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Your Health and Safety

The purpose of this safety manual is to provide general safety rules and guidelines to ensure safe working laboratory conditions for all members of the Lehigh community and their visitors. The content of this manual is not necessarily comprehensive; therefore, supplemental safety procedures may be required as each situation warrants.

Safe laboratory practice is an attitude, knowledge, and an awareness of potential hazards. Safety is a mutual responsibility and requires the full cooperation of everyone in the laboratory. This cooperation means that each student, instructor, and researcher must observe safety precautions and procedures and should:

1. Follow all instructions carefully.
2. Become thoroughly acquainted with the location and use of safety equipment such as fire extinguishers, showers, exits, and eyewash stations.
3. Become familiar with safety precautions and emergency procedures before undertaking any laboratory work.
4. Become familiar with the method of operations and all potential hazards involved before beginning an experiment.
5. Become familiar with Lehigh University's waste guidelines and other programs developed by Environmental Health and Safety (EH&S).
6. Become familiar with your departmental emergency plan. Know your building monitors and your primary and alternate rally sites in the event of a building evacuation.

Many accidents can result from an indifferent attitude, failure to use common sense, and failure to follow instructions. Be aware of what your neighbors are doing, since you may be a victim of their mistakes. Do not hesitate to comment to a neighbor engaging in an unsafe practice or operation.

REMEMBER:

TREAT CHEMICALS, RADIOLOGICAL AGENTS, BIOLOGICAL AGENTS, AND LAB EQUIPMENT WITH CAUTION AND RESPECT.

Instructor and Laboratory Supervisor Responsibilities

The laboratory instructor/supervisor is responsible for advising students of the safety requirements at the beginning of each course of study. The instructor/supervisor will point out particular hazards which may be encountered, rules and procedures to prevent or minimize the hazards, and the need for wearing safety apparel and accessories.

The instructor/supervisor will advise students of fire and accident procedures, building emergency procedures, including the location and use of fire extinguishers, safety showers, and eyewash stations.

Laboratory instructors/supervisors should be satisfied their students understand experimental hazards before they permit the students to participate in or conduct their own experiments.

Facility Safety

All chemistry laboratories should have access to safety showers, eyewash stations, fire extinguishers, fume hoods, laboratory sinks, and an alarm for evacuating the laboratory through well-maintained and unimpeded exits.

All safety equipment such as showers, fire extinguishers, and the nearest, unrestricted telephone should be readily available, operable, and known to all persons in the laboratory. Laboratory personnel should **always** have access to properly-functioning, adequately-designed facilities.

Personal Safety and Hygiene

Good chemical hygiene practices include the use of personal protective equipment (PPE) and good personal hygiene habits. Although PPE can offer a barrier of protection against chemicals and biological materials, good personal hygiene habits are essential to prevent chemical exposure, even when using PPE.

Some general guidelines that should always be followed include:

- Safety glasses must be worn in the laboratory at all times. If you are found not wearing eye protection, you will be subject to disciplinary action.
- Do not eat, drink, chew gum, or apply cosmetics in a lab or other area where chemicals are used.
- Do not store food or drink in refrigerators that are used to store chemicals.
- Never try starting a siphon or pipette by mouth, doing so can result in ingestion of chemicals or inhalation of chemical vapors. Always use a pipette aid or suction bulb to start a siphon.
- Always confine long hair, loose clothing, and jewelry.
- Wear a lab coat when working with hazardous materials.
- Shorts, sandals, flip flops, etc. should never be worn in a lab when working with chemicals.
- Remove laboratory coats, gloves, and other PPE immediately when chemical contamination occurs. Failure to do so could result in chemical exposure.
- After removing contaminated PPE, be sure to wash any affected skin areas with soap and water for at least 15 minutes. Report the incident to your supervisor and Environmental Health & Safety (X84251)

- Always remove lab coats, scrubs, gloves, and other PPE before leaving the lab. Do not wear lab coats, scrubs, or other PPE (especially gloves) in areas outside the lab, particularly not in areas where food and drink are served, or other public areas.
- Always wash hands with soap and water after removing gloves and before leaving the lab or using items such as the phone, turning doorknobs, or using an elevator.
- Familiarize yourself with the location of safety equipment (such as fire extinguishers, safety showers, spill supplies, eyewash stations, first aid kits, etc.) and evacuation routes.
- Never work in the laboratory alone. If a student is required to make-up a lab due to absence during their regularly scheduled lab, then a make-up period will be assigned during normal lab hours.
- **Smoking** is prohibited in all buildings at Lehigh.

