CHEMICAL HYGIENE PLAN

Year 2021

Garcia Lopez's Research Group

460 Chemistry and Materials Building

Department of Chemistry

Louisiana State University

Table of Contents

Emergencies

A. Major Medical Emergencies

1. Determine the extent of the injury to decide the best mode of response. Avoid further injury to the victim or oneself.
2. Call 911 immediately, providing directions to **LSU Police (225-578-3231)** and indicating whether or not chemicals or other agents are involved.
3. For serious injuries then call the **Employee Injury Call Center at 877-764-3574** to speak to a registered nurse. The Call Center is available 24 hours every day. The nurse will discuss the incident/injury with the employee and determine the employee's immediate medical needs which may be treatment by the Student Health Center or the Emergency Room at a local hospital.
4. Assist emergency personnel upon arrival, directing them to the scene.
5. Secure the scene for an accident investigation by EHS or the supervisor (See Accident Reporting).
6. Complete paperwork on accident as required in PS 90, Workers Compensation for University employees.
7. If you contact LSU medical center, an ambulance may be summoned for acute medical emergencies by dialing **578-HELP (4357).** State the condition of the person and the exact location.
8. If you call **911**, be prepared to provide the following information:
    i. Your name and location
    ii. Description of the medical emergency
    iii. Approximate age of the victim
    iv. Status of victim
        a. Is the victim conscious?
        b. Is the victim breathing?
        c. Is the victim bleeding?
    v. Does the victim have any medical condition(s)?
    vi. Do not move the victim unless they are in danger.
    vii. Provide first aid if you are qualified to perform it.
    viii. Stay with the victim to reassure that help is on the way.
    ix. Have someone ready and waiting for the first responders outside the building.

For emergencies that would require ambulance transport, despite of 119 and LSU health center ambulance service, East Baton Rouge Parish Ambulances provide emergency and non-emergency medical transport for patients going to hospitals, medical centers, and other health care facilities in East Baton Rouge Parish, LA.

Acadian Ambulance Service of Baton Rouge

Address: 7777 Hennessy Boulevard, 1005, Baton Rouge, Louisiana, 70808

Phone: 225-761-3330

Lagardes Medical Transportation Ambulances

Address: 7128 Modoc Avenue, Baton Rouge, Louisiana, 70811

Phone: 225-355-0083

Legacy Medical Transportation Ambulance

Address: 4303 Airline Highway, Baton Rouge, Louisiana, 70805

Phone: 225-355-4212

Report all accidents involving an employee's chemical exposure or involving a chemical spill that may constitute a danger of environmental contamination to the Supervisor and EHS. If the spill is significant, also notify LSU Police immediately. The supervisor should fill out a First Report of Injury (Injury Report | LSU Risk Management)

B. Minor Emergencies

Minor emergencies, injuries, or illnesses, any of the emergency rooms are fine, and there are also emergency rooms in the area that are frequented by LSU personnel. For emergencies, call or go to one of the following hospital emergency rooms, open 24 hours daily:

Baton Rouge General Hospital
225-763-4400
8585 Picardy Ave.

Our Lady of the Lake Regional Medical Center
225-765-6565
5000 Hennessy Blvd.

Ochsner Medical Center
225-754-3278
16777 Medical Center Dr.

The above hospitals accept out-of-state checks. They also accept LSU student insurance. (Please check your policy for limitations.) Any expenses incurred as a result of medical care obtained off-campus, including ambulance service, are your responsibility.

When the injury or illness involves a chemical, a Safety Data Sheet (SDS) should accompany the victim to the hospital (SDS available at Safety Data Sheet | LSU Environmental Health and Safety).

Minor medical injuries/illness (i.e., falls, cuts, sprains, and strains) involving employees should be reported immediately to the injurer's supervisor. The supervisor should fill out a First Report of Injury Form (available from the Office of Risk management). If medical attention is required, the injured should be taken to the LSU health center or their physician of choice.

C. Fire Emergencies

1. Try to remain calm and Do Not Enter an Area that may become Dangerous.
2. Pull the fire alarm and begin evacuation of the building in accordance with the fire plan.
3. Call Campus Police (911 or 225-578-3231) and Facility Services (225-578-2327)
4. Assure complete evacuation using assistance from others (floor monitors)
5. Monitor the situation until the all-clear is given by Campus Police. Do Not let Unauthorized People Enter the Building.

D. Reporting Accidents

To report an accident, "near miss" or hazardous situation on campus not involving an injury, contact the Environmental Health & Safety Department. All employees who are reporting a work-related incident/injury involving an LSU employee should follow the protocol outlined on the Workers Compensation | LSU Risk Management.

General Laboratory Use Policy

Laboratories are usually shared areas, and it is the responsibility of all lab personnel to be aware of the activities in the lab.

1. Sole Occupancy of Building. Under normal circumstances, work should not be done in the laboratory when the only person in the building is the laboratory person performing the work. If necessary, special arrangements need to be made to ensure periodic checks on that person.
2. Hazardous Operations. All hazardous operations are to be performed during a time when at least two people are present in the laboratory. At no time shall a laboratory person, while working alone in the laboratory, perform work that is considered hazardous. The determination of hazardous operations shall be made by the laboratory supervisor and/or CHO.
3. New Procedures or Chemicals. Prior to the use of new procedures or chemicals, a review of potential hazards created must be undertaken within the department. The review should also be completed when there is a substantial change in the amount of chemicals used or a change in the equipment used in the procedure.
4. Unattended Operations. When laboratory operations are performed which will be unattended by laboratory personnel (continuous operations, overnight reactions, etc.), the following procedures will be employed:
    a) The laboratory supervisor will review work procedures to ensure the safe completion of the operation.
    b) An appropriate sign will be posted at all entrances to the laboratory.
    c) The overhead lights in the laboratory will be left on.
    d) Precautions shall be made for the interruption of utility services during the unattended operation (loss of water pressure, electricity, etc.).
    e) Containment will be provided in the event of unexpected hazardous material releases.
    f) Tubing for running water must be in good condition and secured at connections by clamps or wire.

https://lsu.edu/ehs/files/Chemical-Hygiene-Plan.pdf

Personal Work Practices

All personnel shall be alert for unsafe practices and conditions in the laboratory and shall immediately report such practices and/or conditions to the laboratory supervisor. The supervisor must correct unsafe practices and/or conditions promptly.

