. The area in which a potentially hazardous spill occurs should be closed immediately and signs posted to that effect at each entrance of the area.

10. Personnel involved in cleaning a hazardous materials spill must utilize appropriate protective equipment and supplies.

11. Waste generated from a spill clean-up must be handled as unwanted chemical materials, and pickups should be requested via the unwanted chemical pick up request located at http://ehs.ua.edu/ .

D. CHEMICAL MANAGEMENT
I. CHEMICAL PROCUREMENT AND STORAGE

1. Before a chemical is received, information on the proper handling, storage and disposal procedures shall be known to any personnel who will be involved with its use.

2. Chemicals must not be accepted without an adequate identifying label.

3. Stockrooms and/or storerooms should not be used as preparation area.

4. Stockrooms and/or storerooms should be open during normal University hours, shall have an employee and/or lab personnel assigned responsible for the area and shall be a controlled access area.

5. Stored chemicals shall be examined periodically by the appropriate lab chemical hygiene officer for deterioration, container integrity, and possible need for replacement.

6. All chemical storage areas must have a storage methodology which allows for segregation of different classes of materials (i.e. acids, bases, flammables, reactives, highly toxic, etc.).

7. Chemicals shall not be stored on bench tops.

8. Toxic chemical storage areas should be clearly designated by signage or placarding.

9. Chemicals that are highly toxic shall be in unbreakable secondary containers.

10. Check the integrity of containers. Observe compatibility of the chemical with the type container used. For example, hydrofluoric acid must not be stored in glass and some oxidizers should not be stored in plastic containers.

11. If chemicals are hand carried, the chemicals shall be placed within an unbreakable secondary container.

12. All chemical purchases shall be made according to department and university policy. All chemical purchases should be checked against the Chemicals Requiring Prior Approval list, maintained by EHS (http://ehs.ua.edu/ordering-information/requestapproval-for-chemicals-of-interest/). Items on this list cannot be ordered without prior approval by EHS. These items should be delivered to Environmental Health and Safety, 410 Campus Drive E, Tuscaloosa, AL 35401-

0178.Items that are not on the prior approval list can be received at the individual department or area by a person so designated for this responsibility by the department or area. This person
must be trained according to DOT regulations

13. Do not store unnecessary chemicals in the hood. Highly toxic chemicals, chemicals with a foul odor, etc. may be stored in a hood if a vented storage cabinet is not available.

14. Chemicals shall not be stored higher than eye level, generally accepted to be six feet.

15. All containers must be labeled as to content and hazard.

16. Shelving should be equipped with ledges.

17. Chemicals shall be segregated by hazard classification and compatibility and then arranged alphabetically within chemical families.

18. Chemicals, equipment, and lab supplies at The University of Alabama are not available for sale to the general public.

II.SHIPPING AND RECEIVING

The U.S. Environmental Protection Agency (EPA) and the U.S. Customs Office require that **all** chemicals (including chemical samples) imported into or exported out of the U.S. must be certified. The type of certification required depends on whether the chemical is listed by EPA under the Toxic Substances Control Act (TSCA). International shipments of chemical samples require a TSCA certification.

The University of Alabama is responsible for complying with the Department of Transportation (DOT) and/or the International Air Transport Association (IATA) regulations as they apply to all areas of our campus. If you intend on shipping and/or receiving a potentially hazardous material (including chemicals, biological materials, or dry ice), please contact EHS.

When ordering chemicals, always check the Chemicals Requiring Prior Approval list prior to placing an order. Any chemical on this list must have an approval from EHS and must be delivered to EHS

EHS does not ship any Chemicals of Interest (COI) off campus or to any unverified third parties. If you wish to ship chemicals to a third party, you will need to complete and submit the third party verification shipping form located at http://ehs.ua.edu/formsanddocumentation/ to EHS. This includes original shipments, returns, samples and/or specimens.

Please visit the Shipping information webpage located on the EHS website (http://ehs.ua.edu/operations/hazardous-materials/shipping-information/).

When transporting chemicals located on campus either between and/or within labs please be mindful of these items:

1. Always transport chemicals with a secondary containment device (i.e., rubber pail) when transporting chemicals from the storeroom to the laboratory or even short distances within the laboratory.

2. When transporting several containers, use carts with attached side rails and trays of single piece construction at least 2 in. deep to contain a spill that may occur.

3. Bottles of liquids should be separated to avoid breakage and spills. Avoid high-traffic areas when moving chemicals within the building.

4. When possible, use freight elevators when transporting chemicals and do not allow other passengers. If you must use a general traffic elevator, ask other passengers to wait until you have delivered the chemicals.

5. Always ground and bond the drum and receiving vessel when transferring flammable liquids from a drum to prevent static charge buildup.

6. Use a properly operating chemical fume hood, local exhaust, or adequate ventilation, as verified by monitoring, when transferring PHSs.

III. CHEMICAL INVENTORY

Chemical inventory must be maintained via the inventory system approved for use by EHS. EHS will set up the initial inventory and will reconcile the inventory information annually. During the year, it is the responsibility of lab personnel to keep the inventory data current.

Access to the inventory system is granted once training is completed. Training is required for all full time faculty and staff who own chemicals. Once this training is completed, they can then request training for any other individuals who work in the laboratory. Training completion accounts are run weekly and inventory accounts are created based on completion report results.

IV. LABELING

1. All chemicals must be prominently and accurately labeled as to content. The full chemical name must be in English. Formulas and abbreviations are not acceptable.

2. Unlabeled chemicals must not be used.

3. All chemicals transferred to secondary containers should be labeled with appropriate hazard identification information.

4. Label all secondary containers with the chemical name and appropriate hazards.

5. Make sure all labels are legible and intact.

6. Date all peroxidizable and other chemicals that may become unstable over time. They should display both the arrival date and date opened.

V. INCOMPATIBLES

Many chemicals when mixed with other materials can produce effects which are harmful to human health and the environment, such as heat or pressure, fire or explosion, violent reactions, toxic dusts, mists, fumes, gases, or flammable fumes or gases. Precautions should also be taken not to store these chemicals together.