Prevention of Chemical Injuries

1. Obtain and thoroughly review all Safety Data Sheets (SDSs) for the chemicals you will use.
2. Be aware of what your neighbor is doing. If their actions indicate confusion or ignorance, inform your instructor/supervisor.
3. Never leave a reaction unattended.
4. Flammable liquids (ether, acetone, etc.) must not be heated in an open container or used in a room where an open flame is burning. It is best to use these types of reagents under a hood.
5. Never heat a closed system.
6. Read the reagent bottle—**TWICE!** Make sure you have selected the correct chemical.
7. Place waste reagents in the appropriate waste receptacles.
8. Clean up your work area completely when finished.
9. Never smell or taste any chemical.

What to Report to Police in a Laboratory Emergency

If a spill occurs in your laboratory, you should be ready to provide the following information to the University Police and/or emergency responders:

1. Your name.
2. Phone number.
3. Building/Lab #.
4. Others involved/witnesses.
5. What spilled/leaked, etc.? Chemical(s) involved? Quantity?
6. Other chemicals and/or hazards in the vicinity.
7. Where in the lab did the spill occur?
8. Was anything done to contain the spill?

Please stay in contact with the spill responders to provide as much information as needed to help in determining the appropriate response.

Building Monitors – Who are They?

Building monitors are individuals in your area/department who have been identified to assist in the event of a campus-wide or building emergency. These individuals play a vital role in the campus safety structure. These individuals are responsible for the following:

- Coordinate evacuation of rooms/buildings.
- Work with building personnel at established rally sites.
- Liaison with emergency responders and University Police.
- Know the building monitor in your area/building along with your primary and alternate rally site.

How to Prepare For An Emergency – Plan Ahead – Take Action

- Become familiar with your department's emergency plan and procedures.
- Know the building monitor for your area/building.
- Know at least two building exits other than the elevators.
- Know the location and operation of the building fire alarm system.
- Know the location of the nearest fire extinguisher.
- Know emergency phone numbers.
- Participate in all fire drills and take them seriously.
- Know the primary and the alternate rally site for your building.
- Begin to evacuate at the first sign of smoke, a fire alarm, or an evacuation notice.

Chemical Storage and Disposal

1. All potentially dangerous chemicals should be properly labeled, stored, and handled.
2. All waste material (chemical, radioactive, biohazard, etc.) should be labeled and/or disposed of according to established Lehigh University procedures to minimize any safety hazards.
3. All radioactive materials should be handled in compliance with the Lehigh University Radiation Safety Program. Contact EH&S (X84251) if you plan to work with radioisotopes or radiation-producing equipment.
4. All broken or cracked glass should be disposed of in well-marked and sealed containers (e.g., cardboard boxes) separate from solid waste containers to prevent injury.
5. Call X84251 for all waste related issues.

Hazard Communication Program Availability

Contact your instructor or laboratory supervisor if you would like to review Lehigh's Hazard Communication Program. Copies of this written program and lists of hazardous chemicals known to be present in the workplace are maintained at the EH&S office.

Safety Data Sheets (SDSs)

SDS are informational sheets which contain facts on a specific chemical. This information includes: hazardous ingredients, physical data, fire and explosion data, health hazards, etc. Chemical manufacturers are required by law to produce and distribute SDSs to their customers. Every laboratory/work area at Lehigh should have an SDS for each chemical in use.

Safety Data Sheets (SDSs) are accessible on the EH&S website or through Google.

Call EH&S at X84251 if you need help or if your search does not find the SDS you need.

Inspections by Regulatory Agencies

Inspections by local, state, and federal regulatory agencies can occur at any time and result in citations and significant fines for the University. The best way to be prepared for these inspections is to understand what regulations apply to your area and what you need to do to comply with these regulations. You can obtain this information from resources such as this Laboratory Safety Manual, by conducting your own self inspections, and by calling EH&S at X84251.

If a state or federal inspector shows up at your work area unescorted, ask them to please wait and contact EH&S (X84251) immediately.

Laboratory Security

Laboratories need to take specific actions in order to provide security against theft of highly hazardous materials, valuable equipment, and to ensure compliance with state and federal regulations. EH&S encourages each unit (college, department, and research group) to review and develop procedures to ensure the security of all hazardous materials in their area of responsibility.

Many laboratories already implement various means of security, including requirements to lock up controlled substances, syringes, and needles, and radioactive materials. EH&S recommends you review and assess the hazardous materials in your laboratory and consider security issues in protecting those materials. The intent is to minimize the risk of theft, especially targeting the five-minute window when the lab is left unattended.

***One easy way to increase security is to make sure your laboratory door is locked whenever the lab is left unattended, even for a few minutes.

