UNIVERSITY of HOUSTON

General Laboratory Safety Manual

Guidelines for the Safe Handling of Hazardous Materials and other Common Laboratory Hazards

Environmental Health and Risk Management Department

Revised February 2006

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PREFACE

A variety of hazards exist in the laboratories at the University of Houston. The risks associated with these hazards are greatly reduced or eliminated if proper precautions and practices are observed in the laboratory. To manage these risks, and in response to a heightened concern for safety in the workplace, the University of Houston has developed this General General Laboratory Safety Manual. The manual is intended to be the cornerstone of a safety program designed to aid faculty, staff, and students in maintaining a safe environment in which to teach, conduct research, and learn.

The development of, and adherence to, procedures in a General General Laboratory Safety Manual (GLSM) is an essential requirement of an effective Comprehensive Comprehensive Laboratory Safety Program. This General General Laboratory Safety Manual applies to all laboratories at the University of Houston. The Environmental Health and Risk Management Department (EHRM) is available to provide assistance and a number of resources. These include maintenance of a comprehensive Material Safety Data Sheet (MSDS) library and the services of staff Laboratory Safety Officerss.

The safety of campus laboratories legally resides with the responsible person in charge of a given laboratory, typically the Principal Investigator. However, EHRM stands ready to assist Principal Investigators with these duties. Through resources such as this General General Laboratory Safety Manual, we hope to become known to laboratory personnel not only as inspectors, but more importantly as a valuable safety resource. To that end, please help us help you, and let us know if we can assist you in any way.

Robert D. Schneller, CSP, ARM
Director, Envrionmental Health and Risk Management Department

HELPFUL TELEPHONE NUMBERS AND USEFUL INFORMATION

Environmental Health and Risk Management Department	*(713) 743-5858*
Fax	*(713) 743-8035*
Chemical Laboratory Safety Officers	*(713) 743-0414*
Biological Laboratory Safety Officers	*(713) 743-5899*
Chemical & Biological Safety Manager	*(713) 743-1200*
Environmental Compliance Manager	*(713) 743-5869*
(UH) Fire Marshall Fire	*(713) 743-5866*
Radiation Safety Manager	*(713) 743-5870*
University Health Center	*(713) 743-5151*
Plant Operations Customer Service	*(713) 743-4948*
Utility Services (Power Plant) (after hours Plant Operations Assistance)	*(713) 743-5691*
University of Houston Police Department	
Medical Emergency	*911*
All Other Emergencies	*(713) 743-3333*
Non-Emergency	*(713) 743-0600*

- *EHRM Office Hours: Monday through Friday 8:00 a.m. - 5:00 p.m.*
- *Please contact the University of Houston Police Department, in the event of an after hours chemical, biological, or radiation laboratory accident or incident.*
- *The Environmental Health and Risk Management Department maintains an on-call mechanism to provide expertise in response to emergencies that occur after hours and require assistance.*

1.0 SCOPE AND APPLICATION

The primary objective of this document is to provide a general guide for working in laboratories. The GLSM establishes the basic safety principles for laboratory procedures, equipment and work practices. **Additionally, there are subject specific safety manuals, such as biological, chemical, and radiation that describe safeguards capable of protecting employees from these specific hazards in a laboratory environment. Please see EHRM website at www.uh.edu/plantops/ehrm for further information.**

The General General Laboratory Safety Manual is intended only to address those universal safety measures necessary for achieving a generally safe and healthy work environment. Where the scope of hazards is not adequately addressed by this general document, specific Standard Operating Procedures must be developed by the Principal Investigator or laboratory coordinator.

1.1 Environmental Health and Risk Management Department

The Environmental Health and Risk Management Department's main purpose is to support the University of Houston in its mission of higher education and research. The Department's efforts are directed at assisting the University in identifying safety hazards and controlling such hazards through protective equipment, hazard mitigation methods, development and presentation of safety training programs, purchase of insurance and other risk control and risk transfer techniques.

The Environmental Health and Risk Management Department will keep abreast of relevant safety, environmental, and risk management regulatory requirements. Regulatory compliance will be achieved through clear communication of recommendations and interpretations regarding such regulations to the appropriate administrators within the university.

1.2 General Laboratory Safety Manual Objective

It is the intent of the University of Houston to provide a safe and healthy laboratory environment to all laboratory occupants through the establishment and maintenance of a Comprehensive Laboratory Safety Program.

The General Laboratory Safety Manual provides control measures essential for protecting all laboratory occupants from common hazards found in the laboratory. These controls consist of, but are not limited to, policies, guidelines, training requirements, standard operating procedures, personal protective equipment, and laboratory audits.

The GLSM describes a minimum level of safe practices that are expected from all individuals (faculty, staff, and students) involved in the laboratory operations.

1.3 Comprehensive Laboratory Safety Program

a. Program Responsibilities

The University of Houston recognizes the need to use potentially hazardous materials for the purpose of research and teaching. At the same time, the University of Houston is committed to ensure the safety of its students, employees, and visitors, and to complying with all regulatory requirements that have an impact on its facilities and operations.

Considering this charge, the University of Houston has designated specific responsibilities for developing and implementing the Comprehensive Laboratory Safety Program to the Environmental Health and Risk Management Department. To ensure a successful program, the cooperation of various entities on campus is required. The individuals responsible for maintaining the integrity of the program are listed below, as well as their respective responsibilities.

Environmental Health and Risk Management Department

The primary purpose of the Environmental Health and Risk Management Department is to support the University of Houston in its mission of teaching and research. Our role to oversee potential safety hazards, to ensure the safety of the campus community and to provide an environment free of unnecessary risks include the following duties:

1. Consult with laboratory users regarding the effectiveness of their department's safety efforts.
2. Provide training and support for the Laboratory Safety Officers, departmental teaching assistants, and/or laboratory safety coordinators.
3. Support the Laboratory Safety Officers with respect to inspections, hazard evaluations, and recommendations for compliance.
4. Where necessary, conduct environmental and/or personal monitoring in order to assess the degree of exposure associated with a particular laboratory operation.