1. Long hair and loose-fitting clothing shall be confined close to the body to avoid being caught in moving machine/equipment parts.
2. Use only those chemicals appropriate for the ventilation system.
3. Avoid unnecessary exposure to all chemicals by any route.
4. Do not smell or taste any chemicals.
5. Wash promptly whenever a chemical has contacted the skin.
6. Do not use mouth suction to pipette anything; use suction bulbs.
7. Wash well with soap and water before leaving the laboratory; do not wash with solvents.
8. Do not drink, eat, smoke, or apply cosmetics in the laboratory.
9. Do not bring food, beverage, tobacco, or cosmetic products into chemical storage areas or use areas.
10. Do not discard food wrappers or waste in the laboratory trash bins.
11. Avoid working alone in the laboratory. When working alone in the laboratory arrange for periodic checks by personnel in adjacent laboratories.
12. Avoid practical jokes or other behavior which might confuse, startle, or distract another worker.
13. Wash areas of exposed skin well before leaving the laboratory.
14. Keep work area clean and uncluttered, with chemicals and equipment being properly stored.
15. Clean up the work area on completion of an operation or at the end of each day.
16. Plan your work. Seek information and advice about hazards, plan appropriate protective procedures, and plan the positioning of equipment before beginning any new operation.
17. Use engineering controls. Use the hood for operations that might result in the release of toxic chemical vapors or dust. See section on engineering controls.

https://lsu.edu/ehs/files/Chemical-Hygiene-Plan.pdf

Standard Operating Procedures (SOP)

1. Avoid working alone in a laboratory or chemical storage area. When you must, take extra precautions to ensure your safety.
2. Wear appropriate eye protection at all times; see Protective Clothing and Equipment.
3. When working with flammable chemicals, be certain that there are no sources of ignition near enough to cause a fire or explosion in the event of a vapor release or liquid spill.
4. Use a blast shield for protection whenever an explosion or implosion might occur.
5. If working with pyrophoric materials such as alkyllithiums, alkylaluminums, or compounds that easily ignite surrounding solvent when exposed to the air such as potassium metal, sodium/ potassium alloy, etc., be equipped with a fire---resistant lab coat. Read the following:
   - http://chemjobber.blogspot.com/2009/05/if-i-were-working-with-tert.html
   - https://blink.ucsd.edu/safety/research-lab/chemical/storage/compatibility.html
6. Upon first working in a lab, and renew the process every six months, walk around the lab and place your hand on every safety shower handle, and every fire extinguisher. This should become a second nature process to locate these facilities in an emergency.
7. If you are ever on fire, get under the lab shower immediately, even if a small fire. If you see someone on fire, pull them under the lab shower immediately and pull the handle for them. If you ever get chemicals in your eyes or on your skin, go to the eyewash immediately or under the lab shower—DO NOT GO HOME to shower. Shower immediately in the lab, stripping your clothing, and just using another's lab coat to cover yourself afterward. Call the campus police for medical help so that you can be properly treated on-site or in the hospital, as directed. Or have another call for you.
8. If there is a small lab fire, attempt to put it out while shouting "fire". But if at all out of control, shout, "fire" and flee the lab and pull the fire alarm on the way out of the building. The hoods are fire safe, so if there is a fire raging in the hood, just shut the sash and pull the fire alarm on the way out or call LSU Police after leaving the lab, shouting "fire!". Watch the following video:
   - https://www.youtube.com/watch?v=BLjoWjCrDqg
9. You are required to ALWAYS wear lab glasses or goggles and a lab coat and closed---toe shoes in the lab.
10. Never put your head in a hood. Always have your hood sash down when you are not using your hood at that moment. If using your hood, be sure to keep it as low as possible so that just your hands can enter. If an explosion hazard exists, also use a blast shield in front of you. No reactions are permitted on the bench---top, only in the hood with sash down.
11. For those working with strong acids (pH < 2) and bases (pH > 10), or strong oxidizers such as Piranha etch or potassium permanganate or 30% hydrogen peroxide or perchlorate, it is required that you wear a lab coat, rubber lab smock, safety glasses, and face shield—we have all this equipment in the labs. Recall be very careful with these acids and bases and oxidizers. One drop in your eye and you are blind. A splash in your face and you will be DISFIGURED FOR LIFE! This is serious business; take it seriously.

12. For those of you working with potassium and Na/K alloys, you must rinse all glassware in the hood, very carefully, before bringing it out to the sink. Please consult the manual for safely working with alkali metals and how to rinse and properly deactivate this material. Please do this! You are required to do so. See the following links:
    - http://pubs.acs.org/doi/abs/10.1021/ie50554a022
    - SOP - Alkali Metals | Safety Web | Oregon State University
13. No open flames in the lab.
14. No running in the lab except in an emergency. No horse---play or wrestling in the lab.
15. If working with alkyllithium or other alkylmetals, be sure you understand how to use a syringe or cannula properly and how to properly transfer these materials and how to quench these compounds. You must follow proper safety clothing precautions and handling instructions. See Professor Garcia-Lopez for questions and training.
16. Leaking manifolds allow air to enter a vacuum system. The liquid nitrogen trap can condense the oxygen into a liquid state. The danger presents itself when the liquid nitrogen either runs dry or the Dewar is removed. The liquid oxygen can quickly form back into gas with enough internal pressure to cause the vacuum manifold system to literally explode. Although it rarely occurs to that extent (if vacuum lines are maintained well) all lab workers should be aware of the hazard and course of action below. If you remove a filled N_2 Dewar from your system and notice liquid inside the trap:
    i. Assume it is oxygen and first "REPLACE DEWAR IMMEDIATELY!"
    ii. Turn off vacuum pumps.
    iii. Place a shield in between you and the Dewar.
    iv. Release vacuum and open system to atmosphere through largest (and closest) ports available.
17. Leave shielded and untouched until all N_2 and O_2 have returned to gas form and vented out the hood. NOTE: If it can be done easily (while still in filled N_2 Dewar with ports open fully) disconnect the trap from the system and move all to a shielded fume hood with all valves open. Post a sign indicating the situation and let the vacuum trap warm until no liquid remains inside it.
18. If working with high voltage or moderate current sources, please consult with an electronics technician for safety instructions before proceeding. Contact with other equipment, wires, conductive materials and/or body parts with high voltages can lead to shorted equipment, sparks that produce fires, electrocution, and death. So please be very careful. If you have never used the high voltage instrument or equipment before, obtain training from someone who knows how to use it. Always wear shoes and stay out of contact with other conductors when working with such equipment. Set all variacs on a cork ring so that it is elevated above the hood's bench surface. That way, if the hood's bench-top becomes flooded, the varia will not be sitting in water.
19. We have a lab safety session at the start of every group meeting. Take this seriously. We cover every page in our lab manual during the course of these meetings, so you must pay attention. It is your job and responsibility to comply with the safety regulations.
20. Our number one reason for this document is to provide a safe environment for all laboratory workers. Therefore, compliance with this Chemical Hygiene Plan is not optional. It is mandatory.

21. If anyone working in the laboratory notices unsafe practices by others, or inadequate safety equipment being provided, they are obliged to inform the professor or the person in charge of the Safety or the Human Resources Office. Efforts will be made to ensure proper equipment or training is applied and implemented.
22. All gas cylinders, whether they have a regulator affixed or not, must be strapped to a sturdy bench or table using a table strap fixture, or to a mounted wall brace, using approved fabric or nylon straps or chains. Tubing is not an approved strapping material.
23. For the chemicals they are working with, all employees and students should know and constantly be aware of:
    i. The chemicals' hazards, as determined from the SDS and other appropriate references.
    ii. Appropriate safeguards for using that chemical, including personal protective equipment.
    iii. The location and proper use of emergency equipment.
    iv. How and where to properly store the chemical when it is not in use.
    v. Proper personal hygiene practices.
    vi. The proper methods of transporting chemicals within the facility. A rubberized or plastic carry jacket must be used when transporting chemicals out of the designated laboratory area. If several items must be transported at once, they must be placed on a rimmed cart.
    vii. Appropriate procedures for emergencies, including evacuation routes, spill cleanup procedures, and proper waste disposal.

