**Table of Contents**

# Contents

# About the Chemistry Graduate Safety Committee

The Department of Chemistry Graduate Student Safety Committee (CGSC) is a graduate researcher-led laboratory safety team (LST) focused on the safety of chemical laboratories within the department. The idea to start this LST was conceived after a few of the graduate students were sponsored by the department to attend the ACS DCHAS "Empowering Academic Researchers To Strengthen Safety Culture" workshop in **Fall 2020**. This workshop started a conversation amongst the students who attended the workshop, and the group was officially formed in Spring 2021.

The CGSC consists of graduate students serving as lab safety officers within the different chemical laboratories, volunteer students, the chemical hygiene office, and the department chair who serves as the champion. The mission of this student-led safety committee is to increase safety awareness and improve the safety culture within the department through student engagement in safety-related discourses. This student-led safety committee seeks to provide a platform where graduate researchers working within chemical labs can teach and learn about safer laboratory practices while building their safety leadership skills.

Currently, the committee meets monthly to discuss safety-related concerns within laboratories and the department.

If you are interested in attending the monthly meetings, please email chemsafetycom-l@mtu.edu

# Roles and Responsibilities of a Lab Safety Officer (LSO)

Each PI/ Laboratory Supervisor is recommended to designate a member of their laboratory to act as a Lab Safety Officer or Officers (LSO) to assist with the day-to-day operations and ensure safe practices in the lab. To help keep research laboratories in safe and operational conditions, LSO must be familiar with how the lab operates as well as have demonstrable lab safety experience. Keeping research laboratories safely could involve a large amount of work and LSO are encouraged to share the work with other members of the lab to ensure that the tasks are completed on time.

## Research Group Responsibilities

The LSO's responsibilities include:

1. **Provide safety training to all personnel working in the research group.**
   - New Personnel
   - Annual refresher
   - Documentation of training

2. **Encourage and Enforce lab safety rules including PPE compliance, Hazardous Waste Procedures and Proper Chemical Storage**

   - Ensure researchers have received the appropriate Personal Protective Equipment training and monitor the use of PPE by researchers in your laboratory. Work with your PI to determine what type of PPE is required for work in your laboratory. This will vary based on the task a researcher is performing, but minimum requirements must be established. Ensure these guidelines are communicated to all researchers in the lab. Also ensure researchers are using all required PPE for your laboratory.
   - Ensure that the proper hazardous waste procedures are followed and all chemicals are stored properly in their respective areas at all times.

3. **Maintain proper lab signage related to emergency contact information.**

   - Ensure labels and warning signs are placed in the laboratory to alert lab workers and emergency response personnel to potentially hazardous materials and allow those unfamiliar with the laboratory surroundings to identify hazardous chemical use and storage areas, safety facilities, emergency equipment, and exits. Specifically:
     - All entrance doors, and entrances to rooms within the lab with new or different hazards, must post an Emergency Response Poster (ensure the emergency contact information is up to date);
     - signage must be posted for Unattended Operations. See section 6.5;
     - areas where Particularly Hazardous Substances are being used must be delineated.

   - A contact list for all group members should be kept inside the laboratory near the door. This can easily be grabbed on the way out of the lab during an emergency evacuation to contact members who are not at the designated meeting place.

4. **Ensure your group has a meeting location in case of an emergency evacuation**
    - Establish a location for all members of your research group to meet in an emergency evacuation. This should be at a location near your building, at least 100 feet from the building but out of the way of responding to emergency personnel. It is important to consider if the chosen location is appropriate during inclement weather. Make sure all group members know where this is located.

5. **Perform weekly checks of eyewash and monthly checks of shower stations.**
    - Ensure eyewashes in the laboratory are checked weekly and shower stations at least monthly for functionality and good water quality. During these checks, the eyewashes should be run for 2-3 minutes; longer if the water is not clear. Maintain a record of these weekly checks on a form near the eyewash (an example shown on the last page of the Eyewash Factsheet). The area around the safety equipment should be free of clutter.