Laboratory Safety Officers (LSO)

The Laboratory Safety Officers are the key to the success of the Comprehensive Laboratory Safety Program. As such he or she must effectively carry out the requirements of this Manual. At a minimum, the Laboratory Safety Officers will complete the following duties:

1. Provide technical guidance and assistance regarding the General Laboratory Safety Manual to the Department Chair, Professors, Principal Investigators, Laboratory Safety Coordinators, Teaching Assistants, Supervisors, students and employees.
2. Audit laboratories, evaluate hazards and document laboratory concerns to the Principal Investigator. If repetitive deficiencies occur and corrective measures are not implemented in the designated time, the Laboratory Safety Officers will initiate escalation procedures defined by the Environmental Health and Risk Management Department.
3. Recommend necessary training to laboratory faculty and staff.
4. Respond to emergencies as needed..

Department Chairs

1. Appoint appropriate individuals to serve as Laboratory Coordinators or Departmental Safety Officers as needed.
2. Ensure that responsible parties comply with the appropriate provisions of the General Laboratory Safety Manual.

Principal Investigators

1. Assume direct responsibility for their laboratory's compliance with the General Laboratory Safety Manual.
2. Develop standard operating procedures (SOPs) for their laboratory.
3. Cooperate with the LSO to ensure program compliance.
4. If necessary, appoint a Laboratory Coordinator to work with the LSO to address persistent issues.

Laboratory Coordinators and Departmental Safety Officers

1. Perform safety activities as directed by the Department Chair and/or Principal Investigator.
2. Work with the LSO to identify and address common or general safety concerns.
3. Maintain GLSM compliance.

Laboratory Employee, Students, and Visitors

1. Follow and obey general safety rules and guidelines described in the GLSM.
2. Read, understand, and follow SOPs for unique laboratory and high hazard operations.
3. Report any potentially hazardous operations to the Principle Investigator or Laboratory Safety Coordinator promptly.

Plant Operations

1. Maintenance or repair problems (mechanical, electrical, plumbing) reported in a reasonable time period.
2. If repairs can not be made in a timely manner then the Principal Investigator should be notified with an anticipated completion date as soon as possible.
3. Upon completion of repairs to safety equipment, (*Example:* fume hoods, eyewashes, safety showers, etc.) Plant Operations should notify the LSO.

b. Implementation and Maintenance

EHRM Training

Environmental Health and Risk Management will schedule training sessions for all new Principal Investigators, Laboratory Supervisors, Laboratory Safety Coordinators, Teaching Assistants and employees. This training course known as the General Laboratory Safety Orientation Class is mandatory and should be completed before conducting laboratory acitivities at UH. The EHRM recommends that this course , which can be attended as often as desired, be repeated at least every five years.

This training will include an explanation of general chemical safety information mandated by the Texas Hazard Communication Act, best laboratory practices, general information about the University's laboratory related review committees and fire safety training. The Environmental Health and Risk Management Department will arrange for a session prior to the start of the fall, spring and summer semsester. These training sessions will be held in large auditoriums to accomadate all interested persons.

In addition to the General Laboratory Safety Orientation Class the EHRM also conducts regularly scheduled training classes for specific hazards such as radioactive materials, lasers, biosafety, etc. Please consult the EHRM web site www.uh.edu/plantops/ehrm for the training catalog and schedule.

Laboratory Specific Training

Chemical or hazard-specific training provided by the Department, Principal Investigators, or Laboratory Coordinator should include:

1. Site-specific standard operating procedures.
2. Specific physical and health hazards of materials used in the work area All other laboratory specific safeguards, rules, practices or pocedures necessary for the employee to work safely in that location.

Laboratory Audits and Walk-throughs

The Laboratory Safety Officers will arrange a meeting with each laboratory on a scheduled basis in order to audit the lab and to review all elements of the GLSM with laboratory personnel. The Laboratory Safety Officers will also conduct random walk-throughs in laboratories to ensure that the guidelines written in the GLSM are observed and to offer consultation to the Principal Investigator, Lab Coordinator, or Departmental Chair if concerns are discovered.

After the Laboratory Safety Officers's audit, any program concerns will be reviewed and a report will be issued to the Principal Investigator. Laboratories are expected to correct items of concerns as soon as possible and file a written response to the Environmental Health and Risk Management Department within 30 days of the initial audit.

The Environmental Health and Risk Management Department will perform follow-up laboratory inspections as it deems necessary in order to preserve safety in University of Houston laboratory space, and to ensure adherence to the current laws as they pertain to laboratories.

1.4 Record Keeping

General Laboratory Safety Orientation training required in the GLSM will be documented by the Environmental Health and Risk Management Department. The EHRM will maintain these training records. Attendees will receive a certificate upon completion of any EHRM training.

Chemical or hazard-specific training must be documented and maintained by the Department, Principal Investigator, or Laboratory Coordinator and be available upon request. An example of a chemical or hazard-specific documentation training form can be view on Appendix A. This form can be modified to fit the needs of the specific department.

The EHRM will maintain records of laboratory audits for federal or state regulatory inspections.

2.0 STANDARD OPERATING PROCEDURES

The General Laboratory Safety Manual offers generic safety guidelines and standard operating procedures for laboratoies on campus. Be aware that this document contains a minimum set of guidelines, regulations, and recommendations required to maintain a safe working environment, and does not provide laboratory workers, research students, or teaching assistants with specific standard operating procedures necessary to work in their respective laboratories. It is the responsibility of the Principal Investigator to develop specific standard operating procedures for his/her laboratory.