As an example, see for a list of incompatible chemicals or the EHS website

http://www.epa.gov/ogwdw/dwa/sanitarysurvey/pdfs/training_sanitarysurvey_addendum02_storageofchemicals.pdf

Chemical Segregation/Compatible Storage

To avoid unwanted reactions, keep chemicals separated by hazard class whenever possible. EHS recommends the following hazard classes for general separation of chemicals, but other approaches can be used:

1. Acids
2. Bases
3. Flammables
4. Oxidizers
5. Reactives

Laboratories with large numbers of hazard classifications may choose to further segregate mineral/organic acids, unstable compounds, heat sensitive compounds, gases, etc.

If you need assistance with your chemical storage/segregation please contact EHS (205) 3485914.

VII. **CORROSIVE CHEMICALS**

General Information

The major classes of corrosive chemicals are strong acids and bases, dehydrating agents, and oxidizing agents. These chemicals can erode the skin and the respiratory epithelium and are particularly damaging to the eyes. Inhalation of vapors or mists of these substances can cause severe bronchial irritation. If your skin is exposed to a corrosive, flush the exposed area with water for at least fifteen minutes. Then seek medical treatment.

Strong acids

All concentrated acids can damage the skin and eyes, and their burns are very painful. Nitric, chromic, and hydrofluoric acids are especially damaging because of the types of burns they inflict. Seek immediate medical treatment if you have been contaminated with these materials (particularly hydrofluoric acid).

Strong alkalis

The common strong bases used in the labs include potassium hydroxide, sodium hydroxide, and ammonia. Burns from these materials are often less painful than acids. However, damage may be more severe than acid burns because the injured person, feeling little pain, often does not take immediate action and the material is allowed to penetrate into the tissue. Ammonia is a severe bronchial irritant and should always be used in a well-ventilated area, if possible in a hood.

Dehydrating agents

This group of chemicals includes concentrated sulfuric acid, sodium hydroxide, phosphorus pentoxide, and calcium oxide. These chemicals have a powerful affinity for water. When skin is exposed to these chemicals, serious burns may result. A large amount of heat is produced when mixing these substances with water; mixing should always be done by adding the agent to water, and not the reverse.

Oxidizing agents

In addition to their corrosive properties, powerful oxidizing agents such as Perchloric and Chromic Acids (sometimes used as cleaning solutions) present fire and explosion hazards on contact with organic compounds and other oxidizable substances. The hazards associated with the use of Perchloric acid are especially severe. It should be handled only after thorough familiarization with recommended operating procedures.

Special Handling Procedures

1. Corrosive chemicals should be used in the chemical fume hood, or over plastic trays when handled in bulk quantities (> 1 liter) and when dispensing.

2. When working with corrosives, wear gloves, goggles, long sleeved lab coat and closed toe shoes.

3. Handling of bulk quantities of these chemicals requires use of rubber aprons and the combined use of face shields and goggles. If you are handling bulk quantities of these chemicals, regularly make certain you know the location of an eyewash station and safety shower as this safety equipment should be immediately available.

4. Spill materials - absorbent pillows, neutral absorbent materials or neutralizing materials (all commercially available) should be available in the laboratory.

5. Store corrosives in cabinets, under the hood or on low shelves, preferably in the impervious trays to separate them physically from other groups of chemicals.

6. Keep containers not in use in storage areas and off bench tops.

7. If it is necessary to move bulk quantities from one laboratory to another or from the stockroom, use a safety carrier (for example rubber buckets for secondary containment and protection of the container).

a) Perchloric acid

Perchloric acid reactions that are less than 48% concentration **and** are not heated may be conducted in a standard chemical fume hood. However, perchloric acid reactions performed with higher concentrations or that involve heat must be used in a designate perchloric acid fume hood.

Under some circumstances perchloric acid may act as an oxidizer and/or present an explosion hazards. Organic materials are especially susceptible to spontaneous combustion if mixed or contacted with perchloric acid. Under some circumstances, perchloric acid vapors form perchlorates in duct work, which are shock sensitive.

Hence, when heating Perchloric acid above ambient temperature, a **Perchloric acid fume hood** with a water wash down system or a local scrubbing or trapping system must be used.

Please refer to our Perchloric Acid-Guidelines for Usage and Storage for more information.

b) Hydrofluoric Acid – Emergency Procedures

First aid must be started within seconds in the event of contact of any form!

Skin Exposure to HF
*Please purchase an HF treatment kit to keep readily available.

1. Immediately flood the affected body area with cool water for a minimum of 5 minutes, if calcium gluconate is available. If no calcium gluconate is immediately available, continue rinsing the affected area until emergency medical responders arrive, using copious amounts of water. Remove contaminated clothing or footwear while rinsing.

2. Call or have a co-worker call for medical assistance. Be sure to indicate that you were exposed to hydrofluoric acid.

3. Gently rub calcium gluconate ointment onto the affected area. Continue applying until emergency medical responders arrive.

4. Inform responders and all others that the exposure involved hydrogen fluoride/hydrofluoric acid.

Eye or Inhalation Exposures to HF

1. Flush eyes with plenty of cool tap water for 15 minutes.
2. Move inhalation exposure victim to clean air.
3. Call or have a co-worker call for medical assistance.

Await emergency medical responders, informing them and all others that the exposure involved hydrogen fluoride/hydrofluoric acid. Hydrogen fluoride and hydrofluoric acid cause severe, deeply penetrating burns to the skin, eyes, and lungs.