    - When checking an eyewash, things to look for include discolored water, on/off valves not operating freely, eyewash basins not draining correctly, uneven water flow from the two sides of the eyewash, and excessively hot or cold water which would make the eyewash unusable. This is especially common in the winter.

    - If an eye wash is not operating properly, immediately contact Facilities Management at the university to have it repaired. Also notify your group that the eyewash is not functioning properly, and it may not be safe to perform some tasks in the lab without a functional eyewash.

6. **Maintain and restock first aid kits and spill kits when necessary.**

- Ensure your laboratory has a first aid kit with its contents in good condition and unexpired. If your laboratory works with any specific hazards, for example Hydrofluoric acid, make sure the proper first aid supplies for injuries involving these chemicals are available. First aid kits and replacement supplies can be purchased from Walmart.

- Also make sure your laboratory has a spill kit available containing materials to clean up any possible spills in your laboratory. A spill kit should contain sufficient amounts of appropriate absorbent materials (for example, polypropylene pads, etc.) to clean up spills in your laboratory.

- It is also good to include supplies for neutralizing common spills and directions for how to proceed to clean up a spill depending on its contents. Supplies to build spill kits (i.e. various kinds of neutralizing absorbents) can be purchased from the Chem Stores.

- Some recommended spill control materials include universal spill absorbent kit (absorbent sock, absorbent granules and powders, spill pads) for solvents, neutralizing spill kit (sodium bicarbonate/baking soda for acid spills, pH paper, citric acid/vinegar for basic spills) for handling corrosive spills.

- The solvent spill cabinet is located on the 6th floor of the ChemSci Building. The code and instructions for handling solvent or hazardous spills can be found here .Each lab should print this out and put it on the back of their lab doors for easy access to all lab users.

7. **Work with departmental Chemical Hygiene Officer and Safety Liaison to ensure group compliance with university safety programs/policies**

- As an LSO, you should be familiar with all of the safety regulations of your research group, the chemistry department and the University. Ensure your group follows all of these regulations. The laboratory walkthroughs conducted by first year graduate students taking the mandatory university safety course are great sources of knowledge about potential issues in your group. Also, you can always contact the departmental chemical hygiene officer and the EHS department when you have specific questions relating to safety in your research group that you need answered.

8. **Assist in writing/evaluating Standard Operating Procedures (SOPs) with your PI and lab researchers**

- Your research group should maintain standard operating procedures for commonly used equipment and processes in your laboratory. These should be thorough and kept up to date. A template for developing laboratory-specific SOPs can be found here. Although SOPs are commonly written by the frequent user of a process, the LSO and PI should work with the super user on drafting the SOP to ensure proper safety rules and processes are in place for safe operation.

- Also ensure super users are maintaining their SOPs and keeping these documents current when changes to the process occur. It is good to update these at least once a year at the very least.

- Ensure all SOPs are stored in a location easily accessible to all group members. Commonly, these SOPs may be stored on a shared drive or physical folder available to all group members or posted near equipment.

9. **Be Familiar with filling EHS safety concern and near misses** https://www.mtu.edu/ehs/report/safety-concerns/ and **Incident and Injury Reporting** https://www.mtu.edu/ehs/report/injury-form/ , and encourage group members to report safety Concerns and near misses and fill out the incident and injury form.

10. **Maintain safety records for your research group.**

- The LSO must ensure that **laboratory specific Chemical Hygiene Plan**, **written Standard Operating Procedures**, and **training documentation** are available in either printed or electronic formats. These documents need to be readily available to anyone that enters the laboratory including all employees, Environmental Health and Safety personnel, and MIOSHA inspectors.

11. **Serve as a resource for safety-related questions within your research group.**

- As an LSO, you are not expected to know the answer to every safety question that comes up in your research group. However, it is your responsibility to be open to questions generated by your group members and to know where to ask questions if you don't immediately know the answer. EHS https://www.mtu.edu/ehs/, Research Integrity or your department chemical hygiene officer are a great resource to turn to when you have questions you do not know the answer to.

