Department of Chemistry

General Use

Chemical Hygiene Plan

2018

Emergency Contact Information

Fire/Police/EMS Dispatch

911

Principle Investigator	Office Phone	Cell Phone
NA	NA	NA

Chemical Safety Officer	Office Phone	Cell Phone
Andrew Bergeron	207-581-1240	802-735-3717

Department Chair/Building Manager	Office Phone	Cell Phone
Alice Bruce	207-581-1182	207-270-0789

Safety and Environmental Management Chemical Safety Specialist	Office Phone	Cell Phone
Peter Snow	207-581-4056	207-812-8491

University of Maine Campus Security 581-4400.

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1 – Purpose

The University of Maine's (UM) Department of Chemistry, in an effort to ensure that all of its employees and students working in laboratories have a reasonable expectation of safety, has put forward this Chemical Hygiene Plan. It is a guide to operating safely with chemicals and understanding your laboratory environment as well as instructions of what is to be done in an emergency. Each person working in a laboratory will be expected to follow the guidelines explained here but borrowed from The University of Maine System, state and federal governments. The regulations most applicable are from:

Lab Standard: Occupational Exposure to Hazardous Chemicals in Laboratories (29 CFR 1910.1450)

Hazard Communication (29 CFR 1910.1200)

Chemical Inventory and SDS Requirements (40 CFR 300 and 40 CFR 370)

UM Security in an Academic Environment (MP07061)

UM Guidance and Policies for Working with Hazardous Materials to Include Chemical Safety (MP09001)

UM CHP Guidance (MG09003)

UM Chemical Inventory Policy (MP09021)

Guidance from the National Fire Prevention Association.

Here at the Department of Chemistry it is our hope that you will take this information and use it towards the successful completion of your education and research. Please do not allow ignorance or complacency through familiarity to endanger you or the people around you. Please take the extra time to review this material and any specific to your needs at regular intervals. The Chemical Hygiene Plan should not be looked upon as your sole reference for information. There are a variety of sources within UM and Department of Chemistry, listed on https://umaine.edu/chemistry/safety or https://sem.umaine.edu/, which can be called upon to guide you through the laboratory hazards.

This Chemical Hygiene Plan is to be kept accessible to all members of the lab at all times. Persons not trained on it cannot work in the laboratory. Space will be provided within to accommodate any specifics that Principal Investigators feel should be added for their laboratories. Likewise, Standard Operating Procedures for working with particularly hazardous substances should be kept with this plan. This plan is not meant to cover biological or radiological safety concerns.

2 – Responsibilities

University of Maine Safety and Environmental Management (SEM) is responsible for:

- Providing training guidance and consultation services to the Department of Chemistry as well as UM as a whole.
- SEM policies are drafted to foster a safe and healthful campus environment and to comply with various regulatory requirements.
- Annually certifying chemical fume hoods.
- Annually collecting chemical inventories to satisfy regulatory reporting requirements.
- Maintaining records of accidents and near misses that are reported and investigated.
- The collecting of hazardous wastes generated in department laboratories.

Department of Chemistry Chairperson is responsible for:

- Providing direction in the creation of the Chemical Hygiene Plan and ensuring compliance with the requirements that it contains.
- Specific training in laboratory chemical safety.

Chemical Safety Officer is responsible for:

- Working with SEM and the Chairperson to create the Chemical Hygiene Plan and updating as needed, but at least annually.
- Promoting a safe and healthful work environment which will include the training of laboratory personnel and Principal Investigators annually and new personnel as needed.
- Serves as the point of contact for SEM and emergency responders.
- Being available for consultations on lab safety and chemical disposal issues.
- Inspecting lab spaces and chemical inventories to ensure the continued safe work of individuals and compliance with regulatory agencies.
- Providing needed safety materials, SDSs and standard operating procedures to personnel.
- Reporting any accidents or near misses to SEM and the Chairperson.
- Keeping records of training completed by employees and students.

Principal Investigator (PI) is responsible for:

- Understanding and implementing the Chemical Hygiene Plan in the laboratory spaces that s/he oversees.
- Making the Chemical Hygiene Plan specific to her/his laboratory space.
- Being the point of contact for any safety inspections and is the first line of authority for enforcing compliance with the plan.
- Reporting any accidents, near misses or overexposures to the Chemical Safety Officer at the earliest possible opportunity.

•Serves as the point of contact for SEM and emergency responders, with the Chemical Safety Officer.
•The PI may appoint a senior person within their lab to assume the role of updating the Chemical Hygiene Plan or assisting with inspections but the responsibility ultimately rests with the PI.

Laboratory Personnel are responsible for:

•Participating in safety training sessions and keeping current on their lab's Chemical Hygiene Plan.
•Being aware of the chemicals they are working with or around and of the proper way of using and disposing of those chemicals.
•Getting the advice and specific training from the PI for any new hazardous procedures.
•Using all available personal protective equipment and engineering controls that are appropriate to the appointed tasks as described by the PI training.
•Reporting any accidents, near misses or possible overexposures to the PI or Chemical Safety Officer at the earliest possible opportunity.

Department of Facilities Management is responsible for:

•Maintaining engineered controls in good working order, including safety showers, eyewash stations, fire extinguishers, sprinklers, alarms, emergency lights, ventilation and fume hoods.
•The removal of nonhazardous waste.

Department of Human Resources is responsible for:

•Maintaining records of medical testing and surveillance required under the Lab Standard and manage any workers' compensation claims.

3 – Definitions

Acutely Toxic – Immediately dangerous to life at concentrations in parts per million (ppm) range. Example: cyanide.

Chemical Hygiene Plan – A written document developed by the Department of Chemistry under the guidance of SEM to provide procedures for the safe use of equipment and personal protective equipment and work practices that meet the requirements of OSHA.

Compressed Gases – Gases or mixtures that have an absolute pressure that exceeds 40psi (276kPa) at 70°F (21.1°C) or an absolute pressure exceeding 104psi (717kPa) at 130°F (54.4°C), regardless of the pressure at 70°F (21.1°C). Also liquids have a vapor pressure exceeding 40psi (276kPa) at 100°F (37.8°C).

Corrosive Chemicals – Strong acids and bases, dehydrating agents and others that cause visible and permanent destruction of human tissue.

Emergency – Is a hazardous situation that is beyond your skill or training to handle safely.

Flammable Liquids – Chemicals that have a flash point below 100°F (37.8°C) and a vapor pressure below 40psi (276kPa) at 100°F (37.8°C).

Hazardous Chemicals – Any chemical which is classified under a specific physical or health hazard including but not limited to pyrophoric, carcinogenic and flammable substances.

Health Hazard – A chemical where there is evidence from at least one scientific study that acute or chronic health effects may occur if exposed.

Laboratory – A facility or workspace where relatively small quantities of hazardous chemicals are used on a non-production basis.

Laboratory Scale – Refers to containers for reactions or handling of chemicals that can be safely manipulated by a single person. This cannot apply to any work place that produces commercial quantities of materials.

Medical Consultation - A consultation which takes place between an employee and a licensed physician for the purpose of determining what medical examinations or procedures, if any, are appropriate in cases where a significant exposure to a hazardous chemical may have taken place.

Near Miss - An unplanned event or sequence of events that has the potential to cause injury, illness, or property damage

Particularly Hazardous Substances (PHS) – A select list of chemicals that are carcinogens, reproductive toxins and highly acute toxins.

Peroxidable Substances – Chemicals that form potentially explosive peroxides upon exposure to air. Example: Tetrahydrofuran

Physical Hazard – A chemical for which there is scientifically valid evidence that it is a combustible liquid, a compressed gas, explosive, flammable, an oxidizer, an organic peroxide, pyrophoric, unstable or water reactive.