Protective Clothing and Equipment

This procedure applies to all Louisiana State University Personnel that work in a laboratory. It is the intent of this guideline to provide information on the general PPE of a laboratory at LSU and afford employee protection while working in a laboratory.

1. Safety glasses meeting ANSI Z87.1 are required for personnel and visitors in laboratories so designated and will be worn at all times when in the laboratory. Glasses do not provide protection from chemical splashes. When working with more than 30 mL of a corrosive liquid, also wear a face shield, type N, large enough to protect the chin, neck, and ears, as well as the face.
2. Appropriate chemical-resistant gloves shall be worn at all times when there may be skin contact with chemicals. The degradation and permeation characteristics of the glove material selected must be appropriate for protection from the hazardous chemical being handled. EHS will provide glove selection information as required.
3. Gloves are to be removed before leaving the work area. Care should be taken not to contaminate the working area where gloves are not required by working in the area with gloves is available from the EHS website.
4. Thermal-resistant gloves shall be worn for operations involving the handling of heated materials and cryogenic fluids. Thermal-resistant gloves shall be non-asbestos and shall be replaced when damaged or deteriorated.
5. When working with allergenic, sensitizing, or toxic compounds, wear gloves made of a material known to be tested and found to be resistant to permeation by the chemical and tested for the absence of pinholes.
6. When working with chemicals, sandals, open-toed shoes, and bare feet should be prohibited.
7. Whenever exposure by inhalation is likely to exceed the threshold limits described in the MSDS use a hood; if this is not possible a respirator must be worn. Consult with your supervisor before doing any such work.
8. Carefully inspect all protective equipment before using it. Do not use defective protective equipment and report all defective equipment to the lab safety officer.
9. A laboratory coat is required at all times when working in the laboratory. We have fire retardant lab coats available for your use if you are working with pyrophoric such as alkyl metals, metal hydrides, or with sodium or potassium or other elements or compounds that can easily combust when in contact with air, water, or solvents or combinations thereof. If there is any possibility regarding a fire hazard, please wear the fire resistant lab coats. Laboratory coats will be laundered on a periodic basis (at least monthly). Laboratory coats shall be removed immediately upon discovery of significant contamination.
10. If you are feeling sick or nauseated, cease working in the laboratory and seek medical attention as outlined above.
11. Respirator usage shall comply with LSU's Respiratory Protection Program. If the faculty or principal investigator feels that respirators are needed, the Chemical Hygiene Officer should be contacted for an exposure assessment. Voluntary use of respirators is encouraged where relief from nuisance odors or dust is desirable. A copy of OSHA's statement, "Information for Personnel Using Respirators When Not Required Under the

Standard," must be given to those individuals using respirators voluntarily. This statement is an attachment to LSU's program and may be found on EHS's website.

https://lsu.edu/ehs/files/SOP_PPE_ChemExposures.pdf

Housekeeping

Only trained and qualified personnel shall be allowed to work in a laboratory at LSU. Each laboratory worker is directly responsible for the cleanliness of his or her workspace, and jointly responsible for common areas of the laboratory. Laboratory management shall insist on the maintenance of housekeeping standards. Supervisors are responsible for ensuring that personnel is trained to work safely in a laboratory. All laboratory personnel are responsible for reading and understanding this procedure. The following procedures apply to housekeeping standards of the laboratory:

1. A cleaning routine should be established for the work area with daily and weekly cleaning schedules in addition to a thorough cleaning once a month.
2. Keep the area as clean as the work allows. Work surfaces should be kept as clean as possible, with only those items needed for the immediate project on that surface.
3. Clean all working surfaces at the end of each day.
4. All apparatus(s) shall be thoroughly cleaned and returned to storage upon completion of usage.
5. Keep floors clean and free of tripping hazards.
6. Chemical containers shall be clean, properly labeled, and returned to storage upon completion of usage. Labels shall face front. Store flammable liquids in a flammable liquids' cabinet. Do not store acids above shoulder height or in unprotected metal cabinets. Store water-reactive materials away from water sources, such as sprinkler systems and sinks.
7. When storing items on shelves, the top of the items should be greater than 18" from the ceiling to ensure adequate coverage by sprinkler heads in the event of a fire.
8. Shelves should be equipped with doors or lips to prevent items from falling.
9. Keep an adequately stocked spill kit in the work area. Clean up all small spills immediately. Know what to do in the event of a hazardous material spill and take appropriate action immediately.
10. Do not let stored items project beyond the front of shelves or countertops. Restrain material stored near aisles, when necessary, to prevent them from falling. Always restrain compressed gas cylinders.
11. Keep stairways, hallways, passageways/aisles, and access to emergency exit dry and free of obstruction.
12. Store items so they do not block access to the fire extinguisher(s), safety equipment, electric panel boxes, or other emergency items such as an eyewash or safety shower.
13. Do not allow combustible material such as paper, cardboard boxes, or pallets to accumulate.
14. Do not place these materials in hallways. Set up a process for immediate disposal or filing of items.
15. Do not let materials accumulate. Ensure materials, chemicals, and equipment that are no longer needed, are disposed of properly or turned in as excess. Know how to manage laboratory wastes properly.
16. Do not let materials accumulate in laboratory hoods. The safety of this workspace and the ventilation provided are compromised when excessive chemicals and equipment are kept in this space.

17. Ensure that proper collection containers for biohazards, sharps, and paper trash are placed near the point of use and are adequate in size.
18. Do not overfill collection receptacles.
19. Ensure that all wastes that are not general refuse (e.g., radioactive, chemical, and biohazardous wastes) are prominently labeled and that custodial staff is trained not to remove these materials from the lab.
20. Faculty and principal investigators should informally conduct housekeeping and chemical hygiene inspections continually.

https://lsu.edu/ehs/files/SOP_Laboratory_Houskeeping.pdf

Lab Cleanup

Lab cleanups are scheduled three times per year. All group members are expected to be present and on time. During cleanup, the following areas must be addressed:

1. Glassware, benches, and desks must be thoroughly cleaned.
2. Samples must be removed from common areas (instrument room, balances, etc.).
3. Common areas must be cleaned. Each lab member is also responsible for cleaning the instrument/equipment for which they are responsible, as well as the area around the instrument.
4. All trash must be removed from the lab.
5. Never discard glass or needles in the normal trash bins. Use only the approved glass trash bins or the sharp device discard boxes.

Management of Change

Non-trivial procedural changes should be properly tracked in order to manage the introduction of new hazards. The Garcia-Lopez laboratory's policy regarding changes to established protocols is the following:

1. When students first learn how to use potentially hazardous equipment/procedures/syntheses, they should be given a set of guidelines as to what constitutes "safe operating parameters."
2. For experiments unique to the Garcia-Lopez laboratory, the safe operating parameters should be included within the Chemical Hygiene Plan.
3. Minor alterations to experiments should be discussed with other group members to assist in the identification of hazards. We encourage you to do this even when you are within the safe operating parameters of your experiment.
4. Major alterations (resulting in the safe operating parameters being exceeded, or the possible incursion of additional hazards) should be discussed during sub-group meetings or with a qualified senior student/post-doc/laboratory manager.