2.1 General Safety Guidelines

Standard operating procedures must be readily available to all laboratory employees. The following guidelines have been established to minimize or eliminate hazards in the laboratory. These guidelines have also been provided to maintain a safe laboratory environment. It is the responsibility of each person that enters into the laboratory to understand the safety and health hazards associated with potential hazardous materials and equipment in the laboratory. It is also the individual's responsibility to practice the following general safety guidelines at all times:

1. Always wear proper eye protection in chemical work, handling and storage areas. Contact lenses should normally not be worn. Fitted goggles are essential if, for therapeutic reason, contact lenses must be worn.
2. Always know the hazards associated with the materials that are being utilized in the lab.
3. Always wear appropriate protective clothing. Cover shorts, cutoffs or miniskirts with a suitable lab coat or apron.
4. Confine long hair and loose clothing. Do not wear high-heeled shoes, open-toed shoes, sandals or shoes made of woven material.
5. Always wash hands and arms with soap and water before leaving the work area. This applies even if you have been wearing gloves.
6. Never perform any hazardous work when alone in the laboratory. At least two people should be present. Undergraduate students must be supervised by an instructor at all times.
7. Never perform unauthorized work, preparations or experiments.
8. Never engage in horseplay, pranks or other acts of mischief in chemical or biological work areas.
9. Never remove chemicals, biological agents, or radioactive materials from the facility without proper authorization.
10. Be familiar with the location of emergency equipment - fire alarm, fire extinguisher, emergency eye wash and safety shower. Know the appropriate emergency response procedures.
11. Use equipment and hazardous materials only for their intended purposes.
12. Never mouth pipet chemicals when transferring solutions. Instead, you should always use a pipet bulb to transfer solutions.
13. Always lubricate glass thermometers, or thistle tubes before inserting them into a stopper. Always wrap toweling around them while inserting into the stopper.
14. Use a hood whenever there is a possibility of poisonous or irritating fumes being emitted.

15. Never leave an experiment unattended while it is being heated or is rapidly reacting.
16. Keep equipment back from the edge of the lab bench to prevent spillage.
17. Support all beakers and flasks with clamps. Do not use cracked or chipped glassware.
18. Report any accident, however minor immediately.

2.2 Eating, Drinking, and Smoking

Eating, drinking, smoking, gum chewing, applying cosmetics, and taking medicine in laboratories is strictly prohibited.

1. Food, beverages, cups, and other drinking and eating utensils should not be stored in areas where hazardous materials are handled or stored.
2. Glassware used for laboratory operations should never be used to prepare or consume food or beverages.
3. Laboratory refrigerators, ice chests, cold rooms, ovens, and so forth should not be used for food storage or preparation.
4. Laboratory water sources and deionized water should not be used for drinking water.
5. Laboratory materials should never be consumed or tasted.

2.3 Housekeeping and Maintenance

In the laboratory, keeping things clean and organized can help provide a safer environment. Keep drawers and cabinet doors closed and electrical cords off the floor to avoid tripping hazards. Keep aisles clear of obstacles such as boxes, chemical containers, and other storage items that might be put there. Avoid slipping hazards by cleaning up spilled liquids promptly and by keeping the floor free of loose equipment such as stirring rods, glass beads, stoppers, and other such hazards. Never block or even partially block the path to an exit or to safety equipment, such as a safety shower or fire extinguishers. Use the required procedure for the proper disposal of chemical wastes and solvents.

Supplies and laboratory equipment on shelves should have sufficient clearance so that, in case of a fire, the fire sprinkler heads are able to carry out their function. The work area should be kept clean and uncluttered, with hazardous materials and equipment properly stored. Clean the work area upon completion of a task and at the end of the day. The custodial staff is only expected to perform routine duties such as cleaning the floor and emptying the general trash.

In preparation for any maintenance service such as, fumehood repair, plumbing, electrical etc. the laboratory staff must prepare the laboratory before the maintenance personnel arrive. Whenever possible remove hazards that maintenance personnel may encounter during their work activities. For example, infectious agents, radioactive materials or chemicals must be moved to a secure area prior to initiation of maintenance work. Additionally, the Principal Investigator or Laboratory Coordinator *must escort Plant Operations personnel into the laboratory and inform them of the presence of any hazardous materials prior to the work being done.* The EHRM recommends that maintenance personnel be supervised at all times while in the laboratory.

2.4 Hazardous Waste Storage and Disposal

Individual users of hazardous materials have specific duties and responsibilities under state and federal law and university policy regarding hazardous waste handling and disposal. These responsibilities include hazardous waste identification and waste minimization as well as proper waste storage and disposal. The Environmental Health and Risk Management Department is charged with the responsibility for ensuring that hazardous waste generated on campus is disposed of in accordance with all applicable regulations.

Hazardous waste must be handled through the EHRM hazardous waste program once the generator has determined that it cannot be recycled or treated on-site. Each generator (laboratory) must complete the UH Hazardous Waste Pickup Request Form online to facilitate EHRM removing and safely handling the waste. All individuals who are designated to prepare laboratory waste disposal must attend the EHRM Hazardous Waste Procedures Class. Contact the EHRM for a schedule of upcoming classes.

2.5 Spills and Accident Reporting

Spills

It is the responsibility of each individual using hazardous materials to become familiar with the emergency response procedures dictated by the manufacturer of such materials. Small spills and minor incidents should be handled by properly trained laboratory personnel.

The following general rules should be followed in the event of a *major* hazardous materials spill or other incident:

1. QUICKLY EVALUATE THE SITUATION

   Ask the following questions:
   Is someone injured or requires immediate medical attention?
   Is the spill manageable with the personnel and resources in the laboratory?
   Is there a danger to others outside the laboratory?

2. ACTIVATE EVACUATION (FIRE) ALARM, IF NECESSARY, FOR THE BUILDING

   Be familiar with the sound of the alarm system in your facility. If the spill/incident could threaten the health of individuals in the building, activate the alarm.

3. CALL UH POLICE 713-743-3333 FOR HELP

   Tell dispatcher as much detail as possible about the spill/incident. If possible, locate a Material Safety Data Sheet. University of Houston Police will contact the Environmental Health and Risk Management Department.