Although concentrated forms of these compounds are readily perceived by a burning sensation, more dilute forms are often imperceptible for many hours. This potential time delay between exposure recognition and treatment can lead to insidious and difficult-to-treat burns. If you work with hydrogen fluoride or hydrofluoric acid, make certain you and your coworkers familiarize yourselves with these first aid procedures and keep an updated supply of 2.5% calcium gluconate ointment in the work area.

c) Picric Acid

Picric acid is used in some biological stains. It is safe to handle when it contains at least 30% water by weight. However, if it is allowed to dry, it becomes shock-sensitive and may explode. Purchase picric acid in small quantities and do not break the seal on the bottle until you need to use it. Store it away from metallic compounds. EHS recommends that you record the weight of the bottle when you open it and again after you have removed material (the "last closed weight"). Next time the bottle is opened, compare the current weight with the last closed weight; if the bottle weighs less, water has evaporated. Add water to the container to return it to the last closed weight before you remove more picric acid.

Be sure to wipe the threads of the bottle and the inside of the cap before you replace the cap. Minute amounts of picric acid can fall into this area, dry out, and become shock-sensitive; the bottle may explode next time it is opened.

E. PROCEDURES FOR WORKING WITH PARTICULARLY HAZARDOUS CHEMICALS

I. PARTICULARLY HAZARDOUS CHEMICALS PRECAUTIONS

In addition to the general safety guidelines, special precautions are needed when handling carcinogens, organ specific toxins, pyrophorics, reproductive toxins and chemicals with a high degree of acute toxicity. A minimum set of guidelines that should be followed are listed below. The lab supervisor should submit a standard operating procedure to ensure appropriate engineering controls are available and that all administrative processes are designed to minimize risk of exposure to these substances.

1. Quantities of these chemicals used and stored in the laboratory should be minimized, as should their concentrations in solution or mixtures.

2. Work should be performed within a functioning fume hood, ventilated glove box, sealed system, or other system designed to minimize exposure to these substances.

3. Compressed gas cylinders which contain acutely toxic chemicals must be kept in ventilated gas cabinets.

4. Each laboratory utilizing these substances must designate an area for this purpose and must sign or mark this area with an appropriate hazard warning. The designated area may be an entire laboratory, an area of the laboratory or a device such as a fume hood or glove box. The designated area should be marked with a DANGER, specific agent, AUTHORIZED PERSONNEL ONLY or comparable warning sign.

5. Chemicals that are known human carcinogens, mutagens and teratogens shall be used only in designated areas in the laboratory. These areas must be posted and their boundaries clearly marked.

6. Only those persons trained in the use of these chemicals can work in the designated area. Pregnant women are urged to consult with EHS before working with mutagens or teratogens.

7. All such persons wishing to work with these chemicals will:

    a. Use the smallest amount of chemical that is consistent with the requirements of the work to be done.
    b. Use the high-efficiency particulate air (HEPA) and/or charcoal filters or high efficiency scrubber systems to protect vacuum lines, pumps, and fume hood exhaust.
    c. Decontaminate a designated area when work is completed.

d. Prepare wastes from work with adverse chemicals for disposal in accordance with specific disposal procedures consistent with the unwanted chemical hazardous material management policies from EHS.

8. Laboratory workers must be trained in the hazards associated with these chemicals and the precautions to take, including proper selection and use of PPE.

9. Employees and lab personnel must be informed of the signs and symptoms associated with exposures to hazardous chemicals used in the laboratory.

10. Storage of all adverse chemicals in locked and enclosed spaces with a slight negative pressure compared to the rest of the building is preferred.

11. Do not wear jewelry when working in designated areas, because toxic chemical decontamination of jewelry may be difficult or impossible.
Wear long-sleeved clothing and gloves known to be resistant to permeation by the chemicals to be used when working in designated areas.

12. Detection equipment may be required in laboratories where chemicals (especially poisonous gases) with a high degree of acute toxicity are utilized.

13. All wastes contaminated with these substances should be collected and disposed of in a timely manner and in accordance with current EHS disposal practices.

14. The designated working area shall be thoroughly and appropriately decontaminated and cleaned at regular intervals.

15. Emergency response planning for releases or spills shall be prepared by the lab supervisor and included in the training of the laboratory workers and others who may be affected in the building.

II. CHEMICALS OF HIGH CHRONIC AND ACUTE TOXICITY

Laboratory workers use a variety of chemicals as part of their daily work routine. Many of these substances are potentially hazardous to a person's health. The actual hazards that a chemical may present depend not only on the properties of the chemical, but also on the manner in which it is used and the resulting exposure to the worker. With the proper handling, even highly toxic or dangerous chemicals can be used safely.
On the other hand, chemicals that are not highly toxic can be extremely hazardous if handled improperly.

Whether or not a chemical exposure will result in injury depends on many factors. In addition to the dose, the outcome of exposure is determined by the way in which a chemical enters the body, the properties of the chemical itself, and the susceptibility of the individual receiving the dose.

Acute Toxicity	**Chronic Toxicity**
Single short exposure	Effects usually delayed
Effects usually appear quickly	Repeated exposure
Effects often reversible	Usually irreversible

1. Work with high chronic or acutely toxic chemicals shall be done in a controlled or restricted access laboratory.

2. All glassware, equipment, fixtures, etc., must be thoroughly decontaminated prior to removal from the controlled laboratory.

3. Vacuum pumps should be protected from contamination by scrubbers or HEPA filters.

4. Contaminated equipment, supplies, glassware, etc. shall be decontaminated or managed as hazardous waste. Contaminated equipment must be labeled indicating which portion of the equipment remains contaminated if any.

5. The controlled laboratory must be decontaminated prior to the resumption of normal activity.

6. When exiting a controlled laboratory, remove any protective clothing, place it in a designated waste container, and thoroughly wash hands, arms, face and neck.

7. Only wet cleaning methods and/or a HEPA filter equipped vacuum must be used for housekeeping.

8. If cancer causing substances are used, a medical surveillance program should be initiated.

9. Controlled laboratories shall be marked on the exterior of all entrances with signs stating "WARNING RESTRICTED ACCESS".

III. CARCINOGENS

For more information on Carcinogens and Probable Carcinogens, go to the Environmental Health Information Service website, at http://www.cdc.gov/niosh/topics/cancer/npotocca.html

Federal regulations govern work with all listed carcinogens. All precautions outlined in Section III A must be observed.