- Also, it is your responsibility to serve as a safety role model for your research group. Make sure you are following all of your group's safety rules and working safely in the laboratory.

- When doing new user safety training for your lab, encourage everyone you are training to be willing to come to you and ask questions when they have safety concerns and make sure you convey your willingness to answer these questions.

**12. Be familiar with hazardous waste requirements and storage**

- LSOs are not responsible for packaging and disposal of waste, *unless* appointed by their PI. However, you are responsible for ensuring proper management of hazardous waste. Refer to the four L's of collecting hazardous waste guidelines for managing hazardous waste in your lab. It is also important to ensure all laboratory users know how to properly dispose of chemical waste generated in their experiments. See the EHS website for more information about proper processing of hazardous waste.

**13. Report Safety Issues back to the PI when necessary.**

- LSOs are encouraged to work with their PIs and inform them about any safety related developments happening in the lab. Do well to report any malfunctioning of equipment and lack of any materials needed for the safe conduct of experiments in the lab.

**14. Mentor the next LSO for 3 months before leaving your position.**

- When you are passing on your LSO responsibilities to a new LSO, it is important you convey as much knowledge as possible to the new LSO. You have learned a tremendous amount about working safely in the lab while you were LSO for your research group, and you need to pass along as much of this knowledge as possible to the new LSO. The easiest way to do this is to have the new LSO shadow you in your LSO duties for at least 3 months before you transition the role. During this time, try to explain as much safety and laboratory operation information to the new LSO as possible and have the new LSO with you in the lab whenever you are performing safety related tasks if possible.

## Lab Safety Team (LST) Responsibilities

1. **LSOs must attend all LST meetings and LSO training.**

- Generally, LST meetings take place once every other month and one LSO training will be given in a year and each meeting is about one hour long. LSOs are expected to attend all of these meetings. These meetings will provide information and updates helpful to LSOs. The meeting times will be communicated to all LSOs by the LST which is why it is important for the LST to have the correct email address of all LSOs.

- LSOs that *cannot* attend should send a representative from their research group.

- After the meeting, it is important to convey all information from the meeting to your research group. While some of the information presented in these meetings is specifically directed towards the group LSO, a lot of the information will be useful to your research group members.

2. **LSOs are encouraged to volunteer to help organize events and departmental training.**

- An LSO that goes above and beyond to help improve CGSC efforts can be nominated by their fellow LSOs, PI, lab members, safety professionals for a Safety Award which includes a $50 monetary prize and certificate presented during the next departmental seminar after the announcement of the award.

- Administrative committee members are not eligible to obtain this prize.

- To nominate an LSO or LST member for an award, email **chemsafetycom-l@mtu.edu** to give their name and a short description of how they went above and beyond to promote a positive safety culture within their lab or department.

3. **LSOs must participate in the annual Peer Lab walkthroughs**
    - These annual lab safety walkthroughs should be seen as an opportunity to get feedback on the safety of your laboratory and to initiate discussions about how the safety culture in your laboratory can be improved. They are not intended to get a research group in trouble but are intended to help a research group identify problems early.

    - Lab walkthrough assignments will be given out by the departmental Chemical Hygiene Officer. A copy of the form used for the walkthrough can be found here.

    - The LSO or in their absence, a designated escort will be the primary point of contact during the walkthrough. The LSO or escort should be willing to answer any safety-related questions the “inspector” will have.

- It is your responsibility to communicate with the one performing the walkthrough to coordinate a time when everyone is available to meet and walk through the lab. After walking through a lab, it is important to discuss among your group (including the LSOs of the lab you just inspected) any safety issues in the lab and any suggestions you have for improving the general safety and working conditions in the lab. Also discuss any significant safety concerns from the lab with the LSO and discuss strategies that could be implemented to improve the lab and address the issues.

# Chemical Safety Plan and Emergency Procedures

Emergency Guide

Important Safety Documents

The following safety guides are intended to inform the safe operation of Michigan Tech and promote the safety and well being of lab researchers and the research community.