4. ATTEND TO LIFE-THREATENING INJURIES

   The primary concern in the event of an emergency is to protect life and health of others. Only give first aid treatment to the level at which you have been trained.

5. ASSIST EMERGENCY RESPONDERS AS NEEDED

Should emergency assistance be summoned, emergency responders will arrive on the scence and take control of the incident. Cooperate with them to the fullest extent possible.

Accident Reporting

All accidents should be reported to the Principal Investigator, Laboratory Coordinator or Supervisor and the EHRM. Employee accidents resulting in even minor medical treatment or observation must be reported to the Environmental Health and Risk Management Department, Workers' Compensation Coordinator.

2.6 Audits

Regular laboratory audits will assist the Environmental Health and Risk Management department in its mission to maintain a laboratory environment that is inherently safe for its employees. Audits will be conducted to ensure the effective communication of the University of Houston's Comprehensive Laboratory Safety Program. The ability of any laboratory to operate in a manner that minimizes risk to personnel and the environment is dependent on laboratory users who understand and carry out prudent practices for the safe handling, storing, and disposing of chemical, biological, and radioactive agents. The goals of each laboratory audits are to:

1. Maintain laboratory facilities and equipment in a safe operating condition
2. Provide a safe working environment for all employees and and assess the level of emergency readiness
3. Ensure that all laboratory procedures and experiments are conducted in a safe and prudent manner
4. Ensure adherence to the content of the General Laboratory Safety Manual.

The general laboratory inspection checklist will be utilized by the LSO, or a designated representative of the EHRM during the annual laboratory inspections. This checklist will assist the EHRM in the overall assessment of safety conditions in the University laboratory areas. A copy of the general laboratory inspection checklist can be view on Appendix B.

3.0 STANDARD LABORATORY CONTROL MEASURES

Laboratories on campus are designed to limit specific hazards in a controlled environment. Once new hazards are introduced into a laboratory environment, the laboratory may need to be modified in some respect to mitigate or avoid an undesirable or adverse condition arising from the new hazard. There are a variety of facility designs and engineering controls that can be utilized in a laboratory to control chemical or biological hazards. Engineering controls consist of various measures for reducing a hazard at its source or for separating personnel from the hazard. Engineering controls might consist of isolating a particular chemical operation, enclosing a potentially explosive reaction, or utilizing local exhaust such as a fumehood for an operation which produces airborne chemicals. Since engineering controls function to reduce or eliminate a hazard at its source or before it is created, they should be fully considered whenever possible as the first step in chemical or biological control measures within the laboratory.

It is the responsibility of the laboratory employees to become familiar with the specific functions and proper use of the control measures provided in the laboratory. However, the Principal Investigator or Laboratory Coordinator is responsible for ensuring that the facility engineering controls are functioning properly at all times. Any malfunctions in the safeguards should be reported to the Plant Operations Customer Service at 3-4948 .

3.1 Hygiene Practices

There are generalized precautions and personal hygiene practices that have been established to protect laboratory employees from hazards associated with working with hazardous materials. These basic precautions will minimize the possibility of such exposure:

1. Do not prepare, store, or consume food or beverages in the laboratory.
2. Do not smoke in the laboratory. Tobacco products in opened packages can absorb chemical vapors.
3. Do not apply cosmetics in a laboratory environment. (This includes lip balm or chapstick).
4. Wash hands and wrists thoroughly before leaving the laboratory, even if gloves were worn during the work day.
5. Wash lab coats, aprons, or jackets separately from personal laundry to prevent cross contamination.
6. Never wear or bring lab coats, jackets or aprons into areas that are designated for the consumption of food.
7. Never mouth pipette.
8. Always use the appropriate personal protective equipment to avoid direct contact with any hazardous chemical.
9. Employees should know the symptoms of potential exposure related to the hazardous material(s) they are working with.
10. Replace personal protective equipment as needed to maintain its integrity.
11. Avoid working alone whenever possible.

3.2 Ventilation

The importance of clean uncontaminated air in the laboratory work environment is well known. Ventilation controls should be readily available and easily accessible to ensure that the laboratory air is continuously replaced and that concentrations of toxic substances do not increase during the workday. Additionally, the ventilation system should ensure that the toxic substances are not recirculated from laboratory to aboratory or within the building. There are two main types of ventilation systems, HVAC and local ventilation.

1. Heating, ventilation and air conditioning (HVAC) systems are designed primarily for temperature, humidity, and air quality.
2. Local ventilation systems are designed to remove the contaminants generated by an experiment or device to the exterior of the building.

It is the responsibility of the Principal Investigator, or Laboratory Coordinator to immediately report any problems with the ventilation systems in the laboratories to Plant Operations Customer Service (3-4948)

3.3 Safety Equipment

All laboratories should be provided with safety showers, eyewashes, and appropriate fire extinguishers. Adequate ventilation, wash sinks, and approved waste disposal receptacles are also necessary. All of these should be conveniently located, properly maintained, and frequently tested. Special consideration should be given to ensure accessibility to safety equipment as well as ease of evacuation of physically disabled individuals.

Fume Hoods

Laboratory air flows should be balanced at the time of fumehood installation to achieve designed fume hood face velocities and uniformity of airflow patterns. To assure the safety of the fume hood user, the following guidelines for fume hood use should be observed:

1. Observe notices posted by the Plant Operations specifying schedules for shutdown of fume hood exhaust fans for routine maintenance and/or repairs.
2. Ensure working condition of exhaust fan prior to fume hood use.
3. Always wear safety glasses and a lab coat when working at or near the fume hood.
4. Remove all items from the fume hood which are not necessary for the immediate operation or experiment.
5. Place all equipment necessary for the performance of experiments at least six inches inside the front face of the fume hood.
6. Perform all work that will release noxious vapors, fumes or aerosols at least six inches inside the front face of the fume hood.
7. Limit the quantity of chemicals and/or number of activities conducted within the fume hood that have potential for creating an explosion or fire situation.
8. Place the fume hood sash at the proper working height for procedures involving the handling of hazardous materials within the fume hood area. Typically this is 14 to 18 inches.

