Bates College Chemical Hygiene Plan (CHP)

Chemical Hygiene Plan

1.0 INTRODUCTION

1.1 Purpose

Bates College has created this Chemical Hygiene Plan (CHP) as guidance to faculty, staff and students who work with hazardous chemicals in laboratories. This plan complies with the requirements laid forth in 29 CFR 1910.1450, frequently referred to as the OSHA "laboratory standard." The plan is intended to outline a program to protect the health and safety of laboratory workers.

1.2 Reference Documents

- Prudent Practices in the Laboratory; The National Academies Press: Washington DC, 2011.
- OSHA, Occupational Exposure to Hazardous Chemicals in Laboratories, 29 CFR 1910.1450.

1.3 Contacts

Department/Title	Name	Location	When to Call	Phone Numbers
Campus Safety	Dispatch	245 College St. Lewiston, ME 04240	Emergency	207-786-6111
			Non-Emergency	207-786-6254
EHS Coordinator	Wade Behnke	5 Andrews Rd Lewiston, ME 04240	Emergency	207-705-1907
			Non-Emergency	207-786-8226
Chemical Hygiene Officer	Jonathan Witt jwitt@bates.edu	45 Campus Ave. Lewiston, ME 04240	Emergency	207-756-5485
			Non-emergency	207-786-6294
Lewiston Fire Department	Dispatch	2 College St. Lewiston, ME 02420	Emergency	911
			Non-Emergency	207-784-5713

1.4 Scope

The program and standards laid out in this document apply to all Bates College faculty, staff, students and student employees working in laboratories with hazardous chemicals. This includes both teaching laboratories and research laboratories. The primary locations where these laboratories are currently operating on campus are Carnegie Science Hall, Bonney Science Center and Dana Hall, though other locations may be subject to the plan as well.

1.5 Definitions

Chemical Hygiene Plan (CHP) - a written program developed and implemented by the employer which sets forth procedures, equipment, personal protective equipment and work practices that are capable of protecting employees from the health hazards presented by hazardous chemicals used in that particular workplace.

Chemical Hygiene Officer (CHO) - an employee who is designated by the employer, and who is qualified by training or experience, to provide technical guidance in the development and implementation of the provisions of the Chemical Hygiene Plan.

OSHA Laboratory Standard - The Occupational Exposure to Hazardous Chemicals in Laboratories standard (29 CFR 1910.1450), commonly referred to as the Laboratory Standard, requires that the employer designate a Chemical Hygiene Officer (CHO) and have a written Chemical Hygiene Plan (CHP), and actively verify that it remains effective.

Globally Harmonized Standard (GHS) - The GHS includes criteria for the classification of health, physical and environmental chemical hazards, as well as specifying what information should be included on labels of hazardous chemicals as well as safety data sheets.

Safety Data Sheets (SDS) – Documents provided by a chemical supplier that detail hazards, safety precautions, chemical components, regulatory information, toxicology, disposal standards and other information pertaining to a particular product.

Personal Protective Equipment (PPE) – Clothing, gloves, eyewear or other equipment worn by an individual to provide a protective physical barrier against chemical exposure.

Secondary/Workplace Containers – Containers other than original manufacturer containers used to store pure chemicals, mixtures, or solutions.

Particularly Hazardous Substances (PHS) – Substances whose characteristics necessitate a high level of control. PHS are classified as either a select carcinogen, reproductive toxin or as having a high degree of acute toxicity.

Hazardous Waste – Waste chemicals that are either specifically mentioned in the P, U, F or K EPA lists, or that qualify as ignitable, corrosive, reactive, or toxic.

Main Accumulation Areas (MAA) – The central storage area for hazardous waste. There are currently four MAAs on campus. They are located in Bonney Science Center, Carnegie Science, Dana Hall and Cutten.

Satellite Accumulation Areas (SAA) – Collection points for hazardous waste that are located in the same room where the waste is being generated.

2.0 RESPONSIBILITIES

In order for the chemical hygiene plan to make a meaningful impact on chemical safety at the college, many people will need to actively participate. Below is a list of roles and responsibilities for those affected by the plan.

Dean of Faculty/Senior Leadership shall:

- Be responsible for the approval of all campus policies, including those described in the Chemical Hygiene Plan (CHP).
- Support the enforcement of the policies outlined in this document.
- Inform Environmental, Health and Safety (EHS) and the CHO when new faculty who will be subject to this plan are hired.
- Inform EHS and the CHO when faculty will be leaving the college.
- Actively participate with EHS/CHO and others to create and reinforce a positive safety culture in college laboratories.

Chemical Hygiene Officer (CHO) shall:

- Be the primary agent of the college that is responsible for the development, maintenance and implementation of the Chemical Hygiene Plan (CHP).
- Be the primary contact for academic laboratory safety matters.

- Maintain a barcoded inventory of chemicals as well as a library of Safety Data Sheets (SDS).
- Establish policies for Hazardous Waste generated in laboratories in concert with EHS.
- Provide hazardous waste training annually for employees who handle laboratory hazardous waste.
- Provide basic laboratory safety training to students, staff and faculty before they initially work in Bates College laboratories and at least annually for all existing personnel.
- Support the efforts of the EHS department.

Environmental Health and Safety Director shall:

- Have ultimate authority and responsibility on issues of regulatory compliance.
- Provide backup and support for the CHO.
- Be responsible for assessing chemical exposures in the workplace.
- Work with the CHO to approve SOPs for the use of chemicals with high levels of hazard, such as acute toxins and other Particularly Hazardous Substances.

Lab Safety Committee shall:

- Meet at least annually.
- Review any accident, spill or near miss incidents.
- Discuss laboratory safety issues and make suggestions to the CHO and EHS concerning potential improvements to the lab safety program.

Laboratory Supervisors/Principle Investigators shall:

- Have ultimate responsibility for the health and safety of the people working in their laboratories.
- Ensure compliance with all safety measures in this plan.
- Adopt SOPs for hazardous chemicals or processes. The general SOPs included in this plan may be used. A lab specific SOP should be developed if a lab is using a chemical or process of particular unique concern
- Ensure students have sufficient knowledge and safety training before allowing them to work in the laboratory.
- Follow institutional guidelines on the accumulation of hazardous chemical waste.
- Provide adequate personal protective equipment as described in the CHP.
- Actively support a positive safety culture in academic and teaching labs.

Laboratory Employees and Students shall:

- Review and comply with the safety measures in this plan, chemical SOPs, as well as any lab/process specific measures adopted in their lab.
- Undergo safety training by the CHO and document this by their signature.
- Actively support and participate in a positive safety culture.

Facilities Services Personnel shall:

- Be trained by the EHS director concerning relevant aspects of the CHP. In particular they should be able to recognize an unsafe situation and also know the limits of their responsibilities in teaching and research labs.

3.0 CHEMICAL HAZARD IDENTIFICATION

Several systems exist that identify chemical hazards. The most widely used standard is the Globally Harmonized Standard. The United Nations established the GHS to standardize hazard communication. More recently the OSHA Hazard Communication Standard has been changed to be compatible with the GHS. Therefore, a single unified standard exists that encompasses visual and written descriptions of chemical hazards. This is the system that is used in Safety Data Sheets.

3.1 Safety Data Sheets (SDS)

Safety Data Sheets (SDS) are documents provided by a chemical manufacturer or vendor that describe the hazards associated with a particular substance. SDS follow a set format adopted with the Globally Harmonized Standard. SDS contain important information such as health and physical hazards, composition, reactivity and toxicity. These documents are intended to provide hazard identification and awareness for laboratory workers or first responders to a chemical involved incident.