Working Alone

Whenever possible, laboratory personnel should avoid working alone when conducting research, especially when experiments involve hazardous substances and procedures. Laboratories should establish specific guidelines and standard operating procedures specifying when working alone is not allowed and develop notification procedures when working alone occurs. All work to be performed by someone working alone, and the monitoring system that is established, must be approved in advance by the Principal Investigator or laboratory supervisor.

If a laboratory person determines it is necessary to work alone, consideration should be given to notifying someone else in the area—in an adjacent room, another lab on the same floor, or a lab on a different floor. It is recommended that a “buddy system” be established for regular, routine checks on personnel working alone, such as every 15—30 minutes, to ensure no accidents have occurred. This could be accomplished by physically walking to the room where the lab worker is or through the use of a phone. If the person working alone is doing highly hazardous work, then the person checking on the lab worker should not enter the same room. A system of visual checks should be established to indicate there are no problems or to determine if help is needed.

In the event of an emergency that requires the buddy to leave prior to the completion of an experiment involving highly hazardous chemicals, the buddy should notify the University Police (X84200) and provide a name, location, and end time of the experiment involved. The buddy should also notify the person conducting the experiment. The person conducting the experiment should make an effort to complete the experiment in a safe manner and notify the University Police at the completion of the experiment.

Please Note: For rooms that are locked due to security needs, prior arrangements are required to allow the designated buddy access. However, be aware the University does have a standardized keying system and the University Police may not always have immediate access to locked doors—which could result in a delay in response in the event of an emergency. Also understand that if the door to the lab does not have a window, or if the window is covered, then there is a chance that if something happened to a person working alone in a locked lab, they may not be discovered until someone from the lab goes into the room (which could be a day or more).

Examples of activities where working alone would be permissible include:

- Office work such as writing papers, calculations, computer work, and reading.
- Housekeeping activities such as general cleaning, reorganization of supplies or equipment, etc. as long as no moving of large quantities of chemicals is involved.
- Assembly or modification of laboratory apparatus when no chemical, electrical, or other physical hazards are present.
- Routine lab functions which are part of a standard operating procedure which has been demonstrated to be safe and not involve hazardous materials.

Examples of activities where working using a “buddy system” should not be considered include:

- Experiments involving toxic or otherwise hazardous chemicals, especially, poison inhalation hazards.

- Experiments involving high-pressure equipment.
- Experiments involving large quantities of cryogenic materials.
- Experiments involving work with unstable (explosive) materials.
- Experiments involving Class 3b or 4 lasers.
- Transfer of large quantities of flammable materials, acids, bases, and other hazardous materials.
- Changing out compressed gas cylinders containing hazardous materials.

Housekeeping

Housekeeping refers to the general condition and appearance of a laboratory and includes:

- Keeping all areas of the lab free of clutter, trash, extraneous equipment, and unused chemical containers. Areas within the lab that should be addressed include benches, hoods, refrigerators, cabinets, chemical storage cabinets, trash cans, etc.
- Keep all containers of chemicals closed when not in use.
- Cleaning up all chemical spills immediately, regardless if the chemical is hazardous or not. When cleaning up a chemical spill, look for any splashes that may have resulted on nearby equipment, cabinets, doors, and countertops.
- Keeping areas around emergency equipment and devices clean and free of clutter. This includes items such as eyewash/emergency showers, electric power panels, fire extinguishers, and spill cleanup supplies.
- Keeping a minimum of (3) three feet of clearance (as required by fire codes) between benches and equipment. Exits must be clear of obstacles and tripping hazards such as bottles, boxes, equipment, electric cords, etc. Combustible materials may not be stored in exits (including corridors and stairways), exit enclosures, boiler rooms, mechanical rooms, or electrical equipment rooms.

- When storing items overhead, keep heavier and bulkier items closer to the floor. In sprinklered rooms, all storage, including both combustible and non-combustible materials, must be kept at least 18" below the level of the sprinkler head deflectors to ensure that fire sprinkler coverage is not impeded.
- Always use a stepladder when reaching for overhead items, do not stand on chairs or countertops. If you do not have a stepladder available, then contact your Department Coordinator.

In summary, good housekeeping has obvious health and safety benefits and can have a positive mental effect on laboratory personnel who work in a clean environment, which can lead to increased productivity. Also keep in mind that during an inspection by a state or federal regulatory agency, the general condition of the laboratory observed in the first few minutes of the inspection (the housekeeping of the lab) can have a significant impact (positive or negative) on the rest of the inspection process.

It is the responsibility of the Principal Investigator and laboratory supervisor to ensure laboratories under their supervision are maintained in a clean and orderly manner and personnel working in the lab practice good housekeeping.