9. Do not use the fume hood for handling and/or storage of hazardous materials during scheduled periods of fume hood maintenance and/or repair.
10. Submit fume hood modification plans to the EHRM for pre-approval. Unauthorized modifications to fume hoods, fume hood exhaust ducts or fume hood exhaust fans are prohibited.

Laboratory fume hoods should be inspected for proper operation and adequate face velocity annually and after maintenance/repair or adjustment. A fume hood sticker with information indicating date of inspection, expiration date, the inspector, face velocity of the fume hood, approved use, and approved sash working height will be attached in a prominent location on the front of the fume hood after completion of each inspection by EHRM personnel.

A standard evaluation form will be used by EHRM for all fume hoods. The completed form will be used to document that the fume hood is functioning properly, needs adjustment, or has other problems. The EHRM laboratory fume hood guidelines can be accessed at www.uh.edu/plantops/ehrm.

Hand wash Stations

Principal Principal Investigators or Laboratory Coordinator should designate an area in the laboratory for a handwash station. These areas are usually located in one or two of the sinks in the laboratory. The handwash stations should be properly labeled and equipped with soap and towels.

These stations should be utilized by individuals who come in contact with chemical, biological, or radioactive agents in the laboratory. Everyone who works with hazardous agents on a routine basis should wash their hands before and after using the agents. The stations should never be used to dispose of hazardous waste. (*Example*: do not pour chemical, biological, or radioactive material down the drains). It is the responsibility of the Principal Investigator, or Laboratory Coordinator to ensure that the handwash stations are available, accessible and properly equipped at all times.

Safety Showers

Each laboratory area should be equipped with a safety shower. The ANSI standard, *Z358.1-1990, Emergency Eyewash and Shower Equipment,* requires that emergency showers be located no more than 10 seconds in time nor greater than 100 feet from the hazard. The shower must be readily accessible, be kept clear of obstructions, and clearly labeled. The valve must open readily and remain open until intentionally closed. Although an associated floor drain is desirable, its absence should not prohibit installation of a safety shower.
The Environmental Health and Risk Management Department will be responsible for inspecting the safety showers on a regular schedule.

Eyewash Stations

Eyewash Stations are designed to provide a gentle and continuous, low-pressure flow of tempered aerated potable water at 0.4 gallons per minute for a period of at least 15 minutes. The stations must be easily accessible from any location in the laboratory. When possible, all laboratory users should practice activating the eyewash stations.

While the EHRM prefers permanent station with plumbing, a hand-held portable eyewash station is better than no station at all.

Eyewashes, like safety showers, must be located no more than 10 seconds in time nor greater than 100 feet in distance from the hazard. Their location should be clearly labeled. It is recommended that safety showers and eyewashes be located at least five feet apart in the same room. The ANSI standard Z358.1 requires that eyewashes be activated weekly. It is the responsibility of the Principal Investigator or Laboratory Coordinator to ensure that all eyewash units are checked on a weekly basis. For more information, visit ANSI web site at: www.ANSI.Org

Fire Extinguishers

Fire extinguishers are very important components of safe laboratory operation. Each laboratory should be equipped with the appropriate type for the expected fire emergency and be capable of immediate utilization. Currently the UH Department of Public Safety Fire Marshal Office is ultilizing multi-purpose (Class ABC) extinguishers for the majority of laboratories on campus. There are several Class D (metal fires) extinguishers in laboratories which work with metals.

Safety Containers for Flammable Liquids

An approved container with a spring-closing lid and spout cover should be used to store flammable liquids. The safety container is designed so that it will safely relieve internal pressure when subjected to fire exposure. The safety container utilized in the laboratories must not exceed 19 L (5 gal) capacity.

These general safety practices should be followed by every individual working with flammables in the laboratory environment.

1. Chemicals in safety cans must be stored in designated storage areas in the laboratory. Storing safety cans in the laboratory work areas, on the floor, or in the hallway is unacceptable.
2. All flammable liquids must be stored in a laboratory storage area that protects the material from sources of ignition.
3. The safety container lid must be kept closed tightly except when adding or removing liquid flammables.

Flammable Storage Cabinets

The safe storage of flammable liquids or highly combustible chemicals should always be provided in a laboratory environment. There must also be adequate security provided at all times to prevent unauthorized access to flammable chemicals. Storage facilities and equipment must be stable and secure against sliding and collapse, and not subject to flooding. The purpose of flammable storage cabinets is to protect the chemicals it holds from the heat and flames of external fire rather than to confine burning liquids within. The cabinets must meet NFPA 30 Guidelines on Flammable Liquids.

In all laboratory work with flammable liquids the requirements of 29 CFR 1910. 1450, NFPA 30, and NFPA 45 should be followed. EHRM has the current versions of these

codes for persons wishing to review the documents. More information could be found at: http://www.nfpa.org

Corrosive Storage Cabinets

Corrosives should be kept in corrosive storage cabinets specially designed to hold them. Do not store corrosives in flammable storage cabinets because they are not coated with an epoxy enamel to guard against chemical attack. Polyethylene trays are used to collect small spills and to provide additional protection from corrosion for the shelves

Biological Safety Cabinets

A biological safety cabinet is the device used to provide containment of infectious splashes or aerosols generated by many microbiological procedures. Three types of biological safety cabinets (Class I, II, III) are used in microbiological laboratories. Class I and II biological safety cabinets are primary barriers which offer varying levels of protection to laboratory personnel and to the environment (when used with good microbiological techniques).

The Class II biological safety cabinet also provides product protection from external contamination of the materials being manipulated inside the cabinet. The gas-tight Class III biological safety cabinet, or glove box, provides the highest attainable level of protection to personnel and the environment. The proper use and maintenance of biological storage cabinets are described in *Biosafety in Microbiological and Biomedical Laboratorie*s, 4th Edition written by the National Institute of Health (NIH) and the Center For Disease Control and Prevention (CDC).