Prior Approval

Laboratory employees and students must obtain prior approval to proceed with a laboratory task from the principal investigator or lab manager whenever:

1. An entirely new laboratory procedure is to be carried out.
2. It is likely that toxic limit concentrations could be exceeded or that another harm is likely.
3. There is a change in a procedure or test, even it is very similar to prior practices. “Change in a procedure or test” means:
4. A 10% or greater increase or decrease in the amount of one or more chemicals in a synthetic protocol.
5. Substitution or deletion of any of the chemicals in a synthetic protocol.
6. Any change in other conditions, such as temperature, pressure, or voltage, under which the procedure is to be conducted that is larger than the safe operating parameters for the given instrument.
7. There is a failure of any of the equipment used in the process, especially of safeguards such as fume hoods or clamped apparatus.
8. There are unexpected results.
9. Members of the laboratory staff become ill, suspect that they or others have been exposed, or otherwise suspect a failure of any safeguards.

Spills and Accidents

Chemical spills, releases, and accidents vary considerably insignificance. If it is possible for the person involved to clean up the spill or stop the release safely, then it is appropriate for the person to do so. If the spill exceeds the capability of the person involved to control it, then leaving the area is the proper response. Notification of spill events is always required. All personnel should know the emergency procedures.

i. Eye contact: promptly flush eyes with water for a prolonged period (15 minutes) and seek medical attention.
ii. Ingestion: Consult SDS.
iii. Skin contact: Flush area and remove contaminated clothing. Consult SDS.
iv. Clean-up: Promptly clean up spills using appropriate protective apparel and equipment and proper disposal.
v. All significant accidents should be carefully analyzed with the assistance of EHS and the results distributed to those who might benefit.

Call LSU Police and EHS if the person in charge cannot contain the spill safely Note: If the spill or release is an immediate danger to buildings and/or occupants, the Baton Rouge Hazmat Unit will be called at the time of the spill to assure a prompt and adequate response. Refer to the appendix for the appropriate response level.

- Warn others on floors that may be affected and evacuate floors if necessary.
- Begin preparation for evacuation of the building if an explosion or poisonous vapor or fumes are possible.
- Follow the guidance of EHS and LSU Police

Procedure-Specific Safety Procedures

All laboratory procedures must contain a written description of specific safety practices incorporating the applicable precautions described in this sec-on. Employees should read and understand these practices before commencing a procedure.

A. Procedure for Toxic Chemicals

The SDSs for many of the chemicals used in the laboratory will state recommended limits or OSHA mandated limits, or both, as guidelines for exposure. Typical limits are threshold limit values (TLV), permissible exposure limits (PEL), and ac-on levels. When such limits are stated, they will be used to assist the chemical hygiene officer in determining the safety precautions, control measures, and safety apparel that applies when working with toxic chemicals.

When a TLV or PEL value is less than 60 or 100, the user of the chemical must use it in an opera-ng fume hood, glove box, vacuum line, or similar device, which is equipped with appropriate traps and/or scrubbers. If none are available, no work should perform using that chemical.

If a TLV, PEL, or comparable value is not available for that substance, the animal or human median inhalation lethal concentration information, LC50, will be assessed. If that value is less than 200 ppm or 2000mg/m^3 (when administered continuously for one hour or less) suggested, then the chemical must be used in an operating fume hood, glove box, vacuum line, or similar device, which is equipped with the appropriate traps and/or scrubbers. If none are available, no work should be performed using that chemical.

Whenever laboratory handling of toxic substances with moderate or greater vapor pressures will be likely to exceed air concentration limits, laboratory work with such liquids or solids will be conducted in an opera-ng fume hood, glove box, vacuum line, or similar device, which is equipped with the appropriate traps and/or scrubbers. If none are available, no work should be performed using that chemical.

B. Procedure for Flammable Chemicals

In general, the flammability of a chemical is determined by its flash point, the lowest temperature at which an ignition source can cause the chemical to ignite momentarily under certain controlled conditions.

- Chemicals with a flash point below 200 °F (93.3 °C) will be considered “fire hazard chemicals”.

OSHA standards and the National Fire Protection Association (NFPA) guidelines on when a chemical is considered flammable apply to the use of flammable chemicals in the laboratory. In all work with fire---hazard chemicals, follow the requirements of 29 CFR, subparts H and L; NFPA Manual 30, “Flammable and Combustible Liquids Code”; and NFPA Manual 45, “Fire Protection for Laboratories Using Chemicals”.

- Fire hazard chemicals should be stored in a flammable---solvent storage area or storage cabinets designed for flammable solvents.
- Fire hazard chemicals should be used only invented hoods and away from sources of ignition.

C. Procedure for Reactive Chemicals

Highly reactive chemicals include those which are inherently unstable and susceptible to rapid decomposition as well as chemicals that, under specific conditions, can react alone, or with other substances in a violent uncontrolled manner liberating heat, toxic gases, or leading to an explosion. Reaction rates almost always increase dramatically as the temperature increases. Therefore, if heat evolved from a reaction is not dissipated, the reaction can accelerate out of control and possibly result in injuries or costly accidents.

1. Water reactives react violently with water. Many produce flammable hydrogen gas that can then ignite when mixed with air (alkali metals, organometallic compounds, and some hydrides). Others give off large amounts of heat when mixed with water resulting in a violent reaction if the heat produced is not sufficiently dissipated.
2. Pyrophoric materials ignite spontaneously when exposed to oxygen and/or moisture in the air at or below 130 ^{o}F. These must be stored under mineral oil or an inert dry atmosphere depending on the substance. Examples: phosphorus, titanium dichloride, tributylaluminum, sodium, and lithium hydride.
3. Incompatible materials must be sufficiently segregated in storage to prevent mixing during fires, explosions, and natural disasters. Accidents with incompatible materials often occur during the commingling of wastes in laboratories.
4. Accidental contact of incompatible chemicals can result in:
    - Generation of heat (acids & bases)
    - Violent reaction (acrolein & acids or other catalysts)
    - Formation of toxic vapors or gases (cyanide salt & acid)
    - Formation of a flammable gas (alkali metal & water)
    - Fire or Explosion (perchloric acid & acetic anhydride)
5. An explosive is a substance or mixture of substances that when initiated by heat, light, friction, impact, or detonation undergoes a rapid chemical reaction giving off large volumes of hot gases. The reaction usually involves a decomposition of the substance(s) but may be caused by a rapid polymerization. Fires typically accompany an explosion. Explosives may detonate (create a high-pressure wave traveling between 1000-9000 meters/second) or deflagrate (rapid decomposition of explosive but little to no high-pressure wave).
6. Oxidizing agents in addition to their corrosive properties are powerful oxidizing agents and present fire and explosion hazards on contact with organic compounds and other oxidizable substances.
7. Organic peroxides are among the most hazardous substances used in the laboratory - both fuels and oxidizers in one. They are typically low-power explosives and very easy to initiate through sparks or shocks. Materials that are susceptible to peroxide formation (i.e., autoxidation) are ones that typically react with air, moisture, or impurities and produce a change in their chemical composition in normal storage. The peroxides that form are less volatile than the solvent itself and thus tend to concentrate. This is particularly dangerous if peroxides are present during a distillation, where the applied heat to the concentrated solution may trigger a violent explosion. Equally dangerous is to allow a container of this material to evaporate to dryness, leaving the crystals of peroxide at the bottom of the container. Some materials, such as ethers, form peroxides

when exposed to air or light. Date these containers when new and dispose as hazardous waste within six months after opening.