Containers of waste from experiments involving appreciable amounts of weak, moderate or controlled carcinogens should be labeled as to content and the warning: "CANCER SUSPECT AGENT". These items should be collected by EHS in accordance with the current EHS disposal practices

Carcinogens are agents that can cause cancer. In research, there are many potential exposures to carcinogens. Generally, workplace exposures are considered to be at higher levels than for public exposures. Material safety data sheets (MSDSs) should always contain an indication of carcinogenic potential.

A list of carcinogens may are located at:

http://www.cdc.gov/niosh/topics/cancer/npotocca.html

https://www.osha.gov/SLTC/carcinogens/

IV. TERATOGENS, MUTAGENS AND EMBRYOTOXINS

1. Mutagens and teratogens may affect the embryo or fetus or may affect the genetic makeup of the exposed person in such a way as to produce cancer or disease in later generations.

2. Strict safety precautions, such as not allowing the chemicals to touch the skin or to be inhaled, must be used.

3. Some common chemicals that are known to or are highly suspected to affect the embryo or fetus include but are not limited to:

4. If the storage container is breakable, it must be kept in an impermeable, unbreakable, secondary container having sufficient capacity to retain the material should the primary container be broken.

5. Each container should be labeled as to the specific toxin contained.

6. Embryotoxins shall only be used in a functional fume hood.

Benzene	Vinyl Chloride	Hydrogen sulfide
Toluene	Formaldehyde	Carbon disulfide
Xylene	Dimethylformamide	Carbon monoxide
Analine	Dimethyl sulfoxide	Nitrates
Nitrobenzene	N,N-Dimethylacetamide	Nitrites
Phenol	PCB	Lead
Mercury	Nitrous Oxide	Formamide

V. ALLERGENS AND SENSITIVITIES

1. Wear appropriate protective apparel to prevent skin contact.

2. Wash hands and arms thoroughly after chemical usage.

V I. PEROXIDE FORMERS

Lab personnel should minimize the hazards associated with peroxidizable compounds. Commonly used solvents such as ether, dioxane, and tetrahydrofuran (THF) can form explosive peroxides after exposure to air. Peroxide formers should be labeled with the date the container is opened. Store the compounds in an obvious location where they will not be forgotten and where they can be readily checked. Check peroxide formers for peroxides every six months after opening, or dispose of them. Since these chemicals may be packaged in an air atmosphere, peroxides can form even though the container has not been opened, necessitating careful handling. Please visit http://www2.lbl.gov/ehs/chsp/html/react_peroxides.shtml for a list of materials which may form peroxides. (This list may not be comprehensive please consult your SDS for your specific chemical)

1. Date all peroxidizables upon receipt and upon opening. Dispose of or check for peroxide formation after the recommended time, 3-months to one year depending on the chemical.

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

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

4. It is recommended to chemically test for peroxides on a regular schedule.

5. Follow the same basic handling procedures as for flammable materials.

6. Metal spatulas shall not be used with peroxidizables.

7. Glass containers with glass stoppers must not be used.

Peroxide Detection Tests

You should test for peroxides; there are a variety of methods used to detect peroxides, if assistance is needed please contact EHS.

VII. PYROPHORICS

SCOPE

These guidelines present information on how to handle and store pyrophoric materials safely. All UA employees and students who work in labs containing pyrophorics should familiarize themselves with this document.

Overview of Hazards

In accordance with the Chemical Hygiene Plan, PIs are responsible for ensuring a safe work environment within their individual laboratories. Training of all laboratory personnel, including general safety training, as well as job specific training, is an important part of maintaining a safe working environment. Any employees working with pyrophoric chemicals must be made aware of the hazards associated with these materials.

Pyrophoric chemicals present certain safety hazards that must be addressed before handling or using them, both in terms of facilities and PPE. The most marked hazard associated with pyrophoric materials is
spontaneous flammability. Pyrophorics are associated with fire and explosion hazards and care
must be taken to avoid conditions which could allow such reactions to occur. All combustible material, including paper products, must not be allowed to come in contact with pyrophoric materials. Store pyrophorics away from sources of ignition and minimize the quantities of pyrophoric chemicals stored in the laboratory. Never return excess chemicals to the original container. Small amounts of impurities may be introduced into the container which may cause a
fire or explosion. For pyrophoric compounds, a **Class D** extinguisher must be kept nearby. If you need a Class D extinguisher for your space please contact EHS. If individuals are expected to use fire extinguishers, they must have been received in person fire extinguisher training. These same individuals should also know how to use a safety shower and eye wash station

Safe Work Methods

PIs must conduct a thorough risk assessment of their procedures and prepare protocols and standard operating procedures (SOP) addressing how to safely work with such materials. The safe work methods listed below provide general guidance on how to work safely with pyrophoric chemicals. However, PIs whose laboratory chemical inventory includes pyrophoric chemicals should prepare specific written procedures for working with such materials and should ensure that all laboratory staff are appropriately trained on proper procedures before being allowed to work with pyrophorics. Principal investigators should satisfy themselves that workers and students within their laboratories are competent to safely handle spontaneously reactive materials.

Administrative controls.

1. Management considerations for pyrophorics and other potentially hazardous chemicals must be included in the laboratory Chemical Hygiene Plan.

2. Principal investigators will develop and implement SOP(s) for work practices and procedures involving pyrophorics and other highly reactive chemicals.

3. All tasks having potential for occupational pyrophoric exposure will only be conducted by competent staff who have received appropriate training regarding the specific pyrophoricrelated health and safety risks, SOPs, and procedures to be followed in event of an exposure incident.

4. Whenever possible, PIs should consider the use of (less hazardous) alternative chemicals that are not pyrophoric. If less reactive materials cannot be substituted, consider conducting the experiment as a pilot to confirm that appropriate safeguards are present and operable.

Storage

1. Consideration for appropriate storage of pyrophoric and other highly-reactive materials should be made prior to introducing the material into the laboratory. Only those quantities of material needed should be brought into the laboratory to minimize storage and disposal requirements.