Training is available on biological safety cabinet levels and uses by the EHRM.

Autoclaves

Autoclaving usually is considered to be the method of choice for decontaminating cultures, laboratory glassware, pipettes, syringes, or other small items known to be contaminated with infectious agents. The location of the autoclave within the laboratory minimizes storage and transport problems. It provides a technically proved treatment method for rendering infectious material safe. Autoclaves must be loaded carefully to allow the steam to penetrate the wrapping, since the steam has to contact the pathogens in order to destroy the hazard. The length of time required for sterilization of biological material is determined by the quantity of the load, the volume of liquid in the load, and the density of the material. Safe work practices when utilizing an autoclave include the following:

1. Read the operating manual carefully and post the operation procedures near the autoclave.
2. Release pressure slowly and open the door only slightly to allow the steam to escape before unloading.
3. Wear insulated gloves when unloading the material.

Autoclaved waste must be placed into a black trash bag before disposal into a dumpster. Contact the EHRM at 3-5858 if you questions about proper autoclaving procedures.

Refrigerators

The storage of flammable or combustible liquid in a domestic refrigerator is prohibited. All laboratory refrigerators must be labeled as safe or unsafe for the storage of flammable liquids. Refrigerators procured for the purpose of flammable liquid storage must be in compliance with the specifications for a Flammable Materials Storage Refrigerator as described in the NFPA Code 45, "Fire Protection for Laboratories Using Chemicals". Existing domestic refrigerators used for storage of flammable liquids can be modified to eliminate sources of ignition within the storage compartment. However, the modification process can be applied only to manual defrost refrigerators. Self-defrosting models cannot be successfully modified to provide even minimum safeguards against vapor ignition. The UH Fire Marshall Office should be contacted to determine feasibility and minimum procedures for modification.

3.4 Personal Protective Equipment

Clothing

Loose or torn clothing can fall into chemicals or become ensnared in equipment and moving machinery. Aprons, lab coats, and other protective clothing, preferrably made of chemically inert material, should be readily available and utilized in a laboratory environment. Hair should also be restrained because loose hair can catch fire or dip into chemical solutions. A laboratory coat or an apron should be worn when working with hazardous materials. This is particularly important if personal clothing leaves skin exposed. Since many synthetic fabrics can adhere to the skin when burning, and thereby increase the severity of a burn, cotton is the preferred laboratory clothing fabric.

Eye and Face Protection

Laboratory work may require eye and face protection to reduce the possibility of chemical exposures due to splashes. Eye protection is required of everyone who enters a chemical work area. The type of eye protection needed depends on the circumstances. Typically, safety goggles that protect the top, bottom, front and sides of the eyes is mandatory. Safety goggles should not be worn in conjunction with contact lenses, except for therapeutic reasons. If contact lenses are worn the Laboratory Coordinator or Principal Investigator and co-workers should all be aware of this, in case an accidental splash renders the wearer of such lenses incapable of washing or rinsing his or her eyes.

Face shields are necessary when working with severely corrosive liquids, with glassware under reduced or elevated pressure, with glass apparatus used in combustion or other high-temperature operations, and when there is a possibility of an explosion or implosion.

Hand Protection

The purpose of gloves is to protect against abrasions, cuts, punctures, snags, chemical burns, thermal burns, and temperature extremes in the work environment. There is a variety of gloves on the market to choose from depending on the chemical, the instrumentation, and the environment in which the hazardous material will be handled.

Respirators

In a laboratory environment respirators may sometimes be relied on if the engineering controls and laboratory design do not adequately limit the potential exposure to hazardous air contaminants. Individuals planning to use respiratory protection should contact EHRM for consultation. The proper selection and type of respirator used should be based on a thorough analysis of the specific activity planned. The EHRM will assist the respirator user in evaluating their individual circumstances. In addition all individuals who wear respirators, other than dust mask as a personal preference, must first be medically approved by a occupational health physician and then should be fit-tested by the EHRM

3.5 Activities Subject to Approval

Principal Investigators and Laboratory Coordinators must identify those activities which warrant prior approval before initiation by an employee or student. These include work with potentially biohazardous materials, radioactive materials, lasers, x-ray machines, animal research, dangerous drugs and controlled substances and human subject research. In addition certain chemicals are considered particularly hazardous and should be reviewed and approved by the Departmental Chair in conjunction with the EHRM.

Biosafety Committee

Researchers working with potentially hazardous biological agents, recombinant DNA and agents specified by the Centers for Disease Control and Prevention (CDC) must receive prior approval from the Biosafety Committee. Information and forms are available from the Research andf Intellectual Property Management Division at www.research.uh.edu.

The following guidelines have been adopted as the minimum safety standards for research involving biological agents and materials at the University of Houston:

1. *Biosafety in Microbiological and Biomedical Laboratories, U.S. Department of Health and Human Services, Public Health Service Centers for Disease Control and National Institutes of Health, HHS Publication No. 93-8395.*
2. *NIH Guidelines for Research Involving Recombinant DNA Molecules, Office of Recombinant DNA Activities.*

Radiation Safety Committee

Users of radioactive materials and radiation producing devices must be authorized by the Radiation Safety Officer and the Radiation Safety Committee. Principal Investigators are issued sublicenses and/or subregistrations citing specific approval and conditions. All Authorized Users must follow good health physics work practices in the labs and maintain regulatory compliance.

The Environmental Health and Risk Management Department is charged with the responsibility for providing certain health physics services and Principal Investigator consultations as well as radioactive waste disposal for the campus. The specific duties

and responsibilities under state and federal law and university policy regarding radiation hazards are detailed in the EHRM Radiation Safety Manual available online at www.uh.edu/plantops/ehrm/ click on manuals.