https://lsu.edu/ehs/files/SOP-Reactive-Chemicals.pdf

Control of Hazards

1. Minimize the quantity of reactive chemicals used or synthesized to the smallest amount needed.
2. Store reactive materials as recommended in the MSDS. An inert gas-filled desiccator or glove box may be a suitable storage location for most materials.
3. Handle reactive chemicals with caution. Appropriate chemical-specific precautions must be taken for mixing even small quantities with other chemicals.
4. Chemical reactions conducted at temperatures or pressures above or below ambient conditions must be performed in a manner that minimizes the risk of explosion or vigorous reaction.
5. Provide a mechanism for adequate temperature control and heat dissipation.
6. Utilize shields and barricades, and personal protective equipment (such as face shields with throat protectors and heavy gloves) whenever there is a possibility of explosion or vigorous chemical reaction.
7. Glass equipment operated under vacuum or pressure must be shielded, wrapped with tape, or otherwise protected from shattering.

The main types of chemical hazards that lab personnel should be aware of are:

A. Corrosively
B. Flammability
C. Reactivity/ Instability
D. Gases/Cryogenic Liquids
E. Acute Toxicity

A. Procedure for Corrosive Chemicals and Contact-Hazard Chemicals

Corrosivity, allergenic, and sensitizer information is sometimes given in manufacturers' MSDS and on labels. Also, guidelines on which chemicals are corrosive can be found in other OSHA standards and regulations promulgated by DOT in 49 CFR and the EPA in 40 CFR.

A corrosive chemical is one that:

- Fits the OSHA definition of corrosive in Appendix A of 29 CFR 1910.1200,
- Fits the EPA definition of corrosive in 40 CFR 261.22 (has a pH greater than 12 or less than 2.5), or
- Is known or found to be corrosive to living tissue.
- A contact hazard chemical is an allergen or sensitizer that:
- Is so identified or described in the MSDS or on the label,
- Is so identified or described in the medical or industrial hygiene literature, or
- Is known or found to be an allergen or sensitizer.

corrosive substances cause destruction of, or alterations in, living tissue by chemical action at the site of contact. Major classes of corrosive substances include strong acids (e.g., sulfuric, nitric, hydrochloric, and hydrofluoric acids), strong bases (sodium hydroxide, potassium hydroxide, and ammonium hydroxide), dehydrating agents (sulfuric acid, sodium hydroxide, phosphorus pentoxide, and calcium oxide), and oxidizing agents (hydrogen

peroxide, chlorine, and bromine). Symptoms of exposure for inhalation include a burning sensation, coughing, wheezing, laryngitis, shortness of breath, nausea, and vomiting. For eyes, symptoms include pain, bloodshot eyes, tearing, and blurring of vision. For skin, symptoms may include reddening, pain, inflammation, bleeding, blistering, and burns. As a physical hazard, corrosive substances may corrode materials they come in contact with and maybe highly reactive with other substances. It is important to review information regarding materials they corrode, and their reactivity with other substances, as well as information on health effects.

Handle corrosive substances with all proper safety precautions, including wearing both safety goggles and face shield, gloves tested for absence or pinholes and known to be resistant to permeation, and a laboratory apron or coat.

B. Procedure for Flammable and combustible Chemicals

Flammable and combustible materials are a common laboratory hazard. Always consider the risk
of fire when planning laboratory operations. Flammable and combustible liquids are classified according to their flashpoint, with flammable liquids having a flashpoint of less than 100 °F and
combustible liquids having a flashpoint between 100-200 °F. Both flammable and combustible liquids are considered fire hazards.

A fire requires an ignition source, fuel, and an oxidizer. Eliminating ignition sources from the area where flammable substances are handled. Avoid the combined presence of fuel and an oxidizer. Control, contain, and minimize the amount of fuels and oxidizers. Keep fuel sources in closed vessels. Although all flammable substances should be handled prudently, the extreme flammability of some materials requires additional precautions. Consider using inert gases to blanket or purge vessels containing flammable liquids.

C. Procedure for Highly Reactive or Unstable Chemicals

Highly reactive or unstable materials are those that have the potential to vigorously polymerize, decompose, condense, or become self-reactive under conditions of shock, pressure, temperature, light, or contact with another material. Examples of highly reactive chemicals are peroxides, water-reactive, and pyrophorics.

Light, mechanical shock, heat, and certain catalysts can be initiators of explosive reactions. Examples of shock-sensitive materials include many acetylides, azides, organic nitrates, nitro compounds, azo compounds, perchlorates, and peroxides. Acids, bases, and other substances may catalyze explosive polymerizations. The catalytic effect of metallic contamination leads to explosive situations.

Many highly reactive chemicals polymerize vigorously, decompose, condense, or become self-reactive. The improper handling of these materials may result in a runaway reaction that could become violent. Highly reactive chemicals lead to reactions with rates that increase rapidly as the temperature increases. If the heat evolved is not dissipated, the reaction rate increases until an explosion results.

Large-scale reactions with organometallic reagents and reactions that produce flammables as products or are carried out with inflammable solvents require special attention. Active metals,

such as sodium, lithium, potassium, calcium, and finely divided magnesium are serious fire and explosion risks because of their reactivity with water, alcohols, and other compounds or solutions containing acidic hydrogens. These materials require special storage, handling, and disposal.

Oxidizing agents may react violently when they come in contact with reducing materials, trace metals, and sometimes ordinary combustibles. These compounds include halogens, oxyhalogens, peroxyhalogens, permanganates, nitrates, chromates, and persulfates, as well as peroxides. Perchloric acid and nitric acid are powerful oxidizing agents with organic compounds and other reducing agents. Perchlorate salts can be explosive and should be treated as potentially hazardous compounds.

Organic peroxides are a special class of compounds with unusually low stability that makes them among the most hazardous substances commonly handled in laboratories, especially as initiators for free-radical reactions. Although they are low-power explosives, they are hazardous because of their extreme sensitivity to shock, sparks, and other forms of accidental detonation.