Pyrophoric Substances – Ignite spontaneously in air at room temperature either by oxidation or by oxidation of moisture in the air. Examples: phosphorous (solid), tributylaluminum (liquid) and phosphine (gas).

Reproductive Hazards – Substances known to affect reproductive capabilities including chromosomal damage (mutagens, example: ethylene oxide) and fetal damage (teratogens, example: Thalidamide).

Satellite Accumulation Area – Collection point for hazardous laboratory waste.

Safety Data Sheets (SDS) – Written material concerning a hazardous chemical that is prepared in accordance with OSHA Hazard Communication Standards.

Water Sensitive Substances – Chemicals that react vigorously with water. Example: alkyl aluminums.

4 – Training

All employees and students working in laboratories will undergo an initial training and an annual training by the Department of Chemistry. No one will be allowed to work in a laboratory until the requirements are satisfied. This training will include, but not be limited to, information on the CHP, Safety Data Sheets, safety equipment and environmental controls.

All training will be documented and the records maintained in the department for the length of the employee or student's tenure.

All employees and student employees must read and sign the Chemical Hygiene Plan before initially entering the lab and then whenever a revised edition is released. This does not apply to students attending teaching laboratories. Teaching labs will have their own safety training either in the beginning of the course or before each teaching session.

5 – Security

Given the current state of affairs it is necessary that we take simple security precautions to protect the people and property inside Aubert Hall. There are chemicals and pieces of equipment that could be of interest to someone who wishes to commit a crime with them. Whether these persons wish to do harm to someone or to produce illegal substances, it is our responsibility to protect ourselves and the department from providing them the means to do it.

Aubert Hall is locked between 6am – 9pm during the weekdays and all weekend. The building can be accessed through an approved Maine Card during those off hours. Please contact the department Administrative Specialist if you are unable to access the building. Never lend your Maine Card or room keys to anyone at any time. Never prop open exterior doors. Report any malfunctioning doors and locks to either the department Administrative Specialist or the chemical safety officer.

Windows should remain closed at all times but must be closed and locked if the room is unoccupied, regardless of the floor.

Each lab space and prep area is to remain locked when unoccupied. If you are away from these areas such that you lose sight of them, you must lock the doors. It is strongly recommended that you also lock any office or study areas when unoccupied.

If a door or window is found to be forcibly opened or left open under suspicious circumstances, you must alert campus security and either the building manager or the chemical safety officer. An emergency contact card should be present on the door to the room. If you find a chemical or apparatus to be missing you must do the same.

Any suspicious persons that are unfamiliar to the lab space you are working in, or in the building after hours, should be challenged. Report to campus police and the department chair or chemical safety officer the incident as soon as it occurs. Do not engage in a physical confrontation with any suspicious persons.

6 – Emergency Preparedness

Everyone who is eligible to work in the lab should know the proper use and location of the nearest:

- Eye wash station
- Emergency shower
- Spill kit
- Fire alarm pull station

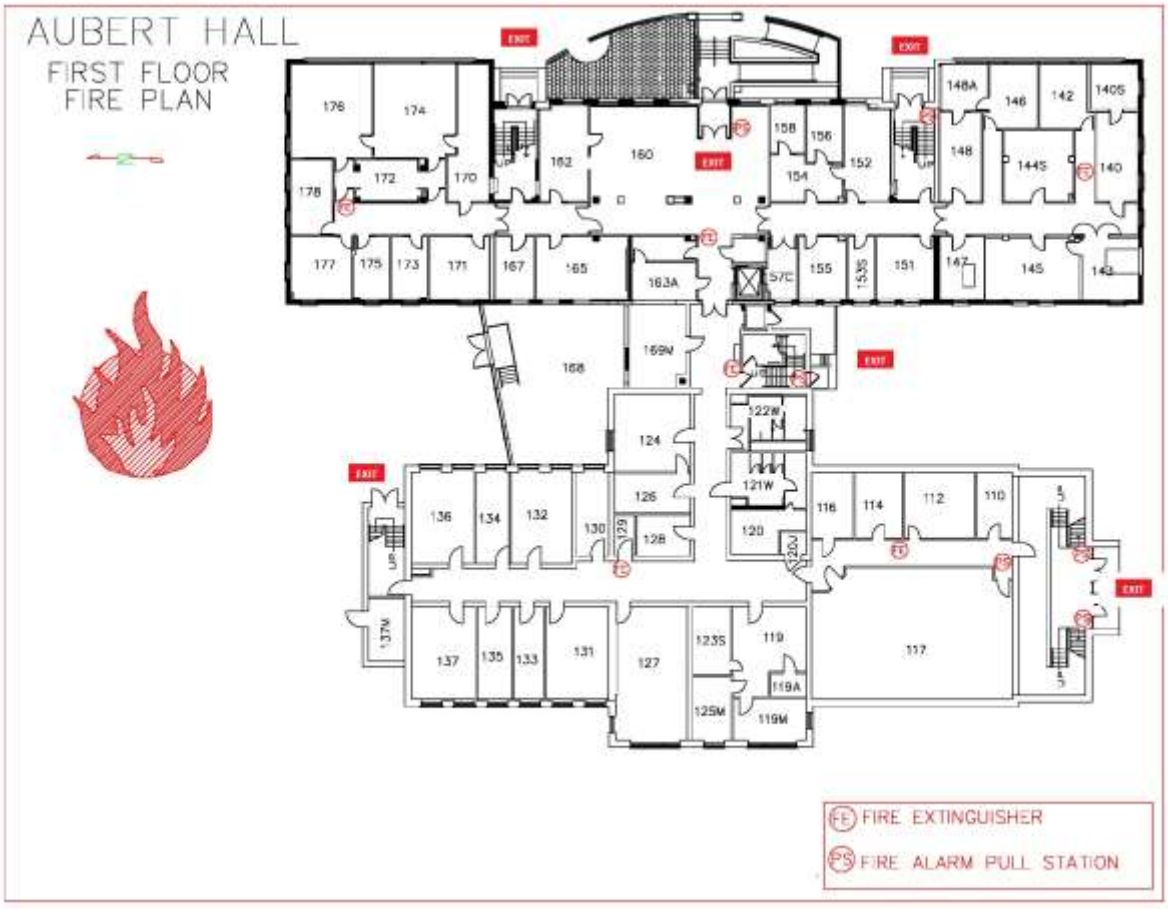
Ingrain into your mind the location of these object as it might be difficult to remember where they are in an emergency situation. Take the time to walk from your typical work space to these objects on a regular basis.

The Emergency Action Plan

The Emergency Action Plan is here to guide you on what to do in the event of an emergency in Aubert Hall.

The emergency evacuation alarm consists of horns and strobe lights, and is sounded from pull stations near the exits and stairs or automatically by heat sensors in the ceilings of each room and corridor.

If it sounds, follow the exit pathways toward the rally point. Exit Pathways are posted in laboratories and in the corridors. They simply show the quickest way out of Aubert Hall. In general, use the nearest pathway that leads out of the building.



The rally point is the lawn of Wingate Hall across Munson Road.

After Evacuation

•If you know the reason of the emergency you must call 911 and give the details of the emergency to the dispatcher so that emergency responders will have an idea of what they are about to address. Be sure to tell them you are at the Orono campus, not all dispatchers are local and may assume another location.
•Contact the Evacuation Coordinator, currently the Chemical Safety Officer, about persons you know to have been in the building or are still in the building and any information about the cause of the evacuation.
•If the coordinator is not present, contact the Department Chairperson or the most senior faculty member.
•Afterwards you may take shelter in Wingate Hall in the event of inclement weather (rain, snow and excessive cold).

IF you can do so safely and without delaying your evacuation by more than a moment please also:
Turn off equipment.
Close any windows.
Close and lock any lab doors.