Animal Research Committee

It is the responsibility of each Principal Investigator who wishes to use live animals to secure prior approval from Institutional Animal Care and Use Committee. Information and forms are available from the Research & Intellectual Property Management Division at www.research.uh.edu

Dangerous Drugs and Controlled Substances

Certain drugs and controlled substances (i.e. narcotics) are regulated by the Drug Enforcement Administration (DEA) and the Texas Department of Public Safety (DPS). Researchers who desire to work with these substances must secure registrations from the DEA and DPS. Contact the EHRM for further information and refer to UH Manual of Administrative Policies and Prcedures (MAPP) 06.XX

Human Subjects

It is the responsibility of each Principal Investigator to identify all research involving the use of human beings as subjects of research and register the research protocol with the Committee for the Protection of Human Subjects. Information and forms are available from the Research & Intellectual Property Management Division at www.research.uh.edu

Particularly Hazardous Chemicals

The EHRM urges all chemical users to read and understand the MSDS before using the specific chemical in question. Certain chemicals have been recognized by the International Agency for Research on Cancer (IARC) and other research bodies to cause or promote cancer in human beings. Preapproval may be required from the EHRM to use particularly hazardous chemical. Please consult the Chemical Hygiene Plan available on the EHRM website.

4.0 SAFE HANDLING REQUIREMENTS IN THE LABORATORY

Seventy eight percent of laboratory accidents are due to human error. Operational requirements for safe handling of hazardous materials in the laboratory when followed, reduce the chance of an accident due to human error. It is the responsibility of each laboratory employee to become familiar with the safe handling requirements in the laboratory described in this section. However, the Principal Investigator or Laboratory Coordinator is responsible for ensuring their employees have sufficient knowledge to avoid recognized hazards in their laboratory.

The National Research Council published *Prudent Practices in the Laboratory, Handling and Disposal of Chemicals* which describes a minimum standard of care in a laboratory.

4.1 Hazard Identification

The EHRM requires that flammable liquids, toxic agents, highly reactive chemicals, and radioactive materials must be handled in a manner which poses no substantial hazard to human health and will not be deliberately discarded with the general waste or by any route into the sanitary sewer system.

The Texas Hazard Communication Act requires that employees using a hazardous chemical receive Hazard Communication (HAZCOM) Training. Contact the EHRM for initial HAZCOM training, which is included in the Hazardous Materials Orientation Class, that is manadatory for all new laboratory employees. The Texas Hazard Communication Act gives employees the right to be informed about hazardous chemicals in the work place, to have access to information regarding the hazards associated with those chemicals, and to be trained in safe work practices with the chemical.

While chemical hazards are probably the most widely recognized in the laboratory environment there are other potential hazards which need to be identified. These include biological, radioactive, electrical, mechanical and physical. Some of these hazards require prior approval as noted in Section 3.5 of this manual. It is imporatant that all potential hazards in the laboratory environment be evaluated and controlled as much as possible.

4.2 Labeling

There are generalized labeling practices that have been established to protect laboratory employees from physical and health hazards associated with working with hazardous chemicals.

These labeling practices require that:

1. Labels on incoming containers of hazardous materialss must not be removed or defaced.
2. All chemical containers used in the work place must, as a minimum, be labeled with the identity of the hazardous material

3. When material is transferred from a labeled container to an unlabeled container, a label must be placed on the unlabeled container.

4.3 Compressed Gas Hazards

There are generalized practices that have been established to protect laboratory employees against physical hazards. These include compressed gas cylinder safety tips, and the EHRM Compressed Gas Cylinder Policy.

Compressed Gas Cylinder Safety

The following must be followed for the transporting, storing, and use of compressed gas cylinders.

Compressed Gas Cylinders Identification

1. The contents of any compressed gas cylinder should be identified clearly so as to be easily, quickly, and completely determined by any laboratory worker.

2. A durable label should be provided that cannot be removed from the compressed gas cylinder.

3. No compressed gas cylinder should be accepted for use that does not identify its contents legibly by name.

4. Color-coding is not a reliable means of identification; cylinder colors vary from supplier to supplier, and labels on caps have no value because many caps are interchangeable.

5. Tags should be attached to the gas cylinders on which the names of the users and dates of use can be entered.

6. If the labeling on the gas cylinder becomes unclear or defaced so that the contents cannot be identified, the cylinder should be marked "contents unknown" and the manufacturer contacted regarding appropriate procedures.

Gas Cylinders Transportation

1. Cylinders transported by truck must be fastened securely in an upright position so that they will not fall or strike each other.

2. Cylinders should not be transported without safety caps. A cylinder's cap should be screwed all the way down on the cylinder's neck ring and should fit securely. Do not lift cylinders by the cap. The cap is for valve protection only.

3. Cylinders should not be transported with the regulator attached to the cylinder.

Compressed Gas Cylinders Storage

1. Cylinders should not be allowed to drop nor be struck violently.

2. Cylinders should be properly secured at all times whether attached to a wall, cylinder truck, cylinder rack, or post.

3. Liquefied flammable gas cylinders should be stored in an upright position or such that the pressure relief valve is in direct line with the vapor space of the cylinder.

4. Caps used for valve protection should be kept on the cylinders at all times except when the cylinder is actually being used or charged.

5. Cylinders should not be used for rolling, supports, or any purpose other than the transportation and supply of gas.

6. Cylinders should be stored in a well-ventilated area away from flames, sparks or any source of heat or ignition. Keep cylinders away from electrical circuits.

7. Cylinders should not be exposed to an open flame or to any temperature above 125 degrees F.

8. Oxygen cylinders (empty or full) in storage should be separated from fuel-gas cylinders and combustible materials by a minimum distance of 20 feet or by a barrier at least 5 feet high having a fire-resistance rating of at least one-half hour.

9. Flammable gas cylinders should not be stored with oxygen or nitrous oxide cylinders or adjacent to oxygen charging facilities.