Certain common laboratory chemicals form peroxides on exposure to oxygen in the air. Over time, some chemicals continue to build peroxides to potentially dangerous levels, whereas others accumulate a relatively low equilibrium concentration of peroxide, which becomes dangerous only after being concentrated by evaporation or distillation. The peroxide becomes concentrated because it is less volatile than the parent chemical. Any sample of a highly reactive material may be dangerous. The greatest risk is due to the remarkably high rate of a detonation reaction rather than the total energy released. A high-order explosion of even milligram quantities can drive small fragments of glass or other matter deep into the body. It is important to use minimum amounts of hazardous materials with adequate shielding and personal protection.

D. Procedure for Gases/Cryogenic Liquids

Compressed gases and cryogenic liquids are similar in that they can create pressure hazards and can also create health hazardous and/or flammable atmospheres. One special property of compressed gases and cryogenic liquids is that they undergo substantial volume expansion when released to air, potentially depleting workplace oxygen content to hazardous levels.

Compressed gas is defined as a material in a container with an absolute pressure greater than 276 kPa, or 40 psi at 21 °C or an absolute pressure greater than 717 kPa (104 psi) at 54 °C, or both, or any liquid flammable material having a Reid vapor pressure greater than 276 kPa (40 psi) at 38 °C. The U.S. Department of Transportation (DOT) has established codes that specify the materials to be used for the construction and the capacities, test procedures, and service pressures of the cylinders in which compressed gases are transported. Prudent procedures for the use of compressed gas cylinders in the laboratory include attention to appropriate purchase, especially selecting the smallest cylinder compatible with the need, as well as proper transportation and storage, identification of contents, handling and use, and marking and return of the empty cylinder to the company from which it was purchased.

Cryogenic liquids are materials with boiling points of less than −73 °C (−100 °F). Liquid nitrogen, helium, argon, and slush mixtures of dry ice with isopropyl alcohol are the materials most commonly used in cold traps to condense volatile vapors from a gas or vapor stream. In

addition, oxygen, hydrogen, and helium are often used in the liquid state. The primary hazards of cryogenic liquids are frostbite, asphyxiation, fire or explosion, pressure buildup (either slowly or due to rapid conversion of the liquid to the gaseous state), and embrittlement of materials. The extreme cold of cryogenic liquids requires special care in their use. The vapor that boils off from a liquid can cause the same problems as the liquid itself.

https://lsu.edu/ehs/files/Chemical-Hygiene-Plan.pdf

E. Procedure for Carcinogens, Reproductive Toxins, Substances with High Acute Toxicity

Follow the procedures described in this section when performing laboratory work with greater than 100 mg of any carcinogen, reproductive toxin, a substance that has a high degree of acute toxicity, or a chemical whose toxic properties are unknown.

The following definitions will apply:

1. Select carcinogen: Any substance defined as such in 29 CFR 1910.1450 and any other substance described as such in the applicable MSDS.
2. Reproductive toxin: Any substance described as such in the applicable MSDS
3. Substances with a high degree of acute toxicity: Any substance for which the LD50 data described in the applicable MSDS cause the substance to be classified as a "highly toxic chemical" as defined in ANSI Z129.1.
4. Chemical whose toxic properties are unknown: A chemical for which there is no known statistically significant study conducted in accordance with established scientific principles that establish its toxicity.
5. For the purposes of the CHP, chemicals in these four categories will be called "inimical".
6. Designated area: A hood, glove box, portion of a laboratory, or an entire laboratory room designated as the only area where work with quantities of inimical chemicals in excess of the specified limit shall be conducted.

Designated areas should be posted, and their boundaries clearly marked. Only those persons trained to work with inimical chemicals will work with those chemicals in a designated area. All such persons will:

1. Use the smallest amount of chemical that is consistent with the requirements of the work to be done.
2. Use high efficiency particulate air (HEPA) filters or high efficiency scrubber systems to protect vacuum lines and pumps.
3. Store inimical chemicals or remove them from storage.
4. Decontaminate a designated area when work is completed.
5. Prepare wastes from work with inimical chemicals for waste disposal in accordance with specific disposal procedures consistent with the Resource Conservation and Recovery Act (RCRA) and as designated by LSU hazardous waste officer.
6. Store all inimical chemicals in locked and enclosed spaces with a slight negative pressure compared to the rest of the building.
7. Because the decontamination of jewelry may be difficult or impossible, do not wear jewelry when working in designated areas.

Ventilation

Laboratory ventilation should be not less than six air changes per hour (calculated). This flow is not necessarily sufficient to prevent the accumulation of chemical vapors. Work with toxic chemicals that have low air concentration limits, or that have high vapor pressures, should always be done in a hood.

Fume hoods should provide 70 to 90 linear feet per minute of air flow. The hoods in the lab are equipped with a monitor that continuously monitors the air flow and will sound an alarm if the air flow drops too far. If this occurs, immediately stop all chemical work, close chemical containers, lower the sash, and contact **Facilities at 713-348-2485**.

Laboratory employees should understand and comply with:

1. A fume hood is a safety backup for condensers, traps, or other devices that collect vapors and fumes. It is not used to "dispose" of chemicals by evaporation unless the vapors are trapped and recovered for proper waste disposal.
2. The apparatus inside the hood should be placed on the floor of the hood at least six inches away from the front edge.
3. Fume hood windows should be lowered (closed) at all times except when necessary to raise (open) them to adjust the apparatus inside the hood.
4. The hood fan should be kept "on" whenever a chemical is inside the hood, whether or not any work is being done in the hood.
5. Personnel should be aware of the steps to be taken in the event of power failure or another hood failure.
6. Inspect hood vent ducts and fans at frequent intervals to be sure they are both clean and clear of obstructions.
7. Hoods should never be used as storage areas for chemicals, apparatus, or other materials.

Fume Hoods | LSU Environmental Health and Safety

Laboratory storage

A. General Guidelines

1. Amounts permitted should be as small as practical.
2. Storage on bench tops and hoods is inadvisable. If hoods are used for storage, they must be labeled as such and not used for experiments.
3. Exposure to heat or direct sunlight should be avoided.
4. Periodic inventories should be conducted, with the items being discarded or returned to the storeroom/stockroom.
5. All labels shall face the front.

B. Procedures

1. Know the properties of the chemicals used.
2. In general, chemicals should be separated according to the following categories:
    a. Solvents, which include flammable/combustible liquids and halogenated hydrocarbons (e.g., acetone, benzene, ethers, alcohols) Note: Store glacial acetic acid as a flammable liquid
    b. Inorganic mineral acids (e.g., nitric, sulfuric, hydrochloric, and perchloric acids).
    c. Bases (e.g., sodium hydroxide, ammonium hydroxide)
    d. Oxidizers
    e. Poisons
3. Explosives or unstable reactives, such as picric acid. Store separately outdoors in flammable storage cabinets. An inventory of all chemicals must be maintained. Inventories must include the full chemical name, location of storage, and associated hazard (e.g. corrosive or flammable)
4. Inventories must be updated annually and signed by the person performing the update. Chemicals purchased throughout the year must be added to the inventory as soon as they are brought into the work area. Post chemical inventories inside the room with a hazard summary posting on the door for emergency response purposes.
5. Ensure that all containers are in good condition, properly capped, and labeled. If you are using shorthand names or acronyms on any solutions, reagents, or aliquots of chemicals, you must maintain a cross-reference sheet that defines the shorthand name or acronym in use such as EtOH(ethanol) or PBS (phosphate buffered saline). Review this list annually to ensure that all shorthand names or acronyms in use are recorded.
6. Store all hazardous liquid chemicals in drip trays that are chemically resistant. Photo trays provide good containment and are widely used at the Lab. Install Plexiglas lips or
   use equivalent means to prevent materials from falling off storage shelves.
7. Avoid storing chemicals on countertops or in fume hoods except for those being currently used.
8. Avoid storing chemicals above eye level. Select low shelves or cabinets for heavy containers. Never store chemicals or any other item closer than 18” to the ceiling. Storing an item close to the ceiling will impede the effectiveness of automatic fire suppression systems.