There are a number of ways that you can access an SDS. They can normally be obtained on a vendor's website. This is often the most convenient way to access an SDS. SDS for chemicals in our inventory can also be accessed using our chemical inventory software Chemwatch. Any person with a Bates login can access the SDS in Chemwatch. This includes students, staff and faculty. Instructions on how to access the SDS in the Chemwatch system can be found in the chemical safety section of the Science Resources and Support Services page on the Bates website.

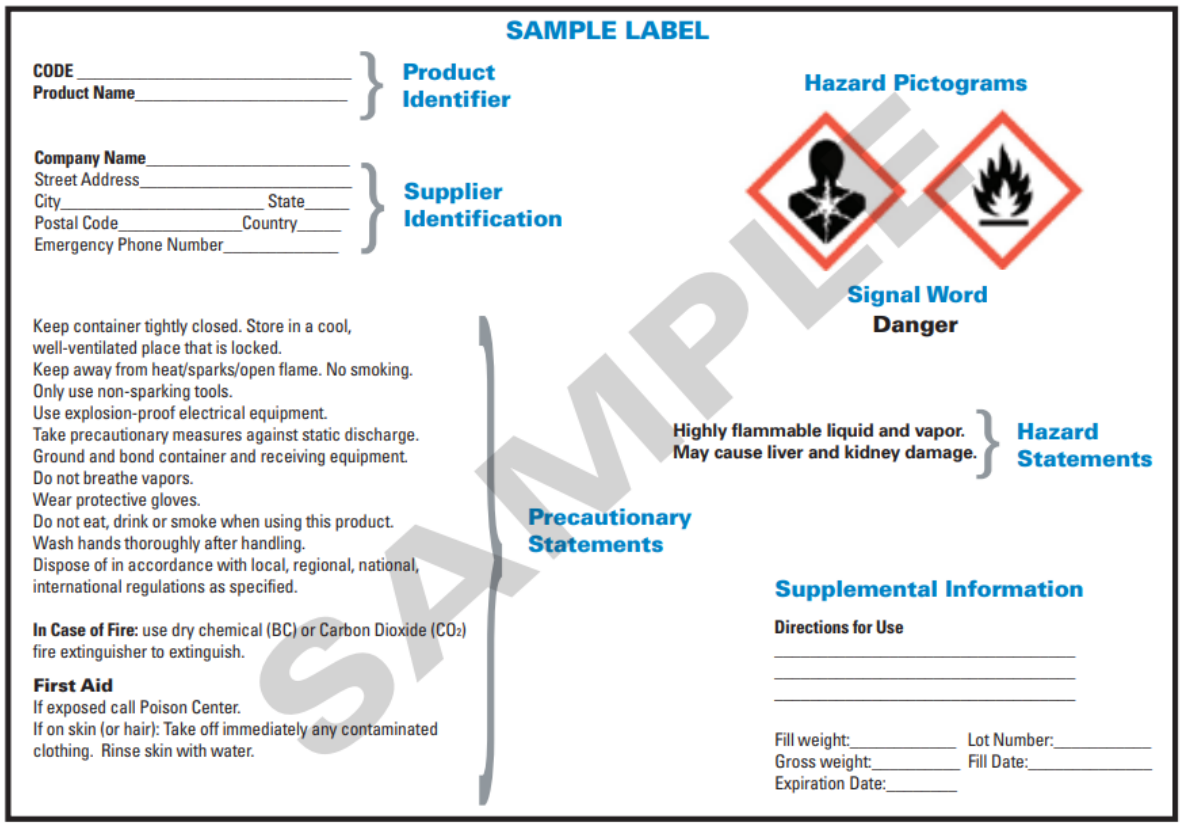
3.2 Chemical Container Labels

3.2.1 Primary Chemical Containers

Primary chemical containers are the original containers from the manufacturer. Any chemical container that is purchased from a chemical vendor is required to have a label that contains the following information:

- Product identifier (CAS Number/Name)
- Signal Word
- Hazard Statements
- Pictograms
- Precautionary Statements
- Information about the manufacturer

The following is an OSHA example of a label that meets the unified GHS/Hazard Communication Standard.



3.2.2 Secondary Chemical Containers

Secondary or “workplace” containers are chemical containers that are created in the laboratory. There is more flexibility concerning how these containers need to be labeled. The label does not have to follow GHS standards for original chemical containers. It can consist of the chemical name and words, pictures or symbols that effectively communicate the chemical hazards.

Bates has adopted the following label for use on all secondary containers. It is consistent with the GHS system of classification and uses pictograms to represent hazards. The relevant pictograms for a particular chemical can be found on the chemical’s safety data sheet.

The full chemical name, concentration if applicable, date of container creation, and name of the person who created the container should be listed. Chemical formulas or abbreviations should be avoided whenever possible. Hazards that do not apply should be defaced by sharpie or other pen.

Blank Label

Filled in Label Example

3.2.3 Immediate Use Containers

Containers that are used during one lab session and are under the control of the individual who made them, may be simply labeled with the name and concentration of the chemical.

3.2.4 Novel Chemical Samples

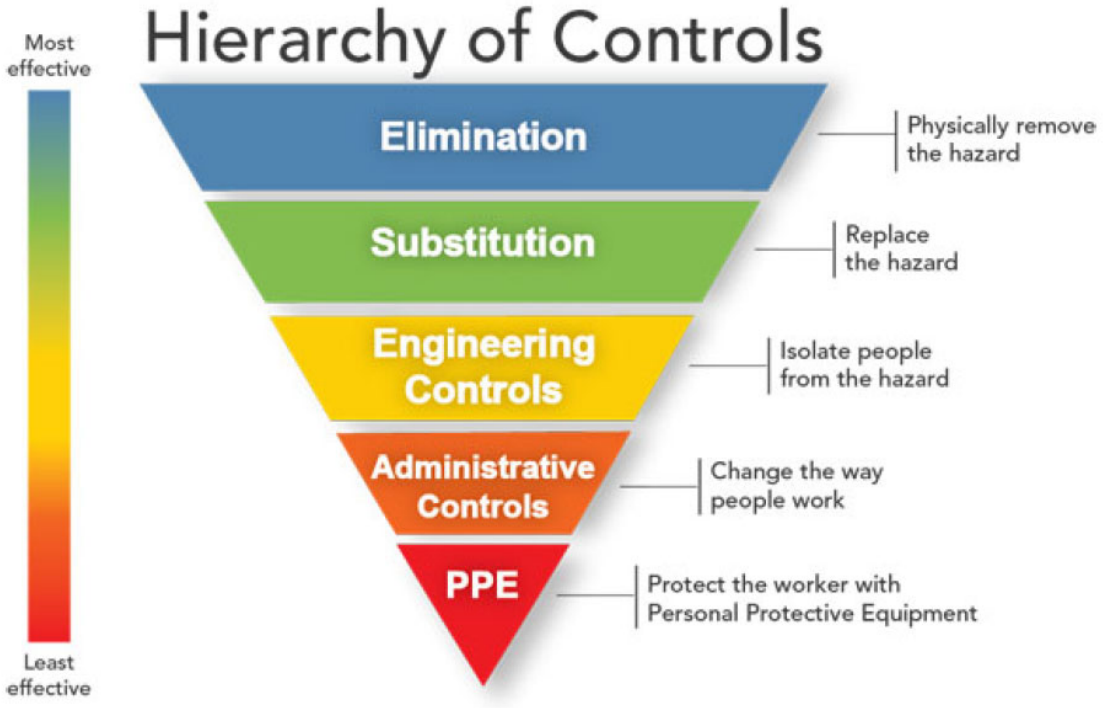
Substances that are synthesized in the laboratory should be labeled in the same manner as secondary containers when possible. If this is not possible due to the size of the container or other practical limitation, containers may be labeled with a notebook page. The notebook must be readily accessible in the lab.