2. Fume hood. Some pyrophoric chemicals release flammable gases and should be handled only in a chemical fume hood. Refer to the chemical safety data sheet (SDS) for appropriate handling instructions. In addition, some pyrophoric materials must be stored under a flammable solvent (such as kerosene), and the use of a fume hood is required to prevent the release of flammable and/or flammable vapors into the laboratory.

3. All containers of pyrophoric or other highly reactive material must be labeled with the date of receipt. The container should also have a highly visible label indicating hazardous situations to avoid (e.g., do not expose to air, etc.). Upon expiration, containers of pyrophoric or other highly reactive chemicals should be promptly disposed of through the university's unwanted chemical pick up program.

4. Glove box. If an inert atmosphere is required to work with the pyrophoric material, a glove box may be used. All laboratory staff working with a glove box must first be appropriately trained and determined to be competent by the PI. The glove box must be inspected/certified regularly or as recommended by the manufacturer.

Personal Protective Equipment (PPE).

1. Laboratory coats. A long-sleeved fire-resistant laboratory coat which is properly buttoned or closed should be worn at all times when working with pyrophoric chemicals. In addition, it is recommended to wear fire-resistant clothing, such as cotton or wool, as opposed to synthetic clothing not intended to be fire resistant while working with pyrophorics. Certain fire resistant synthetic fabrics such as Nomex® may be appropriate when engineering controls cannot completely eliminate the hazard. Shorts and open-toed shoes are inappropriate laboratory attire for working with pyrophorics and/or any other hazardous chemicals.

2. Eye Protection. Eye protection must be worn at all times while working with pyrophoric materials. Safety glasses must meet ANSI Z87.1-2003 standard requirements and should be equipped with side shields. However, regular safety glasses do not provide adequate protection against splashes; therefore, whenever the potential for a splash-hazard exists, additional eye protection and/or face protection must be worn (e.g., safety goggles and face shield). Ordinary prescription eyeglasses do NOT provide adequate protection.

3. Gloves. Wear appropriate gloves when working with hazardous chemicals, including pyrophoric and other highly reactive chemicals. Fire resistant gloves (such as Nomex®) are recommended. While nitrile gloves provide adequate protection against accidental skin/hand contact with small quantities of most laboratory chemicals, one should consult the SDS for specific recommendations on PPE, including appropriate gloves. Resistance of glove materials varies with the chemical involved. If in doubt as to the appropriateness of a glove material for the chemical you are using, contact the glove manufacturer to confirm your glove selection is appropriate.

Work Methods

1. Perform a thorough and comprehensive hazard assessment of the experiment. The hazard assessment should address such issues as proper use and handling techniques, chemical toxicity, storage requirements, fire safety, spill response, and emergency procedures to follow in the event of personnel exposure, spill, fire, or other reasonably anticipated accident.

2. Clearly label all pyrophoric chemical containers in plain English with the correct chemical name, hazard warning, and a received and/or opened date. Appropriately label any secondary containers as required by the chemical hygiene plan. Avoid writing directly on the bottle with a grease pen or sharpie, as such labels often get washed off or may react with vapors from the contents. Materials with an expiration date should be disposed of through the university's unwanted chemical pick up program promptly following expiration.

3. Special storage considerations for pyrophoric chemicals should be determined before the material is introduced into the laboratory, and appropriate storage means must be available. The chemical SDS should be reviewed and consulted regarding storage requirements.

Pyrophoric chemicals should be stored under an atmosphere of inert gas or other inert material as dictated by the pyrophoric material. Pyrophoric chemicals should not be stored with oxidizers or near water. Keep away from sources of ignition, heat, and/or flames. In an effort to minimize storage of pyrophoric chemicals, only working quantities of pyrophoric chemicals should be kept in the laboratory. Excess chemicals should never be returned to the original container, as small amounts of impurities may be introduced into the container, which could cause a fire or explosion. All laboratory staff should be appropriately trained on such requirements.

Spills

Laboratories employees and students working with pyrophoric chemicals must have a spill kit appropriate for the pyrophoric compounds in use in the laboratory. The spill response materials should be inert and non-reactive. If a spill occurs, alert other personnel in the laboratory. Turn off all sources of ignition (if safe to do so). Do not attempt to handle a large spill in which you are not trained and/or equipped to handle. Vacate the laboratory immediately and call UA-EHS 205-348-5914 as well as UAPD 205-348-5454. If a spill occurs after work hours, call UAPD 205-348-5454 and Dr. Delphine Harris 205-561-9335. Remain on the scene, but at a safe distance to receive and provide information to safety personnel when they arrive.

Unwanted/Used chemical Disposal

All hazardous waste should be disposed of through the university's unwanted chemical pick up program. Removal of potentially pyrophoric material from a glove box may involve first placing the material in a quenching material. The PI must ensure that these procedures are clearly communicated by training laboratory personnel and ensuring that the supplies necessary are available prior to beginning work with pyrophoric chemicals. All materials contaminated with pyrophoric materials pose a flammability risk and must be properly containerized and disposed of as hazardous waste. Contaminated materials should not be left in the laboratory overnight.

Emergency Procedures

The PI should anticipate possible emergencies in the laboratory involving pyrophoric chemicals, such as fires, explosions, spills, and/ or injury to staff. All laboratory personnel should be trained on emergency procedures for an incident involving pyrophoric materials. At a minimum, these procedures should address the following:

1. Whom to contact. Numbers (both daytime and evening) should be provided for those who may need to respond, including the PI, UAPD 205-348-5454, and EHS-Dr. Delphine Harris 205-561-9335.