- University Safety Manual
- Hazard Communication Plan
- Chemical Hygiene Plan
- Flammable Storage
- Laser Safety
- Pressurized systems
- Nanomaterials
- Biosafety

## Chemical Spills Emergency Procedures

It is always possible for a chemical spill to occur in a laboratory even when following all of the chemical hygiene rules and working safely. Most of the time, spills in the laboratory involve relatively small quantities of materials. However, even small amounts of highly toxic or highly reactive materials can be life threatening and dangerous. Laboratory personnel can clean up some spills. However, there are a number of circumstances that outside assistance should be requested.

As a part of your obligations as a lab safety officer, you must develop written procedures for responding to a spill of hazardous chemicals and materials handled in your research lab. The American Chemical Society (ACS) has a Guide on Chemical Spill Response. Secondly, you must know and follow an emergency procedure if you encounter a chemical spill. Hazardous and Chemical spills are also covered in the Campus Emergency Guide and the University Safety Manual Chapter 2.4.Chemical Spills. The exact procedure you should follow can vary, depending on the chemicals you use and the nature of the spill.

**If a spill or release is immediately dangerous to life or health OR on-site personnel are unable to safely manage the spill, seek outside assistance as described on the EHS website.**

However, in general, follow these steps:

1. **Evacuate**

- Evacuate everyone from the spill area.
- Shut off electrical equipment as you leave the area.
- Direct everyone to the nearest fire exit. Do not use elevators.
- Give assistance to those that need help exiting the area.
- Alert your neighbors or pull the nearest fire alarm to evacuate the building.

2. **Seek Emergency Aid for Personal Exposures to Chemicals**

- Immediately remove any contaminated clothing
- Flush skin or eyes with running water for at least 15 minutes. Caution: You may not feel any immediate effect from chemical spills, but it is very important to wash quickly and thoroughly. Many chemicals can cause severe tissue damage that is not apparent until hours later.
- Get medical attention.
- Make sure medical personnel understand exactly what chemicals are involved. Be prepared to provide a Safety Data Sheet (SDS)of the chemical to emergency responders and to any medical personnel.

3. **Report the emergency**

- **Call 911 from a safe location**.
    - Give the dispatcher your location: e.g., Michigan Technological University, in Houghton, along with the location on campus including the building name and room number.
    - Describe the situation, any injuries, and if there is a fire or potential for a fire.

- Contact your supervisor. Explain what happened and tell them what is being done in response.
    - It is expected that supervisors will ensure that the department safety officer, department chair, director and/or dean are aware of the incident.
    - If you are unable to contact your supervisor, contact your departmental safety officer or unit leader (chair, director, dean).

**Always report a spill to the departmental office, regardless of who cleans up the spill.**

4. **Meet up with campus Public Safety and Police Services (PSPS) and other emergency first responders. Provide them with directions to the location of the spill/release.**

The type of information you will need to provide when you meet with Public Safety and Police Services (PSPS) and other emergency first responders is:

- Name of spilled substance(s), quantity released, and any known hazards;
- A copy of the Safety Data Sheet(s), if available;
- Other hazards that may be in the room / area.

5. **Clean Up**

Laboratory personnel can clean-up low hazard level spills. Low hazard level spills are those spills that do not spread rapidly, do not endanger people and do not endanger the environment. All other spills are high hazard level spills and require outside assistance.

For high hazard spills either EHS or the fire department will clean up or stabilize the spill. High hazard spills are those that present fire, health or reactivity hazards. If assistance has been requested from EHS, and it has been determined that the spill can be safely cleaned up by laboratory personnel, they will provide advice on how to safely clean up the spill.