3.3 Door Signs

Door signs are a way to communicate the hazards in a particular lab. Each teaching or research lab should have a door card that specifies chemical, biohazard and radiation hazards. These cards also indicate the level of PPE that is required in a particular lab. Emergency contact info should also be found on this card. If there are Particularly Hazardous Substances (PHS) in the lab, this will be stated on the door card. More information about PHS can be found in section 5.0.

4.0 LAB SAFETY POLICIES

The strategy to ensure that laboratory personnel are safe depends on the adoption of controls. Controls can be organized in a hierarchy, as they don't all provide the same level of protection. Some controls are completely effective while others are less effective. Those who are in charge of laboratories should consider each of these control measures for the processes that are a part of their lab work.



4.1 Elimination or Substitution

The most effective control measures are elimination and substitution because they completely remove the hazard. If there is another less harmful chemical or process that can achieve the same experimental result, then it should be used. In teaching labs or demonstrations, the least hazardous possible chemicals and processes should be used. If the same principle can be taught with multiple experiments, the least hazardous should be selected. Some examples of this type of control are:

- Replacement of mercury thermometers with alcohol thermometers.
- Substitution of Carosafe or other preservative in place of formalin for the storage of animal specimens.
- Use of precast polyacrylamide gels.

4.2 Engineering Controls

Engineering controls are designed to mitigate chemical hazards in the workplace before the worker can come in contact with them. These controls are lower on the hierarchy because elimination and substitution completely preclude the possibility of exposure or incident.

4.2.1 Fume Hoods

Chemical fume hoods are the most important type of engineering control for fumes, hazardous gases, dusts and aerosols. If there is a risk of chemical exposure by inhalation, a fume hood should be used. General rules for using a fume hood are:

- When working in a chemical fume hood, the sash should be kept as low as is practical. If using a horizontal sash, the opening should be kept as narrow as possible. This will maximize the efficiency of the fume hood.
- Chemicals should be kept at least 6 inches from the front of the hood. This is the minimum distance required to ensure no fumes will escape.
- Close and open the sash slowly. If the sash is opened too quickly, the motion can create turbulence that will interfere with the efficacy of the fume hood.
- Keep the fume hood clean and uncluttered.
- Keep the sash closed when the fume hood is not in use.
- If performing a reaction that requires cooling with water, make sure that the tubing is attached to the glass with copper wire. The flow of water should be as slow as possible to prevent the tubing from becoming detached.

4.2.2 Snorkel Exhaust

Snorkel exhausts provide ventilation for small point sources of fumes or other harmful substances. They are particularly useful for capturing contaminants in circumstances in which a fume hood cannot be used. For example, they can be used to capture fumes from a large piece of equipment that cannot be kept in a fume hood. In order to be effective, the snorkel must be within approximately 2 inches of the fume source.

4.3 Administrative Controls

4.3.1 General Lab Safety Policies

- Students must be trained by the supervising PI or AI before performing a particular procedure involving hazardous materials.
- Students should not work with hazardous chemicals alone. At a minimum, there must be someone else working on the same floor.
- If the PI or AI is not present, they must be aware of the work being performed by a student.

- Students may never perform experiments that are not explicitly approved by the supervising PI or AI.
- The standard operating procedures included in this plan must be followed.
- Food, drink, smoking and vaping are never allowed in the laboratory.
- Headphones and ear buds are not permitted when lab workers are handling hazardous chemicals.
- Lab workers must wear pants, closed toe shoes, and long-sleeved shirts when working with hazardous chemicals.
- Lab workers must know the location of safety equipment such as eye washes, chemical showers and spill kits. They must be instructed by the PI or AI on the use of this equipment.

4.3.2 Lab Cleanliness

- Do not obstruct access to exits or to safety equipment (spill kits, fire extinguishers etc.)
- Bench tops and hood areas should be free of clutter.
- Glassware should be washed promptly.
- Chemicals should be stored in an organized fashion, with the labels turned outwards so that they are visible.
- Bags, coats and other personal items should be stored outside of the lab.
- Secondary (non-vendor) containers need to be properly labeled. Please see section 3.2 for more detailed requirements.
- Keep containers away from the edge of the bench to reduce the possibility of an accident.
- There should be no visible chemical residue on any surface including bench tops, fume hoods and lab balances.

4.3.3 Purchasing Chemicals

One basic way to improve chemical safety is to control the chemicals we purchase. Before a chemical is purchased, the purchaser should review the following:

- Is the chemical already in stock somewhere on campus? If so, an effort should be made to borrow the chemical before ordering a new container.
- What is the minimum amount needed for the experiment? Chemicals should be ordered in the smallest practical quantities.

- Can the chemical be ordered in a less hazardous form (i.e. 6M HCl vs. concentrated HCl)?
- Is this chemical highly hazardous? If it is, the relevant chemical SOP should be adopted by the lab. Highly hazardous chemicals include acute toxins, carcinogens etc.

4.3.4 Receiving Chemicals

The following guidelines apply to chemicals that are received on campus.

- All chemical orders should be shipped directly to Bonney Science Center.
- Chemicals should not be delivered to Post and Print whenever possible.
- The CHO will add the chemical container to the Chemwatch chemical inventory and generate a barcode for each item. A vendor specific SDS should be linked to the container record.
- Kits, enzymes, or small chemical containers (e.g. 0.25 mL ampules) are not barcoded for practical reasons.

4.3.5 Relocating Chemicals

If a chemical container is moved out of a central storage area, this should be noted in the log book. There is a log book for each of the central storage areas. A note should be made when the chemical is returned. If a chemical if permanently removed this should be noted in the log.

4.3.6 General Chemical Storage Guidelines

- Whenever possible, sturdy shelves with a solid surface and a lip should be used.
- Chemicals should not be stored above eye level whenever possible.
- Heavier items or larger liquid containers should be stored closer to the ground.
- Chemicals can be organized alphabetically, but only if incompatible chemicals are stored separately.
- Containers should be inspected regularly. If a container is compromised (rusting, dented, bulging etc), the chemical should be disposed of as hazardous waste.
- Chemicals should not be left out for extended periods in hoods or on the benchtop.
- Chemicals should be returned to storage after each laboratory session. This decreases the likelihood of a spill.

4.3.7 Storage Groups

Chemicals should be sorted into storage groups, according to their chemical compatibility. Each chemical group should ideally be stored in a separate cabinet. If this is not possible, chemicals from different storage groups should be stored in separate secondary containers.[1]

Code	Storage Groups	Examples
A	Compatible Organic Bases	BIS TRIS, Diethylamine, Imidazole, Triethanolamine
B	Compatible Pyrophoric and Water Reactive Materials	Tert-Butyllithium, Sodium Borohydride,
C	Compatible Inorganic Bases	Sodium Hydroxide, Ammonium Hydroxide
D	Compatible Organic Acids	Acetic Acid , Maleic Acid
E	Compatible Oxidizers including Peroxides	Hydrogen peroxide, Permanganates, Halogens
F	Compatible Inorganic Acids not including Oxidizers or Combustibles	Phosphoric Acid, Hydrochloric Acid, Sulfuric Acid
G	Not Intrinsically Reactive or Flammable or Combustible	Acrylamide, Sodium Bisulfate, Coomassie Blue, Sugars, Dyes, Buffers, Dilute Aqueous Solutions, Amino Acids
I	Compatible Strong, Oxidizing Acids	Chloric acid, Chromic acid, Nitric acid, Perchloric acid, Selenic acid, Nitrosulfuric acid
J	Poison Compressed Gases	Ethylene Oxide, Hexafluoropropylene, Sulfur Dioxide, Trifluoromethyl Iodide
K	Compatible Explosive or other highly unstable materials	Picric Acid Dry, Tetrazole, Ammonium Permanganate
L	Non-Reactive Flammables and Combustibles, including solvents	Hydrocarbons (saturated and unsaturated), Alcohols, Ketones, Aldehydes, Benzene, Toluene, Methanol, 1-Butanol, 1-Propanol, Acetic Anhydride , Acrolein, Formamide, Sigmacote

4.3.7.1 Acid Storage (group D, F, I)

- Acids must be separated from bases in general.
- Group D organic acids should be stored away from oxidizing acids. Organic acids may be stored with flammables.
- Group F Non-oxidizing inorganic acids.
- Group I Oxidizing acids must be separated from organic acids (e.g. acetic acid, ethanoic acid) and flammable materials. These acids should be stored in their own cabinet whenever possible.