9. Do not store chemicals on the floor. Chemical containers could present a tripping hazard or could be knocked over causing a spill.
10. Label all containers (squeeze bottles and Nalgene bottles) to which hazardous materials are transferred with the identity of the substance and its hazards. Be aware that squeeze bottles and Nalgene bottles have varying resistances to different chemicals.
11. Limit the amount of chemicals stored to the minimum required.
12. Avoid exposure of chemicals to heat or direct sunlight. This may lead to the deterioration of storage containers as well as the degradation of the chemicals.
13. Use approved corrosive storage cabinets (constructed of chemically resistant components) for storing acids and bases.
14. Use flammable storage cabinets to store flammable liquids.
15. Refrigerators used for storing chemicals, samples, or media must be labeled with words to the effect as follows: "Caution – Do Not Store Food or Beverages in This Refrigerator". Refrigerators used for food storage in or near work areas (shops and labs) must be labeled with words to the effect as: "Notice – Food May Be Stored In this Refrigerator". Labels may be fabricated by users provided they are legible and securely affixed to the refrigerator. Refrigerators used for food and beverage which are located in lunchrooms and office buildings, where there is no shop or lab type chemical usage do not require any posting.
16. Refrigerators and freezers for storing flammable liquids (including ethanol) must be designed, constructed, and approved for that purpose. Domestic refrigerators/freezers, as well as units that have been modified to remove spark sources, are not acceptable alternatives.

C. Chemical Storage According to Hazard Classes

The following guidelines are provided for the safe storage of hazardous materials in accordance with their hazard classes:

a. Acids

i. Segregate acids from reactive metals such as sodium, potassium, magnesium.
ii. Segregate oxidizing acids from organic acids, flammable and combustible materials.
iii. Segregate acids from chemicals that could generate toxic or flammable gases upon contact, such as sodium cyanide, iron sulfide, calcium carbide.
iv. Segregate acids from bases.

b. Bases

i. Segregate bases from acids, metals, explosives, organic peroxides, and easily ignitable materials.

c. Solvents (Flammable and Halogenated Solvents)

i. Store in approved safety cans or cabinets.
ii. Segregate from oxidizing acids and oxidizers.
iii. Keep away from any source of ignition: heat, sparks, or open flames.

d. Oxidizers

i. Store in a cool, dry place.
ii. Keep away from combustible and flammable materials.
iii. Keep away from reducing agents such as zinc, alkali metals, and formic acid.

e. Cyanides

i. Segregate from acids and oxidizers.

F. Water Reactive Chemicals

i. Store in a cool, dry place away from any water source.
ii. Make certain that a Class D fire extinguisher is available in case of fire.

G. Pyrophoric

i. Store in a cool, dry place making provisions for an airtight seal.

H. Light Sensitive Chemicals

i. Store in amber bottles in a cool, dry, dark place.

I. Peroxide Forming Chemicals

i. Store in airtight containers in a dark, cool, and dry place.
ii. Label containers with receiving, opening, and disposal dates.
iii. Periodically test for the presence of peroxides.

J. Toxic Chemicals

i. Store according to the nature of the chemical, using appropriate security where necessary.

https://lsu.edu/ehs/files/SOP_ChemicalStorageGuidelines.pdf

D. Flammable-Liquid Storage

Flammable Liquid is a liquid having a flashpoint below 100 °F (37.8 °C), having a vapor pressure not exceeding 40 pounds per square inch (absolute) at 100 °F (37.8 °C), and shall be known as a **Class I** liquid. For the purpose of this standard, **Class I** liquids shall be subdivided as follows:

- CLASS IA–shall include all liquids having flashpoints below 73 °F (22.8 °C) and having a boiling point below 100 °F (37.8 °C).
- CLASS IB–shall include all liquids having flashpoints below 73 °F (22.8 °C) and having a boiling point at or above 100 °F (37.8 °C).
- CLASS IC–shall include all liquids having flashpoints at or above 73 °F (22.8 °C) and below 100F (37.8 °C).

Combustible Liquid is a liquid having a flashpoint at or above 100F (37.8 °C). For the purpose of this standard, Combustible Liquids shall be subdivided as follows:

- CLASS II–shall include liquids having flashpoints at or above 100 °F (37.8 °C) and below 140 °F (60 °C).

- CLASS IIIA–shall include those liquids having flashpoints at or above 140 °F (60 °C) and below 200 °F (93.4 °C).
- CLASS IIIB–shall include those liquids having flashpoints at or above 200 °F (93.4 °C).

Safety Can–shall mean an approved container of not more than five-gallon capacity having a spring-closing lid and spout cover and so designed that it will safely relieve internal pressure.

Standards

A. Storage shall be limited to that required for the operation of office equipment, maintenance, demonstration, treatment, and laboratory work. All liquids in laboratories and other points of use shall meet the following storage requirements:
   1. No container for Class I or II liquids shall exceed one gallon, except safety cans, which may be of two-gallon capacity.
   2. No more than 10 gallons of Class I and II liquids combined shall be stored outside of a storage cabinet or storage room, except in Safety Cans.
   3. No more than 25 gallons of Class I and II liquids combined shall be stored in Safety Cans outside of a storage room or storage cabinet.
   4. No more than 60 gallons of Class IIIA liquids shall be stored outside of a storage room or storage cabinet.
   5. Quantities of liquids in excess of those set forth in this Safety Standard shall be stored in an approved inside or outside storage room.

The maximum allowable size of container:

Container	Flammable Liquids						Combustible Liquids			
	Class IA		Class IB		Class IC		Class II		Class IIIA	
	Liters	Gallons	Liters	Gallons	Liters	Gallons	Liters	Gallons	Liters	Gallons
Glass	0.5	0.12	1	0.25	4	1	4	1	4	1
Metal or approved plastic	4	1	20	5	20	5	20	5	20	5
Safety cans	7.5	2	20	5	20	5	20	5	20	5

NOTE: Class IA and Class IB liquids may be stored in glass containers of not more than 1-gallon capacity if the required liquid purity (such as ACS Analytical Reagent grade or higher) would be affected by storage in metal containers or if the liquid would cause excessive corrosion of the metal container only upon written approval of the Office of Occupational and Environmental Safety.