Based on the procedures you develop for your own work (or that your supervisor has developed), you will need to clean up low hazard spills. EHS and the departmental Chemical Hygiene Officer will gladly provide advice on what precautions and equipment to use. When cleaning up a low hazard spill, the proper clean up procedure must be known. If experimental work has been properly planned, this information should be readily available. The appropriate PPE should be worn, and any hazardous waste should be disposed of appropriately. The following guidelines are intended to aid in chemical spill cleanup:

1. The spread of dust or vapors can be prevented by closing the laboratory door and increasing the ventilation (for example, through the fume hood).
2. The spread of a liquid spill can be controlled by making a dike around the edges of the spill using absorbent materials such as spill pillows.
3. Special absorbents are required for some chemicals such as hydrofluoric acid and concentrated sulfuric acid.
4. If flammable liquids are spilled, remove all potential sources of ignition if it can be done safely.
5. In cleaning spills involving direct contact hazards, select PPE resistant to the chemical. It is a good idea to wear two sets of gloves.
6. Acid spills can be neutralized with soda ash or sodium bicarbonate; Laboratories using acids should consider having commercial acid neutralizing absorbents available in the laboratory.
7. Base spills can be neutralized with citric acid or ascorbic acid; Laboratories using liquid alkaline solutions should consider having commercial alkaline neutralizing absorbents available in the laboratory.
8. Laboratories using organic solvents should consider having commercial organic solvent neutralizing absorbents available in the laboratory.
9. Laboratories using formaldehyde solutions should consider having commercial formaldehyde neutralizing absorbents available in the laboratory.
10. Cleanup residues should be placed in a plastic bucket or other suitable container and disposed properly; also see the “Hazardous Waste” section later in this document.

**Resource:**

MTU Master Chemical Hygiene Plan

**Other Important resources**

Chemistry Graduate Safety Committee Website*

MTU Chemical Hygiene Plan

MTU EHS

Department of Chemistry Safety Website

ACS Center for Lab Safety

C&EN Safety Letters

UCLA SOP Library

## Standard Operating Procedures

A Standard Operating Procedure, or SOP, is a document that provides the rules, regulations, and specific procedures followed by all employees, or personnel, associated with a group. In the field of scientific research, SOPs should be used in all laboratory procedures and activities, regardless of the type of research performed. The SOP ensures that a laboratory is adhering to all of the safety protocols established by federal and/or state agencies as well as all policies set forth by the university the laboratory is associated with. The second function of an SOP is to ensure that all personnel working in a laboratory are using the same procedures and following all of the same regulations in the laboratory. This not only helps to reduce breakages, accidents, and injury in the laboratory, but also establishes continuity of laboratory operations when a new hire joins the lab or when a senior member leaves the laboratory. SOPs for each laboratory will vary between labs based on the type of research performed and the regulations imposed by the federal and state authorities, and the university. The following section provides the guidelines on what *should* be included when writing a laboratory SOP or SOP for specific lab activity as well as guidelines on how to maintain an SOP (Chapter 8 of the University's Chemical Hygiene Plan has more information on writing an SOP).

## Writing and Maintaining Laboratory Standard Operating Procedure (SOP)

**Purpose**

Provide guidelines for writing and maintaining effective SOPs in order to maintain continuity of research and a safe working environment in the laboratory. At a minimum, an SOP should include the following:

1. Minimum Personal Protective Equipment (PPE) required for the laboratory.
2. Clear instructions for common laboratory procedures (e.g. storage of chemicals and glassware, handling of waste, etc.)
3. Safety Instructions for working with specialty equipment and chemicals (e.g. lasers, pyrophoric chemicals, oxidizers, compressed gasses, etc.)
4. Basic operating instructions for laboratory equipment (fume hoods, pH meters, water bath and probe sonicators, chromatography/mass spectrometry systems, rotovaps, vacuum systems, etc.)
5. Safe and proper use of any specialized PPE in your laboratory (dry boxes, glove boxes, respirators, etc.)
6. Spill response procedures
7. References and locations/websites for SDS, user manuals, etc. for ALL laboratory equipment, specialty PPE, and specialty chemicals used in your laboratory. The University has an SDS database accessible to all MTU students. All laboratory users should be made aware of this useful chemical information resource.
8. Signatures of the laboratory PI and the LSO

An SOP should serve as a quick reference guide for all established procedures in the laboratory. It should be a supplement to a Safety Data Sheet (SDS) for a specific chemical or a user/hardware manual for a specific piece of laboratory equipment. *THE SOP SHOULD NOT BE USED AS A SUBSTITUTE FOR AN SDS OR A HARDWARE/USER MANUAL.*

## Organizing and Writing the SOP

***a. Introduction*** The introduction of a laboratory SOP should begin with a brief overview of the type of research and techniques commonly performed in the lab. This will give a new member of the laboratory a good idea of the level of PPE, technical knowledge required, and overall safety protocols implemented in the laboratory.