4.3.7.2 Base Storage (group A, C)

- Bases should be stored in corrosives cabinets whenever possible.
- Inorganic bases and organic bases should be stored separately.

[1] https://ehs.weill.cornell.edu/sites/default/files/chemstorage.pdf

4.3.7.3 Flammable and Combustible Storage (group L)

- Whenever possible, flammable materials should be stored in a vented flammable cabinet (underneath a hood or in a free-standing flammable cabinet).
- Keep flammable substances away from ignition sources at all times.
- Flammable materials should never be stored in a commercial refrigerator or freezer. Commercial refrigerators and freezers have many internal ignition sources. A flammable-proof or explosion-proof refrigerator should be used. Flammable-proof refrigerators have no internal ignition sources. This is sufficient for all of the spaces on campus. An explosion-proof refrigerator also has no ignition sources on the outside of the unit. This type of refrigerator would be used in the context of a workplace where high concentrations of flammable gas are in the same space as the refrigerator.
- Flammable chemicals should be stored separately from oxidizing chemicals.

4.3.7.4 Pyrophoric and Water-Reactive Storage (Group B)

- Water-reactive chemicals should be stored in water tight cans away from any possible contact with water (under sinks, exposed to sprinklers).
- Pyrophoric compounds must be stored in air tight containers under inert gas in a cool, dark and dry area.
- These compounds should be stored away from flammable and combustible materials.

4.3.7.5 Compatible Oxidizers Including Peroxides (Group E)

- This category includes nitrates, chromates, permanganates, inorganic peroxides.
- Must be stored away from flammables, reducing agents.

4.3.7.6 Poison Compressed Gases (Group J)

- Poison gases are not compatible with any other group. Poison gases require careful handling. If a lab needs to use a poison gas, a full chemical SOP should be developed and approved by the CHO and EHS.

4.3.7.7 Compatible Explosive or other highly unstable compounds (Group K)

- Explosives are not compatible with any other group. Special considerations and procedures may be necessary. Contact the CHO and EHS before working with explosive

or unstable materials.

4.3.8 Moving Chemicals

The following practices should be observed when moving hazardous chemicals. Similar protocols apply to transporting chemicals within a lab or building and transferring them between buildings.

- Anyone who transports chemicals must be familiar with the hazards of the substances they are moving. They also must know what to do in the event of a spill.
- Secondary containment is mandatory. For a single 1 liter or 4 liter bottle, an appropriately sized bottle carrier can be used. If more than one container is being transported, a cart and plastic bin should be used. The cart must have a 2 inch solid lip.
- Gloves should never be used when transporting chemicals. This is the case even if your gloves are clean.
- The route should be planned ahead of time, considering any obstacles. Chemicals should be moved when there will be the least number of people in the hallways (during classes).
- Elevators should always be used for transporting chemicals.
- Gas cylinders must be moved using an appropriate hand cart designed for moving cylinders and which features a chain for securing the cylinder. Before moving a gas cylinder, whether or not it is empty, remove the regulator and replace it with a cylinder cap.

4.3.9 Peroxide Forming Chemicals

Some organic chemicals can generate hazardous explosive organic peroxides over a period of being exposed to oxygen. An SOP for the use of peroxide forming chemicals can be found in Appendix G.

4.4 Personal Protective Equipment

4.4.1 Eye Protection

Some form of eye protection is mandatory while working with or around hazardous chemicals.

If chemicals are being used in a lab space, all individuals in that lab space must wear eye protection. Safety glasses or goggles conforming to the ANSI Z87.1 standard should be used. Safety goggles should be worn when there is a risk of splashing chemicals or explosion because they provide a higher level of protection.

4.4.2 Gloves

Gloves should always be worn in the laboratory. They are intended to provide a layer of protection between chemicals and the hand. However, typical gloves used on a daily basis in Bates' chemistry labs are not designed to protect the user during continuous exposure. They are intended to be used to briefly protect the hand in case of accidental contact.

Gloves come in many different styles and thicknesses. Each type works well depending upon the situation and chemicals being used. However, no glove material provides ideal protection against all chemicals. The two common types of gloves used in Bates chemical laboratories are:

- Nitrile gloves (at least 4 mils thick) are the most frequently used gloves at Bates. They provide some degree of protection against organic chemicals. These are appropriate for day-to-day experiments using organic or inorganic chemicals. Though they offer better protection than latex gloves to organic chemicals, many solvents will permeate the glove within seconds. Gloves only buy time.
- Latex gloves provide good protection when working with aqueous chemicals. They are less resistant to organic chemicals than nitrile gloves. Latex gloves are known to cause sometimes serious allergic reactions. Laboratory workers with known latex allergies should never use latex gloves.

Prolonged exposure to chemicals (for example when using an acid bath) requires different gloves. Contact the CHO for more information about glove options.

4.4.3 Lab Coats

Lab coats are strongly recommended in all chemical laboratories at Bates. All chemistry and biochemistry teaching labs require the use of 100% cotton lab coats.

In the research lab context, some principal investigators may choose to not require lab coats. From the perspective of this plan and best practice, lab coats are strongly recommended in any lab where chemicals are handled.

It is important that the lab coat material is compatible with the work being performed. Many lab coats are made out of cotton or polycotton blends. These offer fair protection against chemical contact or splashes, providing another barrier between the hazard and the skin. However, they can be flammable. Polyester/cotton lab coats are known to be especially flammable. If an experiment requires the use of large amounts of flammable solvent or use of pyrophoric agents, a flame-resistant lab coat should be used.

4.5 Exposure Monitoring

4.5.1 Air Monitoring for Most Chemicals

In a research laboratory equipped with fume hoods, it is relatively rare for workers to be exposed to chemicals at a level that is problematic in terms of federal regulation. However, OSHA maintains a list of Permissible Exposure Limits (PEL) for a large number of chemicals. If the PI feels that lab workers could be exposed to a chemical with a low PEL value, additional monitoring should be put in place before the work begins.

4.5.2 Methylene Chloride Air Monitoring

Air monitoring is now required for methylene chloride (dichloromethane) use, even in the context of a research laboratory. Initial monitoring was performed in March 2025. The results of this monitoring indicate that the levels present in the lab are below the threshold required by the EPA. A Standard Operating Procedure (SOP) that was used during this testing can be found in Appendix G.

5.0 PARTICULARLY HAZARDOUS SUBSTANCES (PHS)

Certain substances are considered to be particularly hazardous and therefore require more rigorous control measures. There are three types of chemical that fall in this category. A PHS is classified as either a “select carcinogen”, “reproductive toxin”, or a substance with a “high degree of acute toxicity.” If any of these substances are being used in a lab, a “designated area” where this substance will be used must be specified. Chemical SOPs have been developed for each type of PHS (see Appendix G).

5.1 Select Carcinogens

Select carcinogens are found in the following lists:

- OSHA list of regulated carcinogenic chemicals (29 CFR 1910 Subpart Z).
- List of substances "known to be a carcinogen" in the National Toxicology Program *Report on Carcinogens*. Chemicals that are on the "reasonably anticipated to be carcinogen" list may be considered select carcinogens if statistically significant tumor incidence has occurred in animal models.
- International Agency for Research on Cancer (IARC) Group 1 carcinogens. Group 2A or 2B carcinogens may also be considered select carcinogens if statistically significant tumor incidence has occurred in animal models.