Access to Laboratories

Access to Lehigh University laboratories, workshops, and other work areas housing hazardous materials or machinery is restricted to Lehigh faculty, staff, students, or other persons on official University business.

Fire Safety

In case the building fire alarm sounds:

1. EVACUATE IMMEDIATELY, checking your immediate area to ensure everyone leaves the building. Close doors when leaving.
2. USE THE STAIRWAYS, NOT THE ELEVATORS!
3. Touch closed doors with your hand before opening to check for heat that may indicate a fire on the other side. Look through the window for signs of smoke.

4. If you need to travel through smoke, stay low and breathe through a wet cloth, if possible.
5. Do not enter the building until emergency responders give an all-clear signal.
6. Locate all the fire safety equipment near your laboratory and office. Memorize your escape routes including how many flights of stairs are associated with each one.

Visitors and Children in Labs

Due to the potential hazards and liability issues, other persons, in particular children under the age of 16 are not permitted in hazardous work areas, with the exception of University-sanctioned activity, e.g. tours, open houses, or other University related business as authorized by the Principal Investigator or laboratory supervisor. In these instances, all children under the age of 16 must be under careful and continuous supervision.

Miscellaneous

1. Any medical conditions, such as epilepsy, should be reported to the instructor/supervisor. This information can be helpful in an emergency.
2. Every individual at Lehigh University has a right to know about the hazards of the chemicals they are working with and the measures they can take to protect themselves. The University has established training sessions which deal with the Employee Right-to-Know Program and other aspects of the OSHA Hazard Communication Standard. Any student interested in attending one or more of these sessions can obtain a complete list of training sessions from EH&S.

GLOSSARY OF TERMS

Absorption	A mode of entry of a toxic substance into the body in which the substance enters through unbroken skin.
ACGIH	American Conference of Governmental Industrial Hygienists.
Acute	A health effect that is the result of a short time exposure to a high concentration of a toxic material. The effect is usually immediately seen, not more than several hours after the exposure.
Carcinogen	A material capable of causing cancer.
Chronic	A toxic effect that occurs only after exposure to a material for a long period of time, usually months or years. The amount of exposure is usually very low, and often symptoms are not immediately noticeable.
Concentration	The amount of a material in the air, for example 50 parts per million (PPM). May also refer to the amount of a substance in a mixture, for example; 10 percent ammonia in water.
Dose	The amount of a substance that enters the body. The amount depends on the rate at which the substance enters the body and the length of time the substance continues to enter the body. For example, a worker may inhale 10 milligrams of dust per day for 10 days. The total dose is 100 milligrams. Not all of the substance may remain in the body; some is eliminated, possibly as fast as it enters.
Exposure	Similar to dose. The combination of concentration of a substance in the air and the amount of time a worker is exposed to that concentration gives the total exposure or dose.
Flammable Limit	The range of concentrations in air of flammable vapors of a substance between which the vapors will ignite and continue to burn, possibly resulting in an

	<p>explosion. The lower limit is the Lower Flammable (or Explosive) Limit (LFL), and the upper limit is the Upper Flammable (or Explosive) Limit (UFL). Below the LFL there is not enough vapor to support combustion. Above the UFL, there is too much vapor; the mixture is too rich to burn. NOTE: The SDS uses Explosive Limit, but the preferred term is Flammable Limit. These terms are synonymous.</p>
Flash Point	<p>The temperature at which enough vapor is produced from a flammable liquid to reach a concentration equal to the LFL (see Flammable Limits). A substance with a high flash point is less hazardous than one with a low flash point.</p>
LFL or LEL	<p>Lower Flammable Limit or Lower Explosive Limit.</p>
SDS	<p>Safety Data Sheet.</p>
OSHA	<p>Occupational Safety and Health Administration. This Federal agency is responsible for promulgating standards to provide a safe and healthy work environment.</p>
Permissible Exposure Limit (PEL)	<p>OSHA's number that tells the concentration of a chemical in the air a worker may breathe for a given period of time (dose) without experiencing adverse effects. See TLV.</p>
Threshold Limit Value (TLV)	<p>A number that tells the concentration of a chemical in the air that a worker may breathe for a given period of time (dose) without experiencing adverse effects. ACGIH publishes TLVs for about 500 substances. OSHA uses similar limits called Permissible Exposure Limits (PELs).</p>
Toxic	<p>Poisonous and capable of causing damage to the body. A substance is more toxic if a small amount can cause the damage. The degree of hazard of a substance depends partly on how toxic it is.</p>
UFL or UEL	<p>Upper Flammable Limit or Upper Explosive Limit.</p>