10. Full and empty cylinders of all gases should be stored separately and identified by signs to prevent confusion.

11. Cylinders may be stored outdoors but should be protected from the ground to prevent bottom corrosion. Where extreme temperatures prevail, cylinders should be stored so they are protected from the direct rays of the sun.

12. Cylinders should not be exposed to continuous dampness, stored near salt or other corrosive chemicals or fumes. Corrosion may damage cylinders and cause their valve protection caps to stick.

<u>Compressed Gas Cylinders Usage</u>

1. Always use the proper regulator for the gas in the cylinder. Always check the regulator before attaching it to a cylinder. If the connections do not fit together readily, the wrong regulator is being used.

2. Before attaching cylinders to a connection, be sure that the threads on the cylinder and the connection mate are of a type intended for the gas service.

3. Do not permit oil or grease to come in contact with cylinders or their valves.

4. Wipe the outlet with a clean, dry, lint-free cloth before attaching connections or regulators. The threads and mating surfaces of the regulator and hose connections should be cleaned before the regulator is attached.

5. Attach the regulator securely before opening the valve wide. Always use a cylinder wrench or another tightly fitting wrench to tighten the regulator nut and hose connections.

6. Open cylinder valves SLOWLY. Do not use a wrench to open or close a hand wheel type cylinder valve. If it cannot be operated by hand, the valve should be repaired.

7. Stand to the side of the regulator when opening the cylinder valve.

8. Do not attempt to repair cylinder valves or their relief devices while a cylinder contains gas pressure. Tag leaking cylinders or cylinders with stuck valves and move to a safe, secure outdoor location.

Compressed Gas Cylinder Policy

Principal Investigators and Department Chairs must not allow the purchase of non-returnable gas cylinders (*Example*: lecture bottles). In addition, corrosive and reactive gas cylinders must be returned to the manufacturer one year after their date of delivery. All other cylinders must be returned to the manufacturer three years after their date of delivery.

5.0 EMERGENCY AND MEDICAL PROCEDURES

An emergency situation is declared if a release or spill of a hazardous substance occurs that poses a significant threat to the health and safety of the faculty, staff, or students in the vicinity of the release.

The most important fact to remember in an emergency situation is to remain calm. Step away from the incident momentarily, to access the magnitude of the situation and to determine the following information:

- *Is the situation life threatening?*
- *Are there people injured?*
- *Is there a persisting danger (Example: fire)?*
- *What agent caused the emergency situation (biological, chemical, or radiological)?*

Once this information is ascertained, notify the UH Police by dialing (713) 743-3333. Instruct the police to send medical assistance if injuries have occurred. If minor injuries occurred due to the incident, students should seek medical attention from the campus Health Center employees should seek medical attention from their personal physician. The Environmental Health and Risk Management Department should be notified of any hazardous substance release or spill.

5.1 Basic Emergency Response

Major Release

1. Assess the situation
2. If there is an immediate danger to life and health call UH Police at (713) 743-3333
3. Pull the fire alarm and evacuate the area immediately
4. Evacuate and secure the area as much as possible without risking injury
5. Assist emergency responders by giving as much info as poosible upon their arrival
6. Record events as much as possible for post emergency response work

Controllable Release

1. Notify all personnel in the vicinity of the spill or release
2. Confine spill or release as soon as possible.
3. If personnel are contaminated, personnel decontamination should proceed immediately using proper techniques.
4. Notify the EHRM for assistance at (713) 743-5858
5. Collect contaminated materials and PPE for disposal

5.2 Injury and Illness

For medical treatment due to an injury received in a laboratory environment, the affected person must seek medical care and employees must report the injury to the Workers Compensation Coordinator Claim Coordinator within 24 hours of the incident.

For minor injuries first aid kits should be accessible and fully equipped for use. First aid kits are only recommended for incidents that do not require emergency care. The kits should be periodically checked by the Laboratory Supervisor or Principal Investigator to ensure the availability of proper first aid treatment supplies in case of an accident. It is the Principal Investigator's responsibility to:

1. Always have the first aid equipment readily available.
2. Keep essential supplies in the first aid kit at all times.

It is the faculty, staff, or student's responsibility to notify the Principal Investigator, Laboratory Supervisor or Department Chair if they become ill or injured from exposure to any chemical, biological, or radiological agent utilized in the laboratory. The Principal Investigator, Laboratory Supervisor, Department Chair or an individual acting on their behalf the day the incident is reported should:

1. Document the work related injury or illness.
2. Ensure that the injured person(s) receive prompt medical treatment.
3. Report the illness or injury of an employee to the Workers Compensation Claim Coordinator within 24 hours.

For more detailed information on illness and injuries refer to the UH Workers' Compensation Manual provided by the EHRM at www.uh.edu/plantops/ehrm.

The EHRM prefers that all incidents be reported, even those which do not result in injury, if there is a potential for personal injury in the future.

5.3 Medical Consultation and Examinations

All employees are covered by workers' compensation insurance in case of incidents, injuries, and illnesses. The University requests that employees report every incident to their immediate supervisor, and ask that the Employer's First Report of Injury form be filed with the Workers Compensation Claims Coordinator in the EHRM. The University of Houston Workers' Compensation Manual should be reviewed for "Employee Responsibilities" specifically if the injured employee is losing time.

Immediately following a workplace injury or illness, the employee is entitled to emergency medical attention (if required) at any area hospital emergency room. Follow up care under workers' compensation insurance must be approved by the State Office of Risk Management.

Appendix A – CHEMICAL OR HAZARD SPECIFIC TRAINING FORM

A copy of the Laboratory Specific Training Form can be obtained online from the Environmental Health and Risk Management Department website at www.uh.edu/plantops/ehrm/ under Forms.

Appendix B – LABORATORY SAFETY AUDIT CHECKLIST

A copy of the Laboratory Safety Audit Checklist can be obtained online from the Environmental Health and Risk Management Department website at www.uh.edu/plantops/ehrm/ or by calling the EHRM Lab Safety Officer at (713) 743-0414.