Select carcinogens can usually be identified by the hazard identifications on a Safety Data Sheet (SDS). Section 2 of the SDS typically includes either H350: May Cause Cancer, or H351: Suspected of Causing Cancer.

5.2 Reproductive Toxins

Reproductive toxins are substances that affect reproductive capabilities. Specifically, they are chemicals that create chromosomal abnormalities, or teratogens which cause the malformation of fetuses. Unlike select carcinogens, there is no consistent standard for what chemicals qualify as reproductive toxins. Chemicals that are known or suspected of being reproductive toxins include lead, ethylene glycol ethers, carbon disulfide, and ethylene oxide.

5.3 High Degree of Acute Toxicity

Like reproductive toxins, there is no set definition of what constitutes a substance with high acute toxicity. A standard that is sometimes employed is based upon the median lethal dose (LD_{50}) of a substance. A substance with an $LD_{50} < 50$ mg is typically considered to have high acute toxicity. At Bates we adopt this definition of acutely toxic chemicals.

5.4 Designated Areas

PHS must be stored and used in a designated area. A designated area could be a fume hood, lab bench or an entire lab. In most cases at Bates, an entire lab will be the designated area. Any area designated for use of a particularly hazardous substance requires the following:

- The area must be locked at all times. This could be in a locked cabinet or in a lab that is locked.

- A sign must be posted indicating that PHS are stored and used in this space. The CHO can provide such a sign. At a minimum it should be noted on the lab door card that PHS are present.
- Detection/monitoring equipment may be required in laboratories where highly toxic chemicals (especially poisonous gases) are used. If uncertain, contact the CHO/EHS.

5.5 Containment Devices (Fume Hoods)

When working with particularly hazardous substances in fume hoods:

- PHS must always be used in a functioning fume hood.
- Exhaust air from fume hoods in which work is performed with carcinogens, reproductive toxins and acutely toxic chemicals may require filtration before release to the atmosphere. OSHA Permissible Exposure Limits or other regulatory standards may not be exceeded.
- Compressed gas cylinders containing acutely toxic chemicals are highly dangerous and must be handled with extreme care. Use of such chemicals must be explicitly approved by EH&S. A safe method of storage, such as within a specially designed vented cabinet, must be adopted.

5.6 Standard Operating Procedures (SOPs)

Standard operating procedures (SOPs) have been developed for each category of PHS (Appendix G). Labs using these chemicals should adopt these procedures.

Some chemicals may be so hazardous and present such unique hazards that a specific SOP must be developed for safe use. It is the responsibility of the professor and the CHO and EHS to determine whether an SOP must be developed for a particular chemical. Chemicals that may necessitate a unique SOP include, but are not limited to, poison or corrosive gas, explosives and other highly reactive chemicals.

6.0 EMERGENCY PROCEDURES

6.1 Chemical Spills

The correct response to a spill depends upon the nature of the chemical and the size of the spill. Small chemical spills can often be managed by the personnel in the lab, while larger spills may require outside assistance.

What constitutes a large or small spill depends upon the chemical. A 4 liter spill of dilute acid may present less of a hazard, and be less difficult to clean up, than a 10 gram spill of an acute toxin. Each spill needs to be evaluated by the PI or AI that is in charge of the space.

If a significant spill occurs, all personnel should leave the lab and close the door. Solvent fumes or fumes from corrosive or toxic substances present a significant hazard.

6.1.1 Small Chemical Spills

Small chemical spills can sometimes be managed by lab personnel. Each space that contains chemicals will have its own spill kit consisting of the following:

- (3) 3” x 42” Absorbent “Socks”
- (5) 15” x 20” Absorbent Pads
- Nitrile Gloves
- Splash Proof Goggles
- 2 lb Sodium Bicarbonate (Baking Soda)
- 2 lb Citric Acid
- Heavy Duty Plastic Bags
- Bucket

The general procedure is as follows:

- The laboratory supervisor and or assistant in instruction should determine the magnitude of the spill and any hazards related to it (fumes, fire, broken glass).
- In the case of volatile solvent, pay particular attention to the quantity of solvent that has evaporated. It may be hazardous to breathe the fumes from a solvent spill.
- If the PI or laboratory workers conclude that they can proceed safely with immediately available PPE, they should swiftly begin the cleanup. Lab workers should never attempt to clean up a spill of a substance they are unfamiliar or uncomfortable with.
- The spill should be contained using absorbent “socks” or other means to create a physical barrier around the spill.
- If the spill is a strong acid or base solution, a neutralizing chemical should be used. Sodium bicarbonate can be use to neutralize acid, while citric acid can be used to neutralize base.
- Adsorbent pads should be used to soak up the spilled liquid.

- The pads should be collected and deposited in the plastic bags provided.
- The plastic bags should be sealed in the provided bucket.
- The bucket or container should be treated as hazardous waste and immediately deposited in the MAA, following normal documentation procedures for hazardous waste.

6.1.2 Large Chemical Spills

Large spills or spills of highly hazardous materials should not be handled by lab personnel. In this situation, the following emergency procedure should be followed.

- Quickly leave the area and close the door.
- Alert Campus Safety (207-786-6111) and EHS (207-705-1907) immediately.
- Alert the CHO (207-786-6294 or 207-756-5485).

6.2 Chemical Exposure and Related Injuries

6.2.1 Signs and Symptoms of Chemical Exposure and Injury

A range of injuries can result from chemical exposure. Chemicals can enter the body through inhalation, ingestion or absorption through the eyes or skin. Depending on the route of absorption and the chemical, this can lead to a variety of signs and symptoms.

Inhalation of chemicals can result in eye, nose and throat irritation, coughing, difficulty breathing, headache, dizziness, confusion and collapse. Signs of ingestion of chemicals include a metallic or strange taste in the mouth, vomiting, stomach discomfort and problems swallowing. Eye exposure can result in itchy or burning sensations, redness, discomfort and blindness. Symptoms of skin exposure include dry skin, redness, swelling, burning, rashes and blisters. **If a person working around chemicals experiences these symptoms, it should be assumed that a chemical exposure has occurred. Contact the CHO and EHS immediately or 911 if the situation is emergent.**

6.2.2 General Guidelines

General safety guidelines concerning chemical exposure include:

- All lab personnel should be informed prior to any experiment of the potential safety hazards associated with the chemicals being used. SDS are available to students, faculty and staff as needed. Refer to section 3.1.
- All lab personnel should also be aware of what should occur if an accident happens. This includes the locations and proper use of eye washes and safety showers. A general overview is provided in Lab Safety training (see Section 9.0). Practical instruction should be provided by the responsible party (PI or AI).
- **Whenever a known exposure, suspected exposure, or symptoms consistent with exposure occur, the CHO and EHS must be immediately notified.**
- When an exposure occurs or is suspected, the SDS for the chemical should be consulted for first aid information and also given to the treating physician. First aid information is found in section 4 of the SDS.
- In the event of a spill that contaminates a member of the lab, the affected person should be treated immediately. Spill clean up can occur after the injury has been addressed.

For many chemicals, the following first aid measures are appropriate.

6.2.3 Small skin exposure

In the case of chemical exposure to a small area of skin, the affected area should be held under a steady stream of tepid water for a minimum of 15 minutes. EHS and the CHO should be notified immediately. Contact 911 if necessary.

6.2.4 Large Skin Exposure

If a large area of the skin or clothing comes into contact with a hazardous chemical, the safety shower must be used.