2. Location of safety equipment including the eyewash, safety shower, fire alarm, and spill kit.

3. How to alert personnel in potentially hazardous areas.

4. First aid and/or procedures to assist injured laboratory personnel until medical help arrives on the scene.

VIII. EPOXY RESIN COMPONENTS

1. All potentially exposed persons shall be instructed as to the potential health hazards.

2. All skin contact with the components must be eliminated.

3. If any skin contact occurs, immediately wash area with soap and water.

4. Soap should be acidic or neutral.

5. If any component contacts clothing, remove the garment immediately and wash the effected skin under the area.

6. All epoxy resin work should be done in exhaust ventilated enclosures or hoods.

7. Ovens used for curing must have their vents exhausted to the outside of the building.

8. Disposable containers and stirring rods shall be used to mix and work the resin.

9. Disposable items shall be discarded in containers specifically for epoxy resin waste.

10. Containers used for waste must be labeled as containing unwanted chemicals-epoxy resin.

11. All epoxy resin materials must be disposed of as hazardous waste.

12. All non-disposable items used with the resin components shall be cleaned immediately after use.

IX. ACUTE RESPIRATORY HAZARDS

The below listed chemicals are some common acute respiratory hazards and should not be used in a confined area. They should be dispensed and handled only in a hood. This should not be considered an exhaustive list.

Acetyl Chloride	Fluorine	Diborane
Ammonium hydroxide	Hydriodic acid	Methyl fluorosulfonate
Anhydrous ammonia	Hydrobromic acid	Dimethyl oxychloride
Arsine	Hydrochloric acid	Phosgene
Bromine	Hydroflouric acid	Sulfur dioxide
Carbon monoxide	Hydrogen selenide	Stibine
Chlorine	Hydrogen sulfide	Thionyl Chloride
Chloroform	Hydrogen telluride	

X. NEW COMPOUNDS

Some laboratories may synthesize or develop new chemical substances on occasion. If the composition of the substance is known and will be used exclusively in the laboratory, the laboratory worker must label the substance and determine, to the best of his/her abilities, the hazardous properties (e.g., corrosive, flammable, reactive, toxic, etc.) of the substance. This can often be done by comparing the structure of the new substance with the structure of similar materials with known hazardous properties. If the chemical produced is of unknown composition, it must be assumed to be hazardous and appropriate precautions taken.

If a chemical substance is produced for another user outside this facility, the laboratory producing the substance is required to provide as much information as possible regarding the identity and known hazardous properties of the substance to the receiver of the material and must comply with the hazard communication standard. All chemicals must be adequately labeled upon arrival in the lab.

If new compounds are shipped, the laboratory responsible for creating the new compound must provide MSDS/SDS information as well as additional required documentation and/or notification (TSCA, PMN etc.)

XI. GAS SYSTEMS AND REACTIONS

1. Gases shall not be purified by circulation over a liquid alloy.

2. Teflon coated stirrers should not be used to agitate liquid alkali metal in gas systems.

3. Unknown reactions shall be performed using the smallest amount of reactants possible that will allow a successful reaction. Unknown reactions shall initially be performed on a small scale.

4. A reagent should not be added faster than it is being consumed.

5. Precaution shall be taken to control unexpected exotherms whenever a reaction is being scaled up or run for the first time.

6. Reactions shall not be scaled up more than one order of magnitude for each time the reaction is run.

7. Reactions shall not stray from approved standard operating procedure.

XII. COMPRESSED GASES

Many laboratory operations require the use of compressed gases for analytical or instrument operations. Compressed gases present a unique hazard. Depending on the particular gas, there is a potential for simultaneous exposure to both mechanical and chemical hazards. Gases may be combustible, explosive, corrosive, poisonous, inert, or a combination of hazards. If the gas is flammable, flash points lower than room temperature compounded by high rates of diffusion (which allow for fast permeation throughout the laboratory) present a danger of fire or explosion. Additional hazards of reactivity and toxicity of the gas, as well as asphyxiation, can be caused by high concentrations of even "harmless" gases such as nitrogen. Since the gases are contained in heavy, highly pressurized metal containers, the large amount of potential energy resulting from compression of the gas makes the cylinder a potential rocket or fragmentation bomb. In summary, careful procedures are necessary for handling the various compressed gases, the cylinders containing the compressed gases, regulators or valves used to control gas flow, and the piping used to confine gases during flow. Gas cylinders must be handled in the following ways:

1. Storage shall be in a level, fire resistant area, which is well ventilated and dry.

2. Storage areas must be located away from sources of ignition or excess heat.

3. Cylinder temperature must never exceed 51 degrees C (124^{o}F).

4. Cylinders must always be stored upright.

5. Cylinders shall be chained or strapped in place to prevent falling, even if they are assumed to be empty.

6. Cylinder caps shall be in place at all times when not in use.

7. Old, empty, or unusable cylinders shall be returned to the supplier or disposed of in a manner in accordance with all federal, state, local and incorporated guidelines.

8. Hand trucks shall be used to transport cylinders. Hand rolling and/or a walking cylinder are not permitted.

9. All cylinders must be labeled in a conspicuous manner as to content.

10. Acetylene should never be used under pressure in unbarricaded equipment.

11. All cylinders must be inspected for valid hydrostatic pressure tests before being accepted from the vendor.

12. Oxygen cylinders, full or empty, shall not be stored in the same vicinity as flammable gases.

13. A cylinder should never be emptied to a pressure lower than 172 kPa (25 psi/in^2) (the residual contents may become contaminated if the valve is left open).

14. Gases which are flammable, toxins, or poisons shall be stored in an appropriate gas cabinet and piped to the location of use.

Table 1: Maximum allowable quantities for flammable and combustible liquids (Source: NFPA Code, §30)

		Quantity		
	Liquid Class(es)	***gal***	***L***	***Notes***
Flammable liquids	IA	30	115	1, 2
	IB and IC	120	460	1, 2
	IA, IB, IC combined	120	460	1, 2, 3
Combustible liquids	II	120	460	1, 2
	IIIA	330	1,265	1, 2
	IIIB	13,200	50,600	1, 2, 4

Notes:

(1) Quantities are permitted to be increased 100 percent where stored in approved flammable liquids storage cabinets or in safety cans in accordance with the fire code. Where Note 2 also applies, the increase for both notes is permitted to be applied accumulatively.