Talking to First Responders

If you are the person who has the information on the emergency, you will have to speak with the first responders who arrive on the scene. Please keep in mind that they are not here to judge our actions, only to deal with the emergency at hand. Do not argue with or challenge the first responders. They are unaware of our policies and they only know what they have been trained to handle. Give them the information they are going to need to deal with the situation and answer their questions. If the emergency involves a chemical, you will likely know more about it than they will. Because of this be familiar with the chemicals you are working with by reading the safety data sheets so that you can help them help us.

Fire Emergencies

The policy of the department is that the individual discovering the fire shall activate the nearest fire alarm pull station and proceed as described above to report to the rally point. You SHOULD NOT choose to fight the fire. Unless:

You have had fire extinguisher training within the past year.

Not all fires can be contained by all fire extinguishers. Many chemical fires will be made worse by the application of the wrong extinguishing agent. If you have to stop and think about the right choice to make you should choose not to fight the fire and evacuate with everyone else. Section 5 of the SDS will provide valuable information about what to do for a fire involving the chemicals you are working with, but this must be done ahead of time.

If the fire is in a fume hood, and it can be done safely, close the sash before evacuating.

Chemical Spill Emergencies

Chemical spills may or may not be emergencies depending upon a variety of factors that are discussed here. If the spill is an emergency do not attempt a cleanup! Report the incident to emergency responders at 911. Be sure to tell them you are at the Orono campus.

Non-emergency spills can be cleaned up by laboratory personnel unless the following criteria are present. If any of these exist, then the situation is an emergency.

Someone received a serious injury during the spill
The spill is in a public area such as stairwells, corridors or lobbies.
A spill kit and personal protective equipment are not present.
The material spilled is not known.
The spill is more than a spill kit can handle.

In general, if you are uncertain how to handle the spill, DO NOT try to clean it. Please refer to section 6 of the SDS for information on how to handle the specifics of the spills you are working with before you begin. Consult your Principle Investigator for further information on developing a prudent plan.

If The Situation Is An Emergency

And you have been splashed by the spill

1. Use the emergency shower or eyewash station, rinsing the affected area for at least 15 minutes.
2. Loudly alert others around you to the spill and use the nearest pull station if the spill presents a threat to others in the building.
3. Seek immediate medical attention.

If someone else is the victim of the spill

1. Contact emergency responders at 911 if the injuries are serious.
2. Loudly alert others to the spill.

3. DO NOT attempt first aid unless you have had training in the past year and you have the appropriate personal protective equipment.

If no one is involved in the spill

1. Close any doors.
2. Loudly alert others to the spill.
3. Evacuate the area.

If you activate the emergency alarm system you will have to call 911 at the rally point to describe the nature and location of the emergency to the dispatcher. Be sure to tell them you are at the Orono campus. Then contact the Evacuation Coordinator.

Spill Kits

Every laboratory must have a spill kit stocked with the following items. Each member of the laboratory should know the location of the kit before starting work.

1. A five gallon pail with a tight fitting lid to contain the absorbent material.
2. Absorbent, such as cat litter or Speedi Dri, enough to fill the container and handle a spill of 4L of liquid.
3. A heavy duty plastic bag to contain absorbed waste.
4. Neutralizing materials like Sodium Bicarbonate for acids or Citric Acid for bases.
5. Decontamination supplies such as detergent.
6. Chemical Waste labels to identify the contents of the spill.
7. A black marker.
8. Each lab should also consider anything additional that would be special to their needs. Example: Sulfur powder for Mercury spills.

Personal Injury Emergencies

If you are injured in the lab and the situation is beyond your ability to control call 911 or shout to your lab mates for assistance.

If you find someone who has been injured call 911 and follow the instructions of the dispatcher. Do NOT attempt first aid unless you have a current first aid certification and you have Personal Protective Equipment at your disposal, especially gloves and goggles.

If you find evidence that someone has been gravely injured (copious amount of blood for example) call 911. Do not attempt to clean the fluids yourself and prevent others from going near the area. If possible, close and lock the doors to the area.

Once the situation is no longer an emergency then the injury must be reported to the Chemical Safety Officer and UM Risk Management. The form can be found at https://sem.umaine.edu/accident-reporting. An investigation will be conducted to

determine what measures need to be implemented to prevent the accident or injury from happening again.

Any employee may seek treatment by a licensed physician for injuries resulting from a laboratory accident. If the person is not covered by insurance UM will bear the cost of the treatment.

7 – Identifying Chemical Exposure

It is important when working with chemicals to understand the possible adverse effects of them on the human body. Information about this can be found in section 8 and 11 of the SDS. Once the particular hazards of a substance are known the signs of adverse effects can be more easily recognized.

If chemical exposure has occurred seek medical attention from either:

- **Cutler Health Center** on 80 Long Road (Monday – Friday 8am until 5pm). (207) 581-4000
- **Eastern Maine Medical Center** at 915 Union Street in Bangor (Sunday – Saturday 8am until 7pm). (207) 973-7000
- For more urgent care the Eastern Maine Medical Center **Emergency Department** at 489 State St in Bangor (always open).

<u>You must inform them of what you have been exposed to if it is known.</u>

Signs and Symptoms of Chemical Exposure

-Skin may become dried, whitened, reddened, swollen, blistered, rashy or itchy.
-Burning of the skin, nose, throat or eyes (as well as tearing).
-Headache, lightheadedness or dizziness.
-Coughing or difficulty breathing.

Odor – Not all chemicals have a detectable odor. Many chemicals can be smelled at concentrations below hazardous levels and thus serve as a good indicator that you are not working as safely as you could. This might also be a sign of a malfunctioning fume hood. Example: Pyridine has a fish like odor.

Taste – Many chemicals have a characteristic taste that can be detected without intentionally eating the substance. Whether the chemical is in the air and settling in your mouth or the chemical is absorbed through your skin. Example: Dimethyl Sulfoxide is easily absorbed through the skin and gives a garlic like taste in the mouth.

Report any chemical exposure to the Principle Investigator and if medical treatment is required the exposure must also be reported to the Chemical Safety Officer and UM Risk Management.

Exposure Monitoring

Regular exposure monitoring of air quality is not done due to the relatively small volumes of chemicals and the short periods of time of exposure to those chemicals.

Monitoring can be done if the laboratory personnel or the Principle Investigator:

1. Believe that exposure levels exceed those set by OSHA. Use section 8 of that chemicals SDS or https://www.osha.gov/dsg/topics/pel for the exposure limits.
2. Someone reports an overexposure to a chemical in the laboratory space.
3. A Particularly Hazardous Substance is used on a regular basis for an extended period of time or in large quantities.

Monitoring is done by SEM or it might be outsourced to a third party. Badges are available for some substances for workplace monitoring. Example: formaldehyde.

Any employee or student employee who experiences symptom of exposure to a hazardous chemical will be allowed the medical examinations that are deemed necessary by a licensed physician at a time and place that is reasonable to the employee.

8 – Safe Use of Chemicals

Hazard Assessment: The best way to minimize risk is to understand the hazards before you begin your work. Please reference sections 2, 8 and 10 of the pertinent SDSs. Use this information to better mitigate possible areas where problems may occur.

Below is a set of controls that, when set in place, will help to ensure that you are doing your best to minimize the chemical hazards in your work area.

Administrative Controls

- Scheduling workers to prevent anyone from working alone or to prevent prolonged exposure.
- Ensuring that laboratory work is being done by persons who have completed the necessary training as determined by the Department of Chemistry and SEM.
- Remove any workers who are unable or unwilling to work in a safe manner.

Procurement Controls

- Purchase only the amount of a chemical that you will need.
- Order a form of the chemical that is not as hazardous meaning:
  - A more dilute form of the substance.
  - A chemical in a pellet form or solution instead of a powder.
- Check existing inventories and consider borrowing a small amount before committing to a purchase.