B. Flame Proof Storage Cabinets shall be in accordance with National Fire Protection Association (NFPA) 30, Chapter 4.

Quantity and classification of liquids that can be stored:

1. Not more than 120 gallons of Class I, Class II, or Class IIIA liquids.

2. Of the above total, not more than 60 gallons may be of Class I and Class II liquids.
3. No more than three cabinets can be located in a single room unless every group of three is separated by 100′ or more.

C. Tank Storage–of flammable or combustible liquids, above or below ground and in any quantity, shall meet NFPA 30, Chapter 2 through Chapter 9 and all codes set forth by the local authority having jurisdiction.
D. The Office of Environmental Health and Safety (EHS) shall be contacted when any storage tank is being considered for campus use.

Fire hazard chemicals in quantities greater than 4 L should be kept in metal safety cans designed for such storage. The cans should be used only as recommended by the manufacturer, including the following safety procedures:

- Never disable the spring-loaded closure.
- Always keep the flame-arrestor screen in place, replace it if punctured or damaged.

Cabinets designed for the storage of flammable materials should be properly used and maintained. Read and follow the manufacturer's information and also follow these safety practices:

- Store only compatible materials inside a cabinet.
- Do not store paper or cardboard or other combustible packaging material in a flammable liquid storage cabinet.
- The manufacturer establishes quantity limits for various sizes of flammable liquid storage cabinets, do not overload a cabinet.

STORAGE OF FLAMMABLE LIQUIDS (lsu.edu)

Safety Equipment

A. Emergency Showers and Eyewash Stations

1. All chemistry laboratories and areas where faculty, staff, students, or visitors are exposed to harmful chemicals shall be provided with safety showers and eyewash fountains. These facilities shall be conveniently located and tested frequently, readily available, operable, and known to persons concerned.
2. The valve handle of safety showers and eyewash fountains shall be rigidly fixed and plainly labeled. The valve shall open readily in either direction and remain open until intentionally closed. Water flow pressure shall be sufficient to drench the subject rapidly or gently flow in the case of eyewash fountains. The shower and eyewash fountain area shall be kept clear of obstructions. The water of drinking purity shall only be used in safety showers and eyewash fountains.
3. Emergency eyewash fountains shall deliver a gentle flow of clean, aerated water. A handheld eyewash spray with a five-foot hose is more adaptable to unusual situations including head and body splashes but shall not be located where it can be contaminated by waste materials. It shall be understood by all that eye protection is infinitely more important than eyewashes. For chemical splashes, very complete irrigation is indicated. (A 15-minute flush is recommended.)

Immediately flush the eye with a copious amount of water under gentle pressure checking for and removing contact lenses at once.

i. An eyewash fountain shall be used if available.
ii. Forcibly hold the eye open to wash thoroughly behind the eyelids.
iii. In the absence of an eyewash fountain, the injured shall be placed on his back and water gently poured into the eye. The injured eye shall be held open.
iv. The injured shall be given prompt medical attention, regardless of the severity of the injury.
v. Keep the eye immobilized with clean, wet, cold pads while transporting the injured to medical attention.
vi. Neutralizing agents shall not be used for chemical burns to the eye. Experiments have indicated that this type of treatment is likely to increase eye damage.
vii. The emergency shower and eyewash fountains shall be tested regularly and a record kept of such tests.

B. Portable Eye Wash Stations

1. Periodically inspect each station to make sure it is properly filled and ready to use. Check to see if the unit is full. Change the water once a month with water of drinking purity. Test the unit's operation monthly.
2. The unit shall always be clearly visible and there shall be no obstructions to interfere with its use.

C. Respirators

Employees should wear respirators whenever it is possible that engineering controls or work practices could become or are ineffective and that employees might be exposed to vapor or particulate concentrations greater than the PEL, ac-on level, TLV, or similar limit, whichever is lowest.

Respirator usage shall comply with LSU's Respiratory Protection Program. If the faculty or principal investigator feels that respirators are needed, the Chemical Hygiene Officer should be contacted for an exposure assessment. Voluntary use of respirators is encouraged where relief from nuisance odors or dust is desirable. A copy of OSHA's statement, "Information for Personnel Using Respirators When Not Required Under the Standard," must be given to those individuals using respirators voluntarily. This statement is an attachment to LSU's program and may be found on EHS's website.

Vapor Detection

Do not use odor as a means of determining that inhalation exposure limits are or are not being exceeded. Whenever there is reason to suspect that a toxic chemical inhalation limit might be exceeded, whether or not a suspicious odor is noticed, notify the supervisor. Laboratory workers should wear a respirator suitable for protection against the suspect chemical until measurements of the concentration of the suspect vapor in the air show that the limit is not exceeded. Under this circumstance and if there is no reason to anticipate an increase in the concentration of the chemical, and if the supervisor approves, the respirator can be removed, and the work may continue.

Nitrations

When running or working up nitration you must use a blast shield, safety glasses, face shield, rubber gloves, and rubber apron. The first time a new compound is nitrated, do not exceed 1 g of starting material. Run the nitration multiple times at 1 g before scaling up. 10 g is the upper limit when running nitration.

When drying a nitrated aromatic compound, ensure this happens in the hood behind a blast shield. It is common for explosions to occur upon drying, use them as “wet” compounds if at all possible.

Responsibility of the Last Person to Leave the lab

If you are the last person to leave the lab at night, ensure the following tasks are completed and sign and date the sign-out sheet on the door.

1. All nitrogen bubblers have a flow rate of less than 1 bubble per second or less.
2. All hood sashes in the lab are completely closed.
3. All water lines are secured with copper wire via two rotations of wire around the connection nipple and then firm securing with pliers making a double twist. If unclear, see the professor and he will teach you. Most laboratory floods occur by failure to properly secure the tubing to condenser nipples.
4. All faucets are tuned off (except those used for reactions in progress).
5. All variacs are on cork rings.
6. All the lights are turned off, including the lights in the hoods.
7. All the lab doors are locked, including the doors to the instrument and computer rooms.

Everyone in the lab must make a conscious effort to adhere to the safety guidelines established herein; otherwise, the following disciplinary action will be brought against them.

Emergency Contact Numbers

Dr. Víctor García-López - +1 225-578-7168

Campus Police

- 225-578-3231
- 911 (Campus Landline)

EHS – 225-578-5640

LSU Health Center - 578-HELP (4357)

Employee Injury Call Center - 877-764-3574

Radiation Safety – 225-578-2747

Facility Services – 225-578-2327

Contact information of the Group

Position	Name	Contact No	Email Address
Principal Investigator (Professor)	Dr.Víctor García-López	+1 225-578-7168	vglopez@lsu.edu
Group Members	Philip R. Haydel	+1 225-578-2338	phayde4@lsu.edu
	Soumya K. Dawn	+1 225-578-2338	sdawn2@lsu.edu
	Senuri Jayawardana Arachchige	+1 225-578-2338	sjayaw2@lsu.edu
	Udyogi N. K. Conthagamage	+1 225-578-2338	uconth1@lsu.edu
	William Delahoussaye	+1 225-578-2338	wdelah1@lsu.edu
	Gabriela Coronel Hernandez	+1 225-578-2338	gcoron3@lsu.edu
	Macallister L. Davis	+1 225-578-2338	mdav275@lsu.edu