***b. Body***

1. ***Minimum PPE required for your laboratory***

All laboratories, in both industry and academia, require some level of PPE for personnel working there. The level of PPE will be dependent upon the type of research performed. At minimum, most labs require a lab coat, gloves (typically latex or nitrile), and laboratory splash goggles. This section should only be a list of the minimum PPE required to work in the lab. This list should also be made available and visible to all users of the lab.

2. ***Clear instructions for common laboratory procedures***

There are many techniques and procedures that are commonly used in academic laboratories. Although these techniques and procedures are essentially the same, each laboratory may have a way in which they require these to be performed. This ensures that everyone working in the

lab follows the same procedures and helps to minimize the loss of productivity in the lab. Another reason for the subtle differences in basic procedures is that the laboratory may be required to adhere to regulations imposed by federal/state agencies (such as OSHA or the FDA) or by university policies.

When writing SOPs for these procedures, find out what policies the laboratory must follow to ensure that your SOPs are complying. Most agencies (and possibly some universities with large research programs) may have their *own* SOPs for basic laboratory procedures. You will save a lot of time and frustration if you incorporate these procedures into your lab SOP. If you fail to do this, the laboratories could face hefty fines, lose funding, or ultimately be shut down.

3. ***Safety instructions for working with specialty chemicals***

Certain chemicals and laboratory equipment have specific hazards associated with them. The types of chemicals and equipment that is used in your lab will depend upon the type of research and experiments your lab performs. Please refer to the List of Common SOPs for examples of hazards that would require an SOP.

The SDS should be used as a key reference to write the SOP for safe and proper handling of each chemical and/or piece of equipment. However, the SOP is **NOT** a substitute for the SDS. When writing the SOP for these specialty items, the SDS should be referenced and easily accessible to everyone working in the lab.

4. ***Basic Operating Instructions for laboratory equipment***

Laboratories that perform certain types of research require specialized or "lab-designed," and often expensive, equipment. Basic procedures for these instruments, such as start-up, routine analysis/maintenance, and shutdown, are written specifically to prevent injury to the user and damage to the equipment. These procedures can be found in the User Manual, which should be used as a template when writing your laboratory SOP. More technical procedures, such as replacing parts, are also described in the User Manual, so do not need to be included in the SOP. However, the reference and location of the User Manual should be included.

This is especially important when writing an SOP for a "lab-designed" piece of equipment. In this case, you should carefully annotate all procedures performed for ALL basic procedures. Since these pieces of equipment often consist of parts with multiple model numbers or manufactured by multiple vendors, you should reference ALL manuals used to perform the procedures. Also, the SOP should be approved by your PI with safety guidance from the department chemical hygiene officer or EHS.

5. ***Safe and Proper Use of Specialized PPE used in your lab***

Laboratories that routinely use specialty chemicals may require the use of special PPE such as a respirator. Note that this approval is on a person-by-person basis.This information should be listed in the SDS corresponding to the chemical. At MTU, EHS can provide detailed information on the proper use of such specialized PPE. All use of respirators, including N95 particulate filtering respirators (even if used voluntarily) MUST be approved in advance. Prior to writing the SOP for these items, use the SDS to verify that specialty PPE is required for handling certain chemicals and then consult EHS. It is important to consider all controls such as elimination and use of engineering and administrative controls before considering respirators.

### *c. References and Signatures*

#### *1. References*

It is extremely important to provide references to the key documents used to write your SOP such as SDSs and User/Hardware Manuals. If you choose to use other sources to write the SOPs, ensure that they are CREDIBLE (e.g. OSHA and/or EHS regulations, EHS, University Chemical Hygiene Plan, etc). Prior to writing your SOPs, it is also important to verify that ALL documents you reference, and use are easily available and accessible to your lab mates.