(2) Quantities are permitted to be increased 100 percent in buildings equipped throughout with an automatic sprinkler system installed in accordance with NFPA 13, *Standard for the Installation of Sprinkler Systems*. Where Note 1 also applies, the increase for both notes is permitted to be applied accumulatively.

(3) Containing not more than the maximum allowable quantity per control area of Class IA, Class IB, or Class IC flammable liquids, individually.

(4) Quantities are not limited in a building equipped throughout with an automatic sprinkler system installed in accordance with NFPA 13, *Standard for the Installation of Sprinkler Systems*, and designed in accordance with the protection criteria contained in Chapter 16 of this code.

Table 2: Separation of Gas Containers, Cylinders, and Tanks by Hazard Class (Source: NFPA Code, §55)

Gas Category	Other Gas	Unstable Reactive, Class 2, 3, or 4	Corrosive	Oxidizing	Flammable	Pyrophoric	Toxic or Highly Toxic
Toxic or Highly toxic	—	6.1 m (20 ft)	6.1 m (20 ft)	6.1 m (20 ft)	6.1 m (20 ft)	6.1 m (20 ft)	—
Pyrophoric	—	6.1 m (20 ft)	6.1 m (20 ft)	6.1 m (20 ft)	6.1 m (20 ft)	—	6.1 m (20 ft)
Flammable	—	6.1 m (20 ft)	6.1 m (20 ft)	6.1 m (20 ft)	—	6.1 m (20 ft)	6.1 m (20 ft)
Oxidizing	—	6.1 m (20 ft)	6.1 m (20 ft)	—	6.1 m (20 ft)	6.1 m (20 ft)	6.1 m (20 ft)
Corrosive	—	6.1 m (20 ft)	—	6.1 m (20 ft)	6.1 m (20 ft)	6.1 m (20 ft)	6.1 m (20 ft)
Unstable Reactive, Class 2, 3, or 4	—	—	6.1 m (20 ft)	6.1 m (20 ft)	6.1 m (20 ft)	6.1 m (20 ft)	6.1 m (20 ft)
Other Gas	—	6.1 m (20 ft)	6.1 m (20 ft)	6.1 m (20 ft)	6.1 m (20 ft)	6.1 m (20 ft)	6.1 m (20 ft)

Using this Chart: To determine if two gases must be segregated, locate one gas category in the far left and then the second gas type in the top row.

Table 3: Maximum Allowable Quantity of Gases per Laboratory (Source: NFPA Code, §55)

Materials	Unsprinklered Areas		Sprinklered Areas	
	No gas cabinet, gas room, or exhausted enclosure	**Gas cabinet, gas exhausted room, or enclosure**	**No gas cabinet, gas room, or exhausted enclosure**	**Gas cabinet, gas exhausted room, or enclosure**
Corrosive Gas				
Liquefied	68 kg (150 lb)	136 kg (300 lb)	136 kg (300 lb)	272 kg (600 lb)
Nonliquefied	23 m^3 (810 ft^3)	46 m^3 (1620 ft^3)	46 m^3 (1620 ft^3)	92 m^3 (3240 ft^3)
Cryogenic Fluid				
Liquefied	0 L (0 gal)	170 L (45 gal)	170 L (45 gal)	170 L (45 gal)***
Nonliquefied	170 L (45 gal)	340 L (90 gal)	340 L (90 gal)	681 L (180 gal)
Flammable Gas				
Liquefied	114 L (30 gal)	227 L (150 gal)	227 L (60 gal)	454 L (120 gal)
Nonliquefied	28 m^3 (1000 ft^3)	28 m^3 (2000 ft^3)	28 m^3 (2000 ft^3)	56 m^3 (4000 ft^3)
Highly Toxic Gas				
Liquefied	0 kg (0 lb)	2.3 kg (5 lb)	0 kg (0 lb)	4.5 kg (10 lb)
Nonliquefied	0 m^3 (0 ft^3)	0.6 m^3 (20 ft^3)	0 m^3 (0 ft^3)	1.1 m^3 (40 ft^3)
Nonflammable Gas				
Liquefied	No Limit	No Limit	No Limit	No Limit
Nonliquefied	No Limit	No Limit	No Limit	No Limit
Oxidizing Gas				
Liquefied	57 kg (15 gal)	114 kg (30 gal)	114 kg (30 gal)	227 L (60 gal)
Nonliquefied	43 m^3 (1500 ft^3)	85 m^3 (3000 ft^3)	85 m^3 (3000 ft^3)	170 m^3 (6000 ft^3)
Pyrophoric Gas				
Liquefied	0 kg (0 lb)	0 kg (0 lb)	1.8 kg (4 lb)	3.6 kg (8 lb)
Nonliquefied	0 m^3 (0 ft^3)	0 m^3 (0 ft^3)	1.4 m^3 (50 ft^3)	2.8 m^3 (100 ft^3)
Toxic Gas				
Liquefied	68 kg (150 lb)	136 kg (300 lb)	136 kg (300 lb)	272 kg (600 lb)
Nonliquefied	23 m^3 (810 ft^3)	46 m^3 (1620 ft^3)	46 m^3 (1620 ft^3)	92 m^3 (3240 ft^3)

XIII. CRYOGENICS

The use of cryogenic liquids in the laboratory presents a number of hazards. Employees and/or lab personnel should be properly trained in these hazards prior to use. The transfer of liquefied gases from one container to another should not be attempted for the first time without the direct supervision and instruction of someone experienced in the operation.

1. **Fire/Explosions**

   a. Neither liquid nitrogen nor liquid air should be used to cool a flammable mixture in the presence of air because oxygen can condense from the air and lead to a potentially explosive condition.
   b. Adequate ventilation must always be used to prevent the build-up of vapors of flammable gases such as hydrogen, methane, and acetylene.
   c. Adequate ventilation is also required when using gases such as nitrogen, helium, or hydrogen. In these cases, oxygen can be condensed out of the atmosphere creating a potential for explosive conditions.