Engineered Controls

Engineered controls are designed to isolate a worker from a hazard or to move the hazard away from the work area. Examples are:

•Local Ventilation

- A type of ventilation that can be used when there is a localized source of vapors.
- Snorkel exhausts are the most common.
- This type of ventilation should only be set up by the Department of Facilities Management.

•Chemical Fume Hoods

- In research laboratories, almost all processes, save for recrystallizations from innocuous solvents should be conducted in the fume hood.
- Hoods must be kept uncluttered. It is prudent to remove the equipment from one experiment before beginning another.
- Do not keep reagents in a hood while doing the experiment.
- Containers should be capped while in the hood. There are no pollution control mechanisms in place.
- Only the hands should be inside the hood to work with the chemicals or for any other reason.
- Keep the sash at the safe operating level when not adding or removing equipment. This level will be marked on the sides of the sash.
- An alarm will sound if the air flow is higher than or lower than the optimum air flow speed. The speed is generally set to 100 fpm. The alarm only represents the air speed, there are no chemical sensors in the department's fume hoods.
- Preform all tasks at least 6 inches from the hood opening.
- Do not leave items on the foil or sill to disrupt air flow.
- Make sure the hood has been inspected within the last year.
- Close the sash to prevent air disturbances in the hood and save energy.
- These videos will help to illustrate the proper techniques for using a chemical fume hood. https://www.youtube.com/watch?v=A4AHxLnByts or https://www.youtube.com/watch?v=q2Pp3wge2j8

Please Note: Occasionally a fume hood alarm may be activated due to insufficient ventilation. This does not present an emergency. The sound of a hood alarm is localized to the room where the hood is and does not activate the fire alarm system which can be heard at a much louder volume throughout the building. Contact the Chemical Safety Officer. Close the sash to the fume hood and place a sign on the sash (a piece of masking tape and a marker will work) notifying users not to use. A work order will need to be placed through Facilities Management to have this fume hood repaired.

•Glove Boxes or Glove Bags

- Are a good option when working with acute or chronic toxins that should be isolated to minimize exposure.

- Boxes and bags prevent air and moisture reactive hazards when used with nitrogen or argon atmospheres.

•Safety Shields

- Should be used in front of reactions that could be violent such as one involving peroxides.
- The shields can be set up in the fume hood for an extra degree of protection there.
- Be careful that the shield does not obstruct air flow in the fume hood.

•Designated Areas

- Some procedures and chemicals may be used only in specific areas of the laboratory.
- Mark the area with tape and signs.

•Cold Traps

- Vacuum pumps must be protected by cold traps to prevent experimental materials from reaching the pump.
- If cold traps are insufficient to the task the pumps must be vented into a hood.

Safety Equipment

•Eyewash Station

- Bottle type eyewashes are not adequate for laboratory work in Aubert Hall.
- Identify the location of the flushing eyewash station nearest your work space and be familiar with how to turn it on. Most use a simple lever to start the water flow.
- If you experience a splash or other exposure to your eyes loudly shout for assistance and proceed to the eye wash station. You may need assistance locating the station.
- Holding your eyes open or with the assistance of someone holding your eyes open flush them for 15 minutes. The water will be cold but this amount of time is necessary to flush away as much of the contaminant as possible.
- Dial 911 to s eek immediate medical attention.

•Safety Shower

- Identify the location of the safety shower nearest your work space. It is usually attached to the eyewash station and be familiar with how to turn it on. Most use a lever that is pulled underneath the shower cone.
- The shower can be used for clothing fires as well as chemical exposures.
- If you are splashed or otherwise exposed loudly shout for assistance and proceed to the shower.
- Flush the contaminants off for at least 15 minutes. Remove your lab coats and other personal protective equipment and possibly your outer layer of clothing. There is no time for modesty especially with very corrosive or flammable chemicals.
- Dial 911 to seek immediate medical attention.
- If you assist someone, your own personal protective equipment may become contaminated and will have to be dealt with appropriately.

•Pull Stations

- These will activate the building emergency lights and sirens.
- Pull stations are located next to stairways and exits for ease of use while exiting the building in an emergency.
- These red boxes can be activated by pulling the little red circle that says “Pull.”
- Some of these stations will have a metal guard in place to prevent accidental activation. Simply lift the guard and then pull the circle.

•Fire Extinguishers

- Are located throughout the building to assist those trained in their use to put out small fires.
- The Orono fire department would prefer that they go unused.

Personal Protective Equipment

Clothing

- The most basic layer of protection is your own clothing and it should be thought of as your last layer of defense.
- Pants or full length skirts should be worn.
- Loose flowing garments should NOT be worn. Loose jewelry should be avoided as well as ornate rings which can damage gloves.
- Synthetic materials like polyester should NOT be worn. Natural fibers like cotton and wool are less reactive with the chemicals in most laboratories.
- Crop tops or other items of clothing that expose the abdomen should not be worn.
- Close toed shoes with a closed heel should be worn and should be of non-porous materials.
- Neck ties and long hair should be secured.
- Clothing that is contaminated with chemicals cannot be washed with other clothing and should not be taken to a laundromat.
- Clothing that is contaminated with particularly hazardous substances should be disposed of with the chemical waste.

Lab Coats, Gowns and Aprons

- Lab coats or gowns should be worn whenever there is a risk of spills that could contaminate your clothing or react with your skin.
- A rubber apron should be worn when working with the hazardous liquids, cryogens or corrosive materials.
- If there is a risk of heat or fire, a resistant coat, like a Nomex lab coat, should be considered.
- There must be one coat for each person in a research laboratory.

Goggles, Glasses and Face Shields

- Safety glasses are required in the lab when anyone is working with chemicals or an experiment is running.
- Goggles that enclose the area around the eye should be worn when there is a risk of splashing.

- If the risk of splashing is high, then a face shield should be used in conjunction with the goggles. Also with potentially explosive compounds.
- Contact lenses should not be worn in the laboratory. The plastic used is permeable to many of the vapors present in the lab. Chemicals and dust may become trapped behind the lens causing corneal damage. These conditions combined with the added time needed to remove the lenses for proper flushing at an eye wash station mean that it is better not to wear contact lenses in the laboratory.

Gloves

- Consult Section 8 of your chemicals' Safety Data Sheet.
- Disposable nitrile and vinyl gloves are the norm in most labs but they only protect against incidental exposures.
- For long term exposure you should use rubber or Viton gloves.
- Non disposable gloves should be washed before removal.
- Insulated gloves, which are also impermeable, must be used when handling cryogens such as liquid nitrogen or dry ice or items that have been hot liquids.
- Most glove manufacturers publish a guide to selecting the correct glove for the task. One can be found here http://www.ansellpro.com/download/Ansell_7thEditionChemicalResistanceGuide.pdf

Respirators

- Prior approval by a physician is required by SEM.
- You will have to be fitted for the respirator prior to use.
- Special training will have to be conducted initially and annually for continued use.

None of the above Personal Protective Equipment should leave the lab except the clothes you walked into the building wearing.

Each lab is responsible for supplying the coats, gloves, goggles, face shield and aprons that you will need to do your work. Each lab should also have at least one safety shield of medium size.

Particularly Hazardous Substances

This select group of chemicals has been proven to be acutely or chronically toxic and as such should have a specific SOP written for the safe use within the lab. Use of these chemicals should not be done without the knowledge and permission of the Principle Investigator.

A good list of these chemicals can be found http://www.safety.duke.edu/laboratory-safety/chemical-hygiene/particularly-hazardous-substances, courtesy of Duke University.

Transport of Chemicals Between Laboratory Spaces

When moving chemicals between spaces (example: storeroom to laboratory) there must be secondary containment sufficient to the primary container. The use of carts for larger

containers or multiple containers is highly recommended. To move between floors, you must use the elevator, you may not use the stairwells. Please remember that a spill in the hallway is more difficult to clean and a spill on the stairs is much more difficult compared to the laboratory.