#### *2. Signatures*

Your SOP should not be put into practice or made available to your lab mates until the PI of your lab has reviewed, approved, and signed all SOPs you are planning to implement in the lab.

## Maintaining Your SOPs

Maintaining your SOPs is just as important as establishing a SOPs for your laboratory. The purposes of maintaining your SOPs are:

- Ensure your laboratory remains in compliance with any new policies or changes in policy established by federal and state agencies and the university
- Provide up-to-date training for all members of the laboratory upon use of new technique in your lab, arrival of a new piece of equipment, upgrade of new piece of equipment, etc

Although there is no specific timeframe to review your SOPs, you should do it prior to receiving a new member in the lab, when changing LSOs, prior to ANY laboratory inspection, or whenever your LSO or PI requests a review. SOPs should also be reviewed and updated whenever procedures change or a new hazard has been added to the process.

## Conclusion

Laboratory SOPs will vary from lab to lab based on the type of laboratory, research performed, and regulatory policies they are subject to. An SOP is not meant to be a rigid set of instructions, it is a flexible document meant to help provide a safe environment for anyone working in the lab without sacrificing the productivity of the research performed. This document should be used as a guideline and is meant to provide recommendations for writing an effective laboratory SOP that is applicable to any research laboratory.

## List of Common Laboratory SOPs

This list is not meant to be exhaustive or required for every group. It is meant to act as a guide and represents a variety of topics that are present in current SOPs in the Chemistry department. For more examples or detailed write-ups of these topics, the Chemistry department has a google drive folder for SOPs used in the department. The LSO should determine which procedures require an SOP in conjunction with their PI.

A template for developing laboratory-specific SOPs can be found here.

**Reagents:**

- Explosive compounds (azides etc.)
- Sure-seal compounds (*n*-BuLi etc.)
- Raney Nickel
- Perchloric Acid
- Silica Particles/Gels
- Solid pyrophoric materials ($LiAlH_4$, NaH, etc.)
- Reactive metals (Na, Li, K, etc.)

**Equipment:**

- Rotary evaporators
- Schlenk lines
- High-vacuum pumps
- HPLC, GC/GC-MS
- HPLC column packer
- Polarimeter
- Autoclave
- Sonicator
- Centrifuge
- Unisoku dewar
- Vacuum ovens
- Digital pH meters
- Syringe Pumps
- LCxLC, LCxLC-MS
- High pressure liquid $N_2$ tanks
- XRD
- Superconducting magnets
- Gas cylinders and regulators
- Glovebox
- Microwave reactor
- Solvent purification system/solvent stills

- Argon ion laser

**Techniques:**

- Recrystallization
- Distillation
- NMR sample preparation
- IR sample preparation
- Liquid $N_2$ traps
- Preparation/Modification of silica
- Packing HPLC columns
- Filtration
- Extractions (Liquid-liquid, SPE, SPME, etc)
- Preparation of commonly used HPLC mobile phases (buffered solutions, anything containing perchloric acid, etc.)
- Syringe/cannula transfer
- Vacuum transfer of solvents using a Schlenk line
- UV-vis and cryostat
- Electrochemistry

**Biologics:**

- Cell culture maintenance
- Biological safety equipment

## TEMPLATE: MTU CHP Standard Operating Procedure

**Name of Procedure**: *Identify the intended scope of the SOP here*

**Lab Location:** *Building, room number, and/or laboratory name*

**Type of SOP: Procedural _____ Hazardous Material_____ Equipment Specific_____ Other_____**

**Prepared by**:

**Date Established:**

**Revision date**:

**Prior Approval(s) Required**:

This procedure requires approval from the laboratory supervisor every time it is performed

**Yes_____ No_____**

**Hazards**- The following hazards exist with this procedure (check all that apply; list hazard after category; delete categories that don't exist):