- Remove any clothing that has been contaminated.
- Remain under the shower for at least 15 minutes to ensure the chemical has been sufficiently washed off.
- Contact Campus Safety and EHS immediately in the event of a large chemical exposure. Contact 911 if necessary.
- The affected person should always be treated before a spill is addressed. Evacuate the area so others are not affected.

6.2.5 Inhalation Exposure

In the case of accidental inhalation of a hazardous chemical, the first step is to immediately remove the person to fresh air. Fresh air is sometimes sufficient to resolve the situation. EHS and the CHO should be contacted immediately. If the exposure is severe, contact 911 immediately.

Inhalation of chemicals can result in eye, nose and throat irritation, coughing, difficulty breathing, headache, dizziness, confusion and collapse.

6.2.6 Eye Exposure

In the event of chemical exposure of the eyes, the emergency eye wash should be used. There are several types of eye wash stations on campus. The different types are discussed in lab safety training. A list of eye wash locations can be found in Appendix A. EHS and the CHO should be contacted immediately.

In the case of eye exposure, begin rinsing eyes immediately. Hold your eyes open, or ask someone to help you with this.

- The eyes should be rinsed for 15 minutes.
- If the burn is severe or if the water is not helping contact 911.

Eye exposure can result in itchy or burning sensations, redness, discomfort and blindness.

6.2.7 Hydrofluoric Acid Burns[2]

Hydrofluoric acid is not currently being used at Bates. However, it has been used in the past and may be used in the future. Hydrofluoric Acid (HF) is a highly corrosive and toxic chemical. It can cause severe chemical burns and severe pain. Special first aid and emergency procedures must be used. HF not only causes severe skin corrosion, but readily enters the body creating systemic issues.

6.2.5.1 HF Skin Contact

[2] https://ehs.unc.edu/wp-content/uploads/sites/229/2015/09/hfaexposure.pdf

- Immediately have someone contact 911 then Campus Safety and EHS.
- Flush the area with large amounts of water.
- Remove contaminated clothing while continuing to flush. Flush with copious amounts of water for 5 minutes.
- Apply 2.5% calcium gluconate gel to the wound. Massage the gel into the affected area. Reapply gel every 15 minutes until medical help arrives.
- Depending upon the concentration of the HF solution, symptoms can be immediate or take hours to manifest. **Regardless of the concentration, the exposed area should be treated immediately and thoroughly.**

6.2.5.2 HF Eye Contact

- Immediately have someone contact 911 then Campus Safety and EHS.
- Hold the eyelids open and use the eyewash station to flush the eyes thoroughly with water for 15 minutes.
- The victim should seek immediate medical help, ideally from an eye specialist.
- Ice can be applied to the eyes while awaiting medical treatment.

6.2.5.2 Inhalation

- Immediately have someone contact 911 then Campus Safety and EHS.
- Move the victim to fresh air.
- Await medical help.

7.0 INCIDENT REPORTS, MEDICAL CONSULTATIONS AND EXAMINATIONS

7.1 Incident Reports

An incident report must be filled out for any injury or exposure that happens in a lab (see Appendix E). These reports should be completed by the CHO and EHS within 24 hours of an incident. These are examples of cases when an incident report should be used:

- A chemical exposure occurred, including inhalation, ingestion, or skin exposure.
- An employee or student develops signs and symptoms associated with a hazardous material to which they may have been exposed,
- A release (spill, leak or explosion) occurs in the work area which creates the

likelihood of a hazardous exposure.
- A cut, burn, or other trauma not caused by chemicals.

7.2 Medical Examinations

Call the EHS office at 207-705-1907 or contact ehs@bates.edu to coordinate medical examinations and consultations. Medical examinations and consultations must conform to the following:

- Must be performed by or under the supervision of a licensed physician. Occupational Medicine practitioners are most likely to have training in recognizing signs and symptoms of exposure to chemicals. The Bates preferred occupational health clinic is Concentra in Lewiston, Maine (telephone 207-784-1680).
- Must be conducted at a time and place which is reasonable for the student or employee, preferably during normal working hours. Acute symptoms may require an immediate visit to the nearest emergency room. Examination and consultation must be provided at no cost to the employee or student. It is within the employee or student's rights to refuse examination or consultation.

The SDS for the chemical should be printed out and delivered to the medical professional providing care. In addition, medical examiners will need as much information as possible about the potential exposure. The Laboratory Supervisor, EHS and the CHO must collect information from the affected person and others present in the work area immediately for transmittal to medical providers. The information must include, at a minimum:

- The identity (including generic and trade names) of any hazardous chemicals to which an employee or student may have been exposed.
- A description of the conditions in which the exposure occurred. Quantities of chemical present and an estimate of the quantity directly involved are important.
- A description of the employee's/student's reaction, i.e. signs and symptoms, especially if the affected person(s) is unable to communicate. Interviewing others present soon after the event can yield important information.

8.0 CHEMICAL WASTE

8.1 Types of Waste

- Hazardous Chemical Waste (RCRA Regulated)
- Chemical Waste (Non-RCRA Regulated)
- Non-Hazardous Chemical Waste (drain or trash disposal)
- Universal Waste
- Radioactive Waste and Biological Waste

8.1.1 Hazardous Chemical Waste (RCRA Regulated)

In 1976, the legislature passed the Resource Conservation and Recovery Act (RCRA). This law directed the EPA to establish a regulatory framework for the handling and ultimate disposal of hazardous chemicals. This framework, which tracks waste from the point of generation through transportation, treatment and disposal, is referred to as the "cradle to grave" system. Hazardous waste generators are classified according to the volume of waste that they generate. Bates College is a Large Quantity Generator. This means that we are required to adhere to the most rigorous standards.

There are two ways that a chemical can be determined to be hazardous within the RCRA framework.

- The chemical is a "listed" waste. This means that the chemical is found on either the P, U, F or K EPA lists.
- The chemical has one of the following characteristics:
    - Ignitability (flash point below 60 °C)
    - Corrosivity (pH<2 or pH>12)
    - Reactivity (substance may react violently under normal conditions)
    - Toxicity (substance that is toxic and has the ability to leach into the ground if deposited in a land fill)

It is important to note that we must determine whether a waste is a RCRA regulated hazardous waste **at the same time** that we start generating the waste. If we determine that the waste is RCRA regulated, we have to follow all of the RCRA rules from the moment that it is first created. Please contact EHS or the CHO **before** generating waste if you are unsure whether that waste is subject to RCRA regulation.

More detail on hazardous waste identification can be found in the annual hazardous waste

training. All employees who handle hazardous waste are required to have this training (see section 9.4). Hazardous waste accumulation and disposal are regulated at both the state and federal level. The Maine state laws that regulate hazardous waste can be found in CMR Chapters 850-857. Bates College accumulates waste in four Main Accumulation Areas (MAAs). They are located in Bonney Science Center, Carnegie Science Building, Dana Hall and Cutten Maintenance. These storage areas are maintained by the CHO and EHS.

Lab spaces that generate hazardous chemical waste on an ongoing basis should make use of Satellite Accumulation Areas (SAAs). SAAs are allowed by the state in the interests of convenience. There are several important features of SAAs:

- SAA's must be under the control of the person in charge of the area and the processes creating the waste.
- They must be inspected once a week. The CHO is responsible for these inspections.
- The date that a container starts accumulating hazardous waste must be clearly documented on an SAA log sheet.
- The container must have a yellow "Hazardous Waste" tag.
- The contents of the container must be recorded on the log sheet.
- Incompatible hazardous waste must be separated. For example, strong acids and bases should never be accumulated in the same container.
- Halogenated organic waste must be separated from general organic waste.
- Containers must be closed at all times unless waste is being added.
- When the container is full, it should be taken to the MAA in the same building.

Training is required for those who run SAAs in their labs. Please see section 9.4 for more details on hazardous waste training for SAA operators.