9 – Safety Data Sheets and Hazard Signage

Every chemical in your laboratory must have a Safety Data Sheet.

The Safety Data Sheets may be in paper or electronic form but they must be EASILY accessible to the persons working with the chemicals. This is to say that a search engine query does not constitute accessible. Since some of the chemicals are proprietary, getting SDS's from manufacturers can take time. Please get the SDS before you begin working with that substance.

There are a number of places that you can obtain a Safety Data Sheet (formally Material Safety Data Sheet) for the chemical with which you are working. The Department of Chemistry safety website https://umaine.edu/chemistry/safety/, has resources that can aid you in finding the SDS for your chemical. Manufacturers are required to provide them with their chemicals and usually have them on their websites or send a copy with an order, but all of them will send you a copy if requested. Ultimately the source of the SDS is less important than the SDS itself.

MSDSs used to come in a variety of formats however, all SDSs produced after 2012 conform to a universal template, called the Global Harmonized System, which is very similar to the MSDS but in a more consistent and user friendly template.

The sections of the Safety Data Sheet explained.
Courtesy of OSHA Hazardous Comunication Standard Brief

Section 1: Identification - This section identifies the chemical on the SDS as well as the recommended uses. It also provides the essential contact information of the supplier. The required information consists of:

- Product identifier used on the label and any other common names or synonyms by which the substance is known.
- Name, address, phone number of the manufacturer, importer, or other responsible party, and emergency phone number.
- Recommended use of the chemical (e.g., a brief description of what it actually does, such as flame retardant) and any restrictions on use (including recommendations given by the supplier).

Section 2: Hazard(s) Identification - This section identifies the hazards of the chemical presented on the SDS and the appropriate warning information associated with those hazards. The required information consists of:

- The hazard classification of the chemical (e.g., flammable liquid).
- Signal word.
- Hazard statement(s).
- Pictograms.
- Precautionary statement(s).
- Description of any hazards not otherwise classified.
- For a mixture that contains an ingredient(s) with unknown toxicity, a statement describing how much (percentage) of the mixture consists of ingredient(s) with unknown acute toxicity. Please note that this is a total percentage of the mixture and not tied to the individual ingredient(s).

Section 3: Composition - This section identifies the ingredient(s) contained in the product indicated on the SDS. This section includes information on substances, mixtures, and all chemicals where a trade secret is claimed. The required information consists of:

- Chemical name.
- Common name and synonyms.
- Chemical Abstracts Service (CAS) number and other unique identifiers.
- Impurities and stabilizing additives, which are themselves classified and which contribute to the classification of the chemical.
- Mixtures have the same information required for substances.
- The chemical name and concentration (i.e., exact percentage) of all ingredients which are classified as health hazards and are: Present above their cut-off/concentration limits or present a health risk below the cut-off/concentration limits.
- The concentration (exact percentages) of each ingredient must be specified except concentration ranges may be used in the following situations: A trade secret claim is made, there is batch-to-batch variation, or the SDS is used for a group of substantially similar mixtures. Chemicals where a trade secret is claimed
- A statement that the specific chemical identity and/or exact percentage (concentration) of composition has been withheld as a trade secret is required.

Section 4: First-Aid - This section describes the initial care that should be given by untrained responders to an individual who has been exposed to the chemical. The required information consists of:

- Necessary first-aid instructions by relevant routes of exposure (inhalation, skin, eye contact, and ingestion).
- Description of the most important symptoms or effects, and any symptoms that are acute or delayed.
- Recommendations for immediate medical care and special treatment needed, when necessary.

Section 5: Fire-Fighting - This section provides recommendations for fighting a fire caused by the chemical. The required information consists of:
• Recommendations of suitable extinguishing equipment, and information about extinguishing equipment that is not appropriate for a particular situation.
• Advice on specific hazards that develop from the chemical during the fire, such as any hazardous combustion products created when the chemical burns.
• Recommendations on special protective equipment or precautions for firefighters.

Section 6: Accidental Release - This section provides recommendations on the appropriate response to spills, leaks, or releases, including containment and cleanup practices to prevent or minimize exposure to people, properties, or the environment. It may also include recommendations distinguishing between responses for large and small spills where the spill volume has a significant impact on the hazard. The required information may consist of recommendations for:
• Use of personal precautions (such as removal of ignition sources or providing sufficient ventilation) and protective equipment to prevent the contamination of skin, eyes, and clothing.
• Emergency procedures, including instructions for evacuations, consulting experts when needed, and appropriate protective clothing.
• Methods and materials used for containment (e.g., covering the drains and capping procedures).
• Cleanup procedures (e.g., appropriate techniques for neutralization, decontamination, cleaning or vacuuming; adsorbent materials; and/or equipment required for containment/clean up).

Section 7: Handling and Storage - This section provides guidance on the safe handling practices and conditions for safe storage of chemicals. The required information consists of:
• Precautions for safe handling, including recommendations for handling incompatible chemicals, minimizing the release of the chemical into the environment, and providing advice on general hygiene practices (e.g., eating, drinking, and smoking in work areas is prohibited).
• Recommendations on the conditions for safe storage, including any incompatibilities. Provide advice on specific storage requirements (e.g., ventilation requirements).

Section 8: Exposure Controls - This section indicates the exposure limits, engineering controls, and personal protective measures that can be used to minimize worker exposure. The required information consists of:
• OSHA Permissible Exposure Limits (PELs), American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLVs), and any other exposure limit used or recommended by the chemical manufacturer, importer, or employer preparing the safety data sheet, where available.
• Appropriate engineering controls (e.g., use local exhaust ventilation, or use only in an enclosed system).

• Recommendations for personal protective measures to prevent illness or injury from exposure to chemicals, such as personal protective equipment (PPE) (e.g., appropriate types of eye, face, skin or respiratory protection needed based on hazards and potential exposure).
• Any special requirements for PPE, protective clothing or respirators (e.g., type of glove material, such as PVC or nitrile rubber gloves; and breakthrough time of the glove material).

Section 9: Physical and Chemical Properties - This section identifies physical and chemical properties associated with the substance or mixture. The minimum required information consists of:

- Appearance (physical state, color, etc.)
- Upper/lower flammability or explosive limits
- Vapor pressure
- Odor threshold
- Vapor density
- Relative density
- Melting point/freezing point
- Initial boiling point and boiling range
- Partition coefficient: n-octanol/water
- Viscosity
- Flammability (solid, gas)
- Odor
- pH
- Flash point
- Solubility(ies)
- Evaporation rate
- Auto-ignition temperature
- Decomposition temperature

The SDS may not contain every item on the above list because information may not be relevant or is not available. When this occurs, a notation to that effect must be made for that chemical property. Manufacturers may also add other relevant properties, such as the dust deflagration index (Kst) for combustible dust, used to evaluate a dust's explosive potential.

Section 10: Stability and Reactivity - This section describes the reactivity hazards of the chemical and the chemical stability information. This section is broken into three parts: reactivity, chemical stability, and other. The required information consists of:
• Reactivity: Description of the specific test data for the chemical(s). This data can be for a class or family of the chemical if such data adequately represent the anticipated hazard of the chemical(s), where available.
•Stability: Indication of whether the chemical is stable or unstable under normal ambient temperature and conditions while in storage and being handled.
• Description of any stabilizers that may be needed to maintain chemical stability.
• Indication of any safety issues that may arise should the product change in physical appearance.
• Other: Indication of the possibility of hazardous reactions, including a statement whether the chemical will react or polymerize, which could release excess pressure or heat, or create other hazardous conditions. Also, a description of the conditions under which hazardous reactions may occur.
• List of all conditions that should be avoided (e.g., static discharge, shock, vibrations, or environmental conditions that may lead to hazardous conditions).