2. **Pressure**

Cylinders and other pressure vessels used for the storage and handling of liquefied gases should not be filled to more than 80% of capacity, to prevent the possibility of thermal expansion and the resulting bursting of the vessel by hydrostatic pressure.

3. **Embrittlement of Structural Materials**

Appropriate impact-resistant containers must be used that have been designed to withstand the extremely low temperatures.

4. **Contact With and Destruction of Living Tissue**

   a. Even very brief contact with a cryogenic liquid is capable of causing tissue damage similar to that of thermal burns. Prolonged

contact may result in blood clots that have potentially serious consequences. In addition, surfaces cooled by cryogenic liquids can cause severe damage to the skin.

   b. Gloves and eye protection (preferably a face shield) should be worn at all times when handling cryogenic liquids

c. Gloves should be chosen that are impervious to the fluid being handled and loose enough to be tossed off easily. Appropriate dry gloves should be used when handling dry ice.

d. "Chunks" or cubes should be added slowly to any liquid portion of the cooling bath to avoid foaming over.

5. **Asphyxiation**

As the liquid gas warms and becomes airborne, oxygen may be displaced to the point that employees and lab personnel may experience oxygen deficiency or asphyxiation. Any area where such materials are used should be well ventilated. For this same reason, employees and lab personnel should avoid lowering their heads into a dry ice chest. (Carbon dioxide is heavier than air, and suffocation can result.)

XIV. CHEMICAL DISPOSAL

1. Chemical Hazardous Waste must have a hazardous waste label located on the chemical container. These labels must indicate if the name of the hazardous waste chemicals/material, hazard class as well as percentage of the volume.

2. Chemical hazardous waste is removed by EHS. Pickup requests should be submitted via the UA EHS website. http://ehs.ua.edu/operations/hazardous-materials/chemical-storage-facility/request-pickup-of-unwanted-chemicals/

3. Absolutely no chemicals may be poured down the drain or treated in any way without consult and approval from EHS. Contact the CHO to initiate review.

4. The Hazardous Material Management Program (HMMP- http://ehs.ua.edu/operations/hazardous-materials/) is managed by EHS and provides specific information concerning hazardous material management and disposal.

F. MEDICAL SURVEILLANCE

1. All lab personnel shall be provided medical consultation and examination whenever:

    A. An employee, lab personnel or student develops signs or symptoms associated with a hazardous chemical to which they may have been exposed in the laboratory.
    B. Exposure monitoring reveals a level routinely above the action level, PEL or TLV.
    C. An event such as a spill, leak, explosion, etc., occurs resulting in the likelihood of a detrimental exposure.

2. All medical exams and consultations shall be performed by a licensed physician and provided without cost to lab personnel and without a loss of pay.

3. EHS shall provide the following information to the physician:

    A. The identity of the hazardous chemicals to which the employee, lab personnel a n d / or student may have been exposed.
    B. A description of the conditions under which the exposure occurred, including quantitative exposure data, if available.
    C. A description of the signs and symptoms of exposure that the employee, lab personnel and/or student is experiencing, if any.

4. EHS shall obtain from the examining physician a written opinion which shall include the following:

    A. Recommendations concerning further medical follow-up.
    B. The results of the medical exam and any associated tests,
    C. Any medical condition, which may place the employee, lab personnel and/or student at an increased risk as a result of exposure to a hazardous chemical in the laboratory, and
    D. A statement that the employee, lab personnel and/or student has been informed by the physician of the results of the medical exam and the need of any further exams or treatment.

5. The physician's written opinion shall not reveal findings or diagnoses unrelated to the exposure.

6. Lab personnel shall be sent to University Medical Center for initial evaluation and examination. On the Job Injury documentation should be completed and submitted to the Office of Risk Management.

7. Students shall be sent to Student Medical Center for initial evaluation and examination. Student injury reports should be completed and submitted to EHS.

I. MONITORING

1. Exposure monitoring shall be provided by EHS to all Employees and /or lab personnel if there is reason to believe that exposure levels exceed action levels.

2. Monitoring and analysis shall be conducted in a manner consistent with National Institute of Occupational Safety and Health (NIOSH) methodology or recognized competent practices.

3. If monitoring needs change, monitoring may be reassessed at any time and continued or discontinued complying with regulatory standards.

4. Within 15 working days after the receipt of any monitoring results, EHS shall notify the affected employees, lab personnel, or students in writing. This notification may be communicated either individually or by posting the results in an area accessible to all individuals involved.

II. RECORDKEEPING

1. Records including monitoring results, medical exams, training documentation, laboratory and equipment inspections, chemical inventories, etc. must be maintained in the affected department and EHS for a period of 30 years after the last day of association with the institution.

2. Records shall be made available to any regulation agency or University department that has a legal right to review this documentation.

3. Records must be maintained in accordance with the records policies approved by relevant agencies.

G. APPENDIX I. DEFINITIONS

1. “ACTION LEVEL ”AL is an 8-hour time weighted average concentration for which there is only a 5% risk of having more than 5% of the employee workdays involve an exposure level greater than the relevant PEL-TWA.

2. "ADEM” is an acronym for Alabama Department of Environmental Management.

3. "Hazardous Chemical" means a chemical for which there is evidence based on at least one study that acute or chronic health effects may occur in exposed individuals.

4. "HEPA" is an acronym for high efficiency particulate absolute filter capable of trapping 99.97% of all particles with a diameter greater than 0.3 microns.

5. "LABORATORY" means a facility where the laboratory use (bench scale) of potentially hazardous materials or chemicals occurs.

6. "OSHA” is an acronym for Occupational Safety and Health Administration.

7. "PEL” is an acronym for permissible exposure level based upon an 8 hour day as established by OSHA.

8. "POTENTIALLY HAZARDOUS" means that due to the characteristics of the material or the methods or equipment used, a significant potential for an accident or injury to occur exists.

9. "TLV" is an acronym for threshold limit value based upon an 8-hour day as established by the American Conference of Governmental Industrial Hygienist.