8.1.2 Chemical Waste (Non-RCRA Regulated)

A large portion of the chemical waste generated on campus is put into an SAA. Any RCRA regulated waste that is generated by a continuing process in a lab **must** be managed in an SAA by law. However, it is also prudent to collect some waste that may not fit the strict definition of RCRA hazardous waste. For example, a certain lab may be working with an acute toxin, reproductive toxin, carcinogen or environmental hazard that is not a RCRA regulated waste. The lack of regulation by RCRA does not mean that it is appropriate to put this waste in the trash or down the drain.

Wastes with significant hazards that are not RCRA regulated should also be collected in SAAs in many cases. Though these wastes are not subject to RCRA regulations, we want to track these wastes to ensure they are handled appropriately and do not end up in the trash or a drain. If you are unsure about a particular waste, contact the CHO and EHS.

8.1.3 Non-Hazardous Chemical Waste

Some chemicals possess very minimal hazards and therefore are considered essentially non-hazardous. These chemicals can be disposed of either in the trash or down the drain. Please see Appendix D for a list of chemicals that are approved to be disposed of in this manner. This list is not all inclusive. Please contact EHS or the CHO if you are unsure about a particular chemical. It is always best to err on the side of caution if you are not confident.

8.1.4 Universal Waste

The rules regarding universal waste are different from the rules governing hazardous waste. This category of waste was created to streamline the storage and disposal of certain common types of waste. You may encounter this type of waste in your laboratory. We collect this waste and send it with our waste contractor. There are five categories of universal waste.

- Batteries
- Pesticides
- Mercury-containing equipment
- Lamps (light bulbs etc.)
- Aerosol Cans

If you have universal waste that you need to dispose of please contact either the CHO or EHS.

8.1.5 Radioactive Waste and Biological Waste

Radioactive and biological waste are not addressed in this document. For more information about how to handle this type of waste, please contact the CHO.

8.2 Treatment or Dilution of Hazardous Waste

It is not permissible to treat or dilute hazardous waste on campus. Bates is not permitted as a

hazardous waste treatment facility. Therefore, we are not allowed to treat or dilute chemicals in almost all cases. Examples of procedures that are not allowed:

- Quenching of organometallic reagents.
- Quenching of peroxides.
- Dilution of strong acid/strong base solutions to meet the drain disposal allowed pH.
- Dilution of ethanol solutions.

Aqueous solutions up to 500 mL can be treated to adjust the pH for drain disposal. It is not permissible to either dilute or treat waste of a larger volume. This waste must be disposed of with the hazardous waste.

8.3 Empty Chemical Containers

8.3.1 Definition of Empty Chemical Containers

Chemical containers are considered empty if all contents have been removed to the greatest extent possible by typical methods such as pouring or scraping. A container meets the technical definition of empty if <3% of the original contents remain. In most cases this means that the container is no longer considered regulated hazardous waste.

Containers that held chemicals on the EPA's P-list are an exception to this rule. Any container that previously held P-listed waste is considered to be regulated hazardous waste. These containers must be rinsed three times and the rinsate should be collected as hazardous waste.

8.3.2 Disposal of Empty Chemical Containers

When disposing of empty chemical containers, ensure that the maximum amount of chemical has been removed and used. This can be done in an appropriate manner such as scraping or pouring. If the chemical is a solvent, the container can be left in a fume hood to evaporate any residue, but only after a rigorous attempt is made to remove the contents.

If a container is barcoded, it should be discarded in an "empties" bin. Empties bins are located in many labs and also in stockrooms. An empties bin can be provided by the CHO by request.

9.0 TRAINING

9.1 Safety Training for Teaching Labs

The Assistants in Instruction (AI) and professors overseeing a lab course are responsible for delivering safety information to students or other employees who are present. At a minimum, this information should include:

- The hazards associated with the experiment being performed.
- The location of the emergency equipment and the procedure for different types of emergency.
- How to access the CHP and SDS for the chemicals being used.

9.2 Lab Safety Training for Research Students

9.2.1 General Description

This training is a prerequisite for students who plan to work in a laboratory environment. The training provides basic safety information about working in a lab with chemicals. It also includes information about first aid and emergency procedures.

9.2.2 Applicability

All students who will be performing independent chemical research, either for a thesis or another reason, must attend this in-person training before starting work.

9.2.3 Description of Training

The training consists of an in-person PowerPoint presentation that gives background on chemical safety. It is designed to help students identify chemical hazards and protect themselves from those hazards as well as providing information on emergency procedures.

Topics in PowerPoint presentation

- Introduction to the CHP and CHO.
- GHS hazard classification.
- How to locate and interpret SDS for chemicals.
- Chemical labels.

- The hierarchy of controls.
- Fume hood use.
- Personal protective equipment.
- Brief overview of SAA use.
- Use of safety eye washes and showers.
- Emergency procedures.

9.2.4 Frequency and Type of Continuing Training

All student researchers must repeat in-person training on an annual basis.

9.2.5 Documentation

Training is documented with physical signatures. An excel spreadsheet is maintained to track which students have been trained at what time.

9.3 Lab Safety Training for Faculty and Staff (Including Teaching Assistants and Vivarium Workers)

9.3.1 General Description

This training is a prerequisite for all employees at Bates who will work in a laboratory environment. The training provides basic safety information about working in a lab with chemicals. It also includes information about first aid and emergency procedures.

9.3.2 Applicability

All Bates employees, including student workers, who will be working a laboratory environment require this training. The training must be completed before the employee can start work in the laboratory.

9.3.3 Description of Training

The training consists of an in-person PowerPoint presentation that gives background on chemical safety. It is designed to help employees identify chemical hazards and protect themselves from those hazard as well as providing information on emergency procedures.

Topics in PowerPoint presentation

- Introduction to the CHP and CHO.
- GHS hazard classification.
- How to locate and interpret SDS for chemicals.
- Chemical labels.
- The hierarchy of controls.
- Fume hood use.
- Personal protective equipment.
- Brief overview of SAA use.
- Emergency procedures.

9.3.4 Frequency and Type of Continuing Training

After the initial in-person training, annual refresher training is required. All undergraduate employees must undergo annual in-person refresher training. Other staff and faculty will undergo virtual refresher training which consists of a recorded PowerPoint presentation.

9.3.5 Documentation

In-person training is documented with physical signatures. Virtual training is documented using a Google form with timestamps. Virtual refresher training is to be completed by April 1 of each year. Both types of certification are tracked with an Excel spreadsheet

9.4 Hazardous Waste Training (For SAA Users)

9.4.1 General Description

This training is a prerequisite to handling hazardous waste at Bates College. The training provides background information on hazardous waste laws. It also prepares employees for the practicalities of running a Satellite Accumulation Area (SAA). The procedures for the transfer of waste to the Main Accumulation Area are also covered.

9.4.2 Applicability

This training is necessary for employees who inspect, manage, or move hazardous waste as a

part of their employment in laboratories at Bates College. Specifically, this training is necessary for professors and others that manage SAAs at Bates College, or may have to in the future. All Principal Investigators who have an SAA in their lab need this training, even if someone else in their lab is maintaining the SAA.

9.4.3 Description of Training

The training consists of a PowerPoint presentation that gives background concerning hazardous waste laws and a practical component which is concerned with maintaining an SAA. All managers of hazardous wastes are given detailed instructions about maintaining their SAA.

Topics in the PowerPoint Presentation

- The history of hazardous waste laws, both Federal and State.
- The concept of cradle to grave waste management.
- Hazardous waste determination.
- Introduction to the concept of an SAA.
- Practical guidelines concerning the maintenance of an SAA.
- Strong emphasis on the importance of SAA inspections.
- Guidelines concerning moving bottles from the SAA to the Main Accumulation Area (MAA).
- What to do in the case of a large hazardous waste spill or accident.