• List of all classes of incompatible materials (e.g., classes of chemicals or specific substances) with which the chemical could react to produce a hazardous situation.
• List of any known or anticipated hazardous decomposition products that could be produced because of use, storage, or heating. (Hazardous combustion products should also be included in Section 5 (Fire-Fighting Measures) of the SDS.)

Section 11: Toxicological Information - This section identifies toxicological and health effects information or indicates that such data are not available. The required information consists of:
• Information on the likely routes of exposure (inhalation, ingestion, skin and eye contact). The SDS should indicate if the information is unknown.
• Description of the delayed, immediate, or chronic effects from short- and long-term exposure.
• The numerical measures of toxicity (e.g., acute toxicity estimates such as the LD50 (median lethal dose)) - the estimated amount [of a substance] expected to kill 50% of test animals in a single dose.
• Description of the symptoms. This description includes the symptoms associated with exposure to the chemical including symptoms from the lowest to the most severe exposure.
• Indication of whether the chemical is listed in the National Toxicology Program (NTP) Report on Carcinogens (latest edition) or has been found to be a potential carcinogen in the International Agency for Research on Cancer (IARC) Monographs (latest editions) or found to be a potential carcinogen by OSHA.

Section 12: Ecological Information - This section provides information to evaluate the environmental impact of the chemical(s) if it were released to the environment. The information may include:
• Data from toxicity tests performed on aquatic and/or terrestrial organisms, where available (e.g., acute or chronic aquatic toxicity data for fish, algae, crustaceans, and other plants; toxicity data on birds, bees, plants).
• Whether there is a potential for the chemical to persist and degrade in the environment either through biodegradation or other processes, such as oxidation or hydrolysis.
• Results of tests of bioaccumulation potential, making reference to the octanol-water partition coefficient (Kow) and the bio concentration factor (BCF), where available.
• The potential for a substance to move from the soil to the groundwater (indicate results from adsorption studies or leaching studies).
• Other adverse effects (e.g., environmental fate, ozone layer depletion potential, photochemical ozone creation potential, endocrine disrupting potential, and/or global warming potential).

Section 13: Disposal Considerations - This section provides guidance on proper disposal practices, recycling or reclamation of the chemical(s) or its container, and safe handling

practices. To minimize exposure, this section should also refer the reader to Section 8 (Exposure Controls/Personal Protection) of the SDS. The information may include:
• Description of appropriate disposal containers to use.
• Recommendations of appropriate disposal methods to employ.
• Description of the physical and chemical properties that may affect disposal activities.
• Language discouraging sewage disposal.
• Any special precautions for landfills or incineration activities.

Section 14: Transport Information - This section provides guidance on classification information for shipping and transporting of hazardous chemical(s) by road, air, rail, or sea. The information may include:
• UN number (i.e., four-figure identification number of the substance).
• UN proper shipping name.
• Transport hazard class(es).
• Packing group number, if applicable, based on the degree of hazard.
• Environmental hazards (e.g., identify if it is a marine pollutant according to the International Maritime Dangerous Goods Code (IMDG Code)).
• Guidance on transport in bulk (according to Annex II of MARPOL 73/783 and the International Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk (International Bulk Chemical Code (IBC Code)).
• Any special precautions which an employee should be aware of or needs to comply with, in connection with transport or conveyance either within or outside their premises (indicate when information is not available).

Section 15: Regulatory Information - This section identifies the safety, health, and environmental regulations specific for the product that is not indicated anywhere else on the SDS. The information may include:
• Any national and/or regional regulatory information of the chemical or mixtures (including any OSHA, Department of Transportation, Environmental Protection Agency, or Consumer Product Safety Commission regulations).

Section 16: Other Information - This section indicates when the SDS was prepared or when the last known revision was made. The SDS may also state where the changes have been made to the previous version. You may wish to contact the supplier for an explanation of the changes. Other useful information also may be included here.

Hazard Pictograms

Being familiar with the pictograms below will help to understand at a quick glance the nature of the substances you are working. These pictograms should serve as the warning to examine the safety data sheet and consult any SOPs that exist before working with the material.

Do not assume that because you understand the pictogram you understand the material. Often the only pictogram given is that of the most hazardous quality not all the hazardous qualities.

Explosive

Flammable

Oxidizer

Compressed Gas

Corrosive

Acutely Toxic

General Hazard

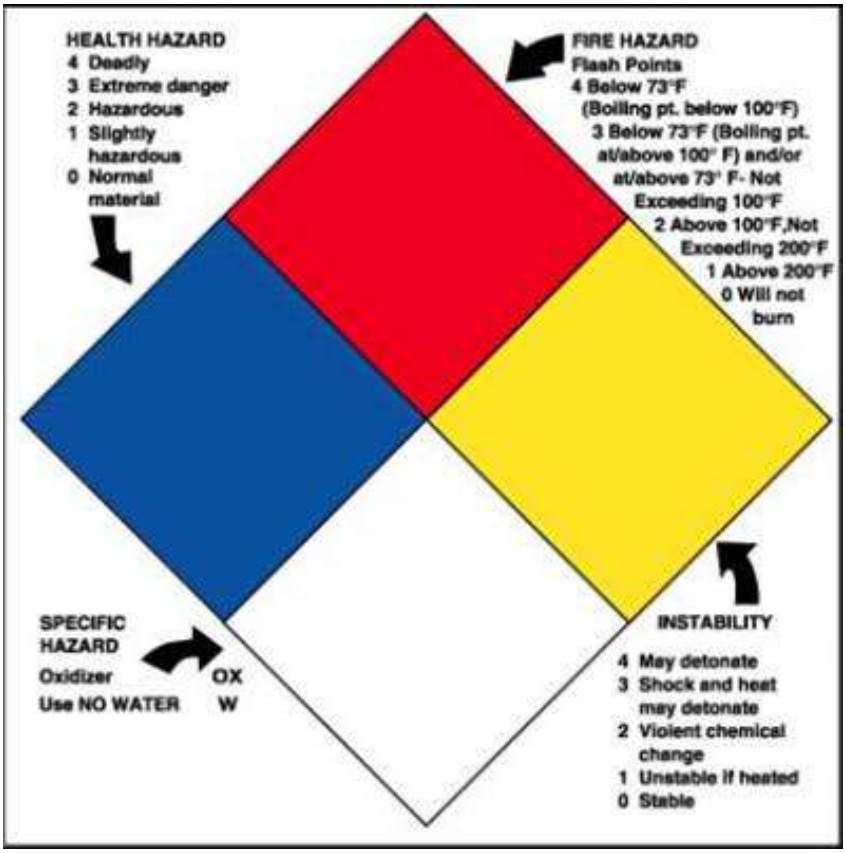
Health Hazard

Environmental Hazard

Space is limited on the label of a bottle or on the shipping container. You may not get all the information you need to work with the chemical but you should get enough to give you pause so you can research the safest way of working with it.

Developed by the National Fire Protection Association, the Hazard Diamond is a good way to get information about a chemical at a quick glance if you are familiar with the color scheme and

understand that the hazardousness increases as the numbers increase from 0 to 4. The white square can contain some of the most important information as it pertains to the specifics of the reactive nature of the chemical.



Once again, do not expect to understand the material you are working with because you understand the hazard diamond. Use the safety data sheets and standard operating procedures.

10 – Storage of Chemicals

The storage of chemicals in an academic laboratory is regulated by OSHA and the EPA at both the state and federal levels. These rules require the storage of like classed compounds together. Additional information on storage can be found in section 7 of the SDS.

Solvents and Flammables
Peroxidable Substance

Oxidizing Agents
Acids and Bases
Health Hazards
Nonhazardous Materials

Remember to purchase and store the smallest amount of chemical possible.

All new bottles should be dated when opened.