**Chemical Hazards**

__ Strong Acids

__ Strong bases

__ Hydrofluoric acid

__ Flammable solids, liquids, or gasses

__ Toxic or highly toxic substances

__ Possible organic peroxides

__ Pyrophoric chemicals

__ Highly reactive chemicals, chemicals that undergo rapid polymerization

__ Chemicals classified as explosives (GHS or DOT categories)

__ Other chemical hazards (specify)

**Physical Hazards**

__ Distillations

__ High/low pressure

__ Lasers (class 3 or 4, open beam)

__ Extreme temperatures

__ High voltage

__ Mechanical hazards

__ Other physical hazards (specify)

**Biological Hazards**

__ BSL II manipulations

__ Biological activities that might create aerosols

**Engineering Controls**- The following engineering controls are required for this activity; (check all that apply; list activity after category; delete categories that don't exist):

__ Chemical fume hood

__ Additional local ventilation (i.e. snorkel)

__ Glove box

__ Biological Safety Cabinet

__ Other engineering controls

5. **Personal Protective Equipment (PPE)**- The following personal protective equipment must be worn (check all that apply; list hazard after category; delete categories that don't exist):

__ Impact resistant eye protection

__ Splash resistant goggles

__ UV, IR, or laser eye protection

__ Face shield

__ Chemical resistant gloves (specify material type and thickness)

__ Extreme temperature gloves

__ Cut resistant gloves

__ Disposable lab coat

__Standard cloth lab coat

__ Fire resistant lab coat

__ Other specialize lab coat, coveralls, or other protective clothing (specify)

__ Head protection (specify)

__ Foot protection (specify)

__ Other PPE (specify)

6. **Storage and Handling Requirements** – describe any specific storage or handling requirements of any hazardous chemicals:

*State the precise methods of storage and handling issues that are pertinent to this procedure.*

7. **Waste disposal**- List the waste products that will be generated, how they will be collected, and how the container will be labeled.

*What waste products are likely to be produced with this procedure and how will they be disposed of?*

8. **Accidental Spill**- In the event that a hazardous material used in this procedure are spilled, be prepared to execute the following emergency procedure:

*What method will be employed if any of the chemicals used in this procedure are spilled during use or during transport?*

9. **Procedure**: List the step-by-step procedure, including any specific safety steps:

*Provide an exact description of the procedure that you will be conducting.*

10. **Certification**- I have read and understood the above SOP. I agree to contact my Supervisor if I plan to modify this procedure.`

**Signature** _____ **Name** (print)

**Supervisor Signature**_____ **Name** (print)_____

**Date**_____ **Room**_____

## Record Keeping

**Purpose**

To document all types of training that a lab member will undergo and provide guidance on how to keep and maintain the training records, in addition to all the lab-specific CHP and SOPs.

At a minimum, every researcher should participate in:

1. Initial mandatory safety course by the Chemistry department
2. Lab specific training for lab specific hazards, potentially based on hazards present in the Standard Operating Procedures for the lab
3. Yearly safety online refresher training

As an LSO, it is your responsibility to maintain the documentation of (1), (2), and (3). Records may be kept for 3 years after the researcher departs

These guidelines are supposed to represent the minimum requirements for a lab. If your lab decides further documentation of training is necessary, please feel free to add training documents to reflect that.

**The LSO must ensure that laboratory specific Chemical Hygiene Plan, written Standard Operating Procedures, and training documentation are available in either printed or electronic formats. These documents need to be readily available to anyone that enters the laboratory including all employees, Environmental Health and Safety personnel, and MIOSHA inspectors.**

## Hazardous Waste

For dealing with hazardous waste (consider the 4 L's of collecting hazardous waste), please refer to the EHS website on Hazardous Waste Collection and Disposal Procedures and the department of Chemistry's Safety webpage on Chemical Disposal Procedures.

## Other Additional Links

MTU Online Chemical Inventory

UNC Laboratory Ergonomics

Prudent Practices in the Laboratory

Laboratory Safety Self Evaluation

PubChem (Laboratory Chemical Safety Summary Datasheet)

Safety - Electrical

Sigma Aldrich - Peroxide Forming Solvents