Flammables

Must be stored in an approved cabinet, by the National Fire Prevention Association, which are double wall and metal. Vents in these cabinets should be connected to a fume hood or a proper ventilation system, otherwise plugged.

Peroxidables

Special attention must be paid to these substances as they form explosive peroxides with air. These peroxides can take the form of a crystal precipitate. If these crystals are observed leave the bottle in place and alert the chemical safety officer and SEM to have the bottle taken away.

Chemicals that are Peroxidable require regular testing. In the storeroom there are potassium iodide starch paper strips and Quantafix semi quantitative test strips. Use the starch strips first as they are very cheap and will give you a quick yes or no answer on the presence of a peroxide. If the strip darkens, peroxides are present. If peroxides are present use the Quantafix strips to better determine the concentration. These strips have a range up to 100 ppm.

It is highly recommended that you discard any container that reads as much as 10ppm but it is mandatory to discard anything that approaches 100ppm. Mark the dates of each test on the bottles with the results.

Here are some examples that you might come across in Aubert Hall and how often they should be tested.

After three months these should be tested for the presence of peroxides:

Diethyl ether	Dioxane
Cumene	Isopropyl ether
Vinylidene chloride	Sodium amide

After six months these should be tested:

Tetrahydrofuran	Furan
Cyclohexene	Cyclopentene

Methyl acetylene	Ethylene glycol dimethyl ether

Since most of these are solvents and flammable, a separate cabinet is suggested but separation with secondary containers is acceptable with the other flammables.

Oxidizers

Must be stored away from substances which undergo vigorous oxidation. Strong Oxidants include:

Perchloric acid	Sulfuric acid
Perchlorate salts	Nitric acid
Chlorate salts	Bromate salts
Hypochlorites (including bleach)	Liquid bromine
Perbromate salts	Persulfate salts

- Nitric acid and sulfuric acid should be stored away from everything in their own cabinet. Chromic acid may also be store here.
- Perchloric acid should never be used in Aubert Hall or anywhere else at the University of Maine. This chemical requires a purpose built hood and cannot safely be used with any other hood system.

Reducing agents should never be stored with oxidizing agents.

Acids and Bases

Acids and bases should be stored apart from one and other due their tendency to have very exothermic reactions.
They are also corrosive and should be stored apart for that reason alone.
Hydrofluoric acid is so corrosive and produces such severe burns that it is not recommended for teaching labs and must have a specific SOP associated with it.

Health Hazards

These are either acutely or chronically toxic compounds that need to be stored away from others.

Acute	Chronic
Sodium and potassium cyanide	Anilines
Ammonium molybdate	Thiocyanates

Nonhazardous

Nonhazardous materials pose minimal health risks to the user and thus can be stored under less stringent conditions.

Calcium chloride
Copper metal
Buffer solutions

Storage areas that are needed

1. Sulfuric and nitric acids. Chromic acid could also be stored here.
2. Corrosive acids
3. Corrosive bases
4. Flammables
5. General Storage permitting separation of hazardous materials.

Refrigerators and freezers that store chemicals must be labeled as such to prevent their use for food storage.

The best material for storage shelving is steel that has been coated with a chemical resistant paint.

You cannot safely work with chemicals if they are not safely stored according to their class. You must return the chemicals to their proper storage. You cannot leave chemicals in the fume hoods or bench tops.

It is strongly recommended that you eliminate unused materials from your inventory on a regular basis.

Containers

In general, the containers that chemicals arrive in from the manufacturer are adequate for reasonable periods of time. Secondary containment in cabinets is required for liquids and should provide enough volume to hold the contents of the primary container. Any bottle of 250 mL or more requires a secondary container. It is acceptable to store multiple bottles in the same secondary container provided there is sufficient volume to handle all the bottles should they break all at the same time.

Damaged containers should be disposed of immediately. Cracked, chipped, corroded, broken caps or anything else that compromises the integrity of the container is damage. This is a legal requirement.

Glass ampoules used should be used entirely or should be disposed of after the seal is broken. Never attempt to reseal.

Labels

All materials, either purchased or created must have a label. Without identification, safety cannot happen. Labels of newly acquired materials should never be defaced.

Additional information, such as its storage location, should not cover original information and should be protected from spills and fading. If needed chemical resistant labels can be procured from the storeroom.

Labels must show the names of the chemicals present, the date created and whose work is being described at a minimum.

Date all bottles when they are opened.

The color coding of hazardous materials into their storage classes is highly recommended. Example:

Red	Peroxidable
Yellow	Oxidizers
White	Acids and Bases
Blue	Health Hazards
Green	Nonhazardous

Compressed Gases

Storage of compressed gas cylinders requires special precautions because of the high pressures they contain. They must be protected from falling, rolling, pinching and the contents inside. If there is a sudden release of the gas, the cylinder will behave energetically and erratically like an unguided missile.

- Hazardous gases such as HCl, acetylene and vinyl gases much be treated as the corrosive, flammable or the reactive chemicals that they are. They should be stored separately from "non-hazardous" gases.
- Flashback arrestors are strongly recommended for flammable gases.
- Flammable gas tanks greater than 400ft^3 must be electrically grounded.
- "Non-Hazardous" gases such as N_2, He and Ar pose an asphyxiation hazard if a large amount of the gas is released in a quick period of time or if the work area has poor ventilation.
- All compressed gases have specific regulators. Be sure to use the correct regulator with the correct tank of gas.
- When not in use the tank should be stored with its protective cap screwed in place. Even while empty.
- Empty cylinders must be treated the same as full cylinders. They should be capped and secured to prevent damage that could cause problems for the next user.
- Only use a purpose built cylinder cart to move even empty gas cylinders. The risk of losing control of the cylinder and releasing the gas is too great.
- Never attempt to fill a gas cylinder.

Full size cylinders – Must be fastened to the wall or other immovable object like a lab bench or fume hood. The chain or strap should be about one third of the way down from the top of the cylinder. This location must be away from heat sources.
Lecture bottles – Must be in a purpose built rack or firmly clamped to a ring stand in an upright position. Never on its side or upside down.

Cryogens

These apply to liquefied gases and dry ice.

Tissue damage from frost bite or severe burns is the most common injury when working with cryogens.

Asphyxiation from the displacement of the breathable atmosphere is of greater concern with liquefied gases than with simple compressed gases. One liter of liquid nitrogen will expand to almost 700 liters of gas. A spill of 10 liters will create an environment in a room with less than $100m^3$ that would be difficult to maintain normal functions.

Atmospheric moisture can freeze with liquid helium around the relief vent which can lead to over pressurization of the Dewar if it is unable to properly vent.

Liquid helium can lead to oxygen enrichment. Oxygen and nitrogen in the atmosphere can condense as liquids when in the presence of liquid helium. The nitrogen evaporates more quickly than the oxygen causing small pockets of atmosphere with high concentrations of oxygen once it too has evaporated. Fires have been reported to have started this way.

Storage

- Storage vessels must be properly ventilated; pressure cannot be allowed to build up within the container.
- Only Dewars that were designed for the specific cryogen should be used.
- Liquid nitrogen and helium should be stored away from flammable materials and heat sources due to their ability to enrich oxygen.
- Never insert a hollow rod or tube into liquid gases. The liquid will quickly travel up the tube and create a kind of fountain.

Ventilation Requirements

In general, a room that gets one air exchange per hour is sufficient for normal use of asphyxiating gases. It is highly recommended to have six air exchanges per hour for chemical storage areas. Most of the rooms in Aubert Hall have adequate ventilation for the use of small of amounts of liquefied gases.

If you are unsure of the room you are working in or feel the ventilation has stopped working contact the Chemical Safety Officer and the department will work with Department of Facilities Management to address the problem.

The tables below offer a quick look at how the concentration of oxygen in a room can change when working with liquid nitrogen (LN).

The standard equation for calculating nitrogen gas concentrations is:
CN = L / VR * n
Where CN = increase in gas concentration after a long period L = gas release (m3 /hour);
VR = room volume (m^3); n = air changes/hour
1 liter of LN produces 683 liters of gas.
Atmospheric oxygen is 21%.

The tables below are borrowed from University College London

Room volume m3	Volume of liquid nitrogen, litres										
	10	25	50	75	100	150	200	250	300	400	500
15	20.0	20.0	20.0	20.0	20.0	19.9	19.9	19.9	19.9	19.8	19.7
25	20.4	20.4	20.4	20.4	20.4	20.4	20.3	20.3	20.3	20.3	20.2
50	20.7	20.7	20.7	20.7	20.7	20.7	20.7	20.7	20.7	20.6	20.6
75	20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.7	20.7
100	20.9	20.9	20.9	20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8

Table 1: The effect of topping off with 10 liters of LN + evaporation on oxygen concentration (%) assuming 1 air change per hour.

Room volume m3	Volume of liquid nitrogen spilled, litres						
	1	2	3	4	5	10	25
10	19.6	18.1	16.7	15.3	13.8	6.7	
25	20.4	19.9	19.3	18.7	18.1	15.3	
50	20.7	20.4	20.1	19.9	19.6	18.1	
75	20.8	20.6	20.4	20.2	20.0	19.1	16.2
100	20.9	20.7	20.6	20.4	20.3	19.6	17.4

Table 2: Effect of LN spillage on oxygen concentration (%).

11-Chemical Inventories

Each teaching and research laboratory will keep a complete inventory of every chemical in its control. This inventory is required for regulatory purposes by the State of Maine and the Environmental

Protection Agency. Every year these inventories have to be given to SEM where they are combined with information from the Chemicals of Interest list. This list is given to the department each year by SEM and is a compilation of chemicals that the state and federal governments are interested in for a variety of reasons. This list does require that we give a good faith estimate of the amount of each chemical used, if any.

Every chemical in the laboratory must be recorded except the following:

Waste
Food, drugs, tobacco or cosmetics intended for personal consumption.
Consumer products used in household quantities.
Wood and wood products that do not result in exposure to hazardous chemicals or dust.
Nonhazardous buffers or growth media.
Mixtures of chemicals that contain less than 1% by weight of hazardous chemicals or less that 0.1% of carcinogens.

12 – Disposal of Chemicals

The disposal of chemicals is highly regulated by the EPA and OSHA, this information can be found in sections 12 and 13 of the SDS. Thus most chemicals will be collected by SEM and will have to comply with the conditions below.

Substances that can be disposed into the Sewer System.

Acids and Bases – Mineral Acids and Bases may be neutralized and flushed down to the sewer.
•Prepare a dilute aqueous solution by adding the acid to the water in a wide mouth flask or beaker.
•Similarly prepare a dilute solution of sodium hydroxide for waste acids and hydrochloric acid for waste bases. Keep the solutions cool in ice baths.
•Neutralize to pH 6.6 – 7.4 while stirring well.
•Wash the solution down the drain with copious amounts of water.

Inorganic Compounds maybe dissolved in water and disposed of into the sewer if they do NOT contain heavy metals or toxic anions.
•Lithium, Sodium or Calcium salts may be flushed.
•Chlorides, Carbonates and Sulfates salts may be flushed.
•Copper, Tin and Silver salts may NOT be flushed.
•Fluorides, Cyanides and Sulfides salts may NOT be flushed.
•Phosphate salts should not be flushed.

Waste Accumulation

Other than the chemicals described above, all waste, unused and research-generated chemicals must be disposed of by having SEM collect the material.

To do this a Chemical Hazardous (Spent Waste) Determination Form (https://mycampus.maine.edu/group/mycampus/sm-documents) will be needed to first assess the dangers and waste stream needs of your waste. This form can then be used as the waste pickup form to be emailed to UMHazwaste@maine.edu. Instructions on how to fill out the form can be found with the form itself. SEM will send someone out to collect the waste containers.

The areas within the laboratory where waste is temporarily stored is called a Satellite Hazardous Waste Accumulation Area. There is no centralized waste collection in the department.

- Incompatible materials must be stored separately from each other.
- Label the container as Hazardous Waste with the standard yellow label. Sub labeling with more specific information about the contents should be done to prevent mixing incompatible chemicals. Date the container when the waste stream begins.

- The name on the label should be that of the person who started the waste and the address on the label should be that of the lab space where it was created.
- The waste may not be transported from where it was generated.
- Do not fill containers more than 80% to prevent overflows and enable easier disposal by persons after collection.
- Containers must be kept closed unless there is the potential to generate gas and build pressure.
- Each site must be inspected each working day by a designated person.
- If a fume hood is used for waste storage it cannot be used for anything else.
- Waste must be contained within secondary containers such that it cannot reach the floor or sink drain.

•Once the waste container is deemed full or no other contents will be added, SEM must be contacted quickly to come and collect the waste. Once the request has been sent SEM has 72 hours to remove it. Date the container when it is deemed full.
•If there is a problem with the waste being collected contact the Chemical Safety Officer.

SAA Inspection Logs

The satellite accumulation area must be inspected by a member of the laboratory every week and recorded on the log sheet. Log sheets can be found at https://mycampus.maine.edu/group/mycampus/sm-documents.
At the end of every month the log sheet must be scanned and sent to umhazwaste@maine.edu and the original must be kept near the SAA for at least one year.

UNKNOWNS

•Present a problem as all compounds must have an SDS associated with it.
•Disposal of unknown items can be done by SEM but it is strongly discouraged. The cost is much higher for these compounds.

Nonhazardous waste can be disposed of in the normal garbage collection but should be labeled as "Nonhazardous Waste" to prevent any confusion and eliminate any concerns from the custodial staff.

13 - Prudent Practices

These are rules not suggestions.

Absolutely no food or drink in the laboratory at any time, unless the food items are part of the experimental design in which case the food must be labeled "Not For Human Consumption."

Absolutely no smoking in any part of Aubert Hall or on campus.

Hands should be washed after every experiment.

Treat all research generated samples as if they are hazardous until you know otherwise.

Maintain a clean and well organized work space with easy access to safety equipment.

Reference the SDS and SOP of the chemicals you are working with before you begin.

Regularly inspect chemical and waste storage areas.

Have waste collected frequently.

All spills must be cleaned immediately regardless of the hazardous nature of the compounds.

Keep aisles and doorways clear of any impediments.

No electrical cords or tubing should cross any aisles and extension cords should not be used.

Avoid working alone in the laboratory, use the buddy system and check in on each other. Undergraduates CANNOT work alone in the lab under any circumstances.

If you have to leave an experiment unattended a label should indicate its nature.

14 – Additional Information

The information contained in this chemical hygiene plan cannot cover all the potential hazards that you will come across in the laboratory. More information can be found at:

UM Safety and Environmental Management: https://sem.umaine.edu/
- Security in an Academic Environment: http://sem.umaine.edu/files/2018/02/Security-in-an-Academic-Environment-Policy.pdf
- Guide for Peroxide Forming Chemicals: http://sem.umaine.edu/files/2014/10/Reactive-and-Peroxide-Forming-Chemicals.pdf

UM Department of Chemistry: https://umaine.edu/chemistry/safety/

OSHA Lab Standard: https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=10106
- Hazard Communication: https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=10099

American Chemical Society: https://www.acs.org/content/acs/en.html
- Safety Zone Blog: http://cenblog.org/the-safety-zone/

Never be afraid to consult with your Principle Investigator or senior members of your laboratory. Communication between all the members of the laboratory is crucial for everyone's safety and workplace efficiency.

15 - Laboratory Specific Additions

16 - Training Record

Printed Name	Signature	Date