Practical topics (instruction given at the SAA*)*
All new employees who will be handling hazardous waste are given practical instruction before they begin managing an SAA. A copy of this training protocol is kept in the hazardous waste initial training sign-in binder.

9.4.4 Frequency and Type of Continuing Training

All new employees who will need to manage hazardous waste, or employees who have not managed hazardous waste previously at Bates College, are given both the PowerPoint and practical training in person. Employees who manage hazardous waste and have previously had both trainings receive the PowerPoint training every year. The annual “refresher” hazardous waste training is performed digitally using a PowerPoint presentation and is documented by a Google form. This training is to be completed by September 1st each year.

9.4.5 Documentation

All initial training of new employees that will be handling an SAA as a part of their job is in person. This is documented with physical signatures. Job title and description should be included. Annual refresher training for those who have already had the in-person training is conducted digitally with timestamps recorded. Training is tracked by Excel spreadsheet.

10.0 LAB INSPECTIONS AND LAB SAFETY COMMITTEE

10.1 Lab Inspection Procedures

All chemical laboratories are required to be inspected on an annual basis. The CHO and EHS representative will perform the inspections and deliver results to PIs and AIs. The CHO will retain records of lab inspections and any resulting changes to lab conditions. The lab inspection form is in Appendix C.

10.2 Lab Safety Committee

The Lab Safety Committee (LSC) will meet on an annual basis to discuss lab safety matters. The committee is intended to be a place for the CHO and EHS to communicate with PIs/AIs concerning lab safety matters and to receive feedback. Topics to be discussed include the CHP, lab inspections, lab safety incidents, changes to lab safety protocols and any other pertinent lab safety related topics of interest to faculty and staff.

The LSC is comprised of the Science Department chairpersons, the Associate Dean of Faculty, CHO, Director of EHS and any other interested parties.

11.0 APPROVAL

By signing this document, the following persons accept the safety measures and policies outlined in this plan and agree to support their implementation.

Alexander Diamond-Stanic
Physics Department Chair — 11/5/2025 Date

Beverly Johnson
EACS Department Chair — 11/13/25 Date

Brett Huggett
Biology Department Chair — 11/5/25 Date

Donald Dearborn
Associate Dean of the Faculty and Professor of Biology — 10/16/2025 Date

Geneva Laurita
Chemistry and Biochemistry Department Chair — 10/27/25 Date

Geoffrey Swift
Vice President for Finance and Administration and Treasurer — 10/8/25 Date

Joanne Roberts
Dean of Faculty — 10/22/25 Date

Jonathan Witt
Chemical Hygiene Officer — 10/23/25 Date

Justin Hulbert
Neuroscience Department Chair — 10/28/25 Date

Sonja Pieck
Environmental Science Chair

11/18/25
Date

Wade Behnke
Environmental, Health and Safety Director

10/8/2025
Date

Appendix A – Eyewash and Shower Locations

Bonney

Room	Type
MB21	C
By B32	C
B42	ED
B62A	ED
111	C
111	ED
121	ED
143	C
223	C
223	ED
By 250	C
260	C
260	ED
265	C
265	ED
270	C
323	C
325	C
327	C
340	C
360	C
360	ED
361	C
363	C
369	C
370	C
370	ED

C = Combination Eye Wash/Shower
DH = Drench Hose
ES = Eye Station
32 Oz = 32 Oz of Saline Solution for Eyes
ED = Eye Drench

Carnegie

Room	Type
B6	2 32oz
B8	2 32oz
B8	2 32oz
B10	1 16oz
B14	2 32oz
B15A	DH
B21A	DH
B22	2 32oz
132	ES
By 146	C
143	2 32oz
206	DH
207A	2 32oz
208	DH
By 214A	ES
214A	2 32oz
215	2 32oz
By 305	C
305	1 16oz
307	DH
310	2 32oz
314	1 32oz
325	1 32oz
344	DH
By 401	C
404	ES
412	DH

Room	Type
413	1 16oz
417	2 32oz
425	2 32oz
430	ES
431	ES
437	2 32oz
512	1 32oz
522	C
524	C
533	2 32oz
534	ES

C = Combination Eye Wash/Shower
DH = Drench Hose
ES = Eye Station
32 Oz = 32 Oz of Saline Solution for Eyes
ED = Eye Drench

Dana

Room	Type
119	C
106	C
123	ED
116	ED
304	C
306	C
319	ED

C = Combination Eye Wash/Shower
DH = Drench Hose
ES = Eye Station
32 Oz = 32 Oz of Saline Solution for Eyes
ED = Eye Drench

Appendix B -SAA Locations 2024-2025

Bonney

Room	Location
111	Fume Hood
265b	Cabinet
260	Fume Hood
223c	Fume Hood
327	Cabinet
360	Fume Hood
361	Fume Hood
363	Cabinet
369	Cabinet
370	Fume Hood
323	Cabinet

Carnegie

Room	Location
206	Fume Hood
424	Cabinet
215	Cabinet
214a	Cabinet
404	Fume Hood
413	Fume Hood

Dana

Room	Location
106	Fume Hood
119	Fume Hood
306	Fume Hood

Some SAAs are closed for certain periods when waste is not being accumulated, such as the summer in a teaching lab.

Appendix C -Lab Safety Checklist

Lab Safety Checklist **Date:**
PI:
Lab Room Number:

Safety Items	y/n	Comments
Lab door card posted outside the lab.		
Up-to-date version of the Chemical Hygiene Plan available.		
Lab personnel know how to access SDS.		
At least one spill kit is present and appropriately stocked.		
Personal Protective Equipment (PPE) is available and worn at time of inspection (minimum eye wear, gloves, lab coats).		
Food or drinks are stored and consumed in separate designated areas outside of the lab.		
Any microwaves in lab are labeled “For lab use only”		
Any refrigerators or freezers are labeled “For lab use only”		
Exits and aisles are clear and unobstructed.		
Approved eyewash and shower are available and unobstructed.		
Eyewash and shower have been inspected and are working properly.		
Fume hood has been inspected and is working properly.		
Fume hood is not being used for excess storage of chemicals or equipment.		
Electrical cords are not frayed. Electrical outlets are not overloaded, piggybacked or cascaded.		
If extension cords are used they should be of appropriate gauge and used for less than 90 days.		
Bench tops are not cluttered with materials and chemicals.		
Good housekeeping is practiced throughout the lab.		
All containers, primary and secondary (wash bottles, carboys, etc.) are labeled correctly.		
All container labels have the full chemical name.		
All container labels are in good condition and legible.		

All chemical containers and lids are in good condition.		
Chemicals are segregated by hazard class and chemical compatibility.		
Fire extinguishers are present secure, unobstructed, and/or up-to-date.		
Flammable liquids are in an approved cabinet (if >10 gal. in lab)		
Refrigerated flammables are stored in a proper fireproof refrigerator.		
Glass apparatus is assembled properly with all water/liquid hose line connections clamped.		
No chemicals stored around sinks or drains.		
Hazardous or corrosive liquids are not stored above eye level.		
Explosive and temperature sensitive chemicals are stored properly.		
Reactive and time-sensitive chemicals (eg peroxide formers) are stored properly, dated, and are not expired.		

General Comments

Appendix D -Non-Hazardous Chemicals

Chemicals Safe for Drain or Trash Disposal

Acid, pH over 4 (No Heavy Metals)
Agar
Agarose
Alanine
Albumin, bovine
Ammonium Chloride
Ammonium Acetate
Ammonium phosphate dibasic
Ammonium sulfate
Asparagine
Aspartic Acid
Base, pH less than 10 (No Heavy Metals)
Calcium Acetate
Calcium chloride dihydrate
Calcium Citrate
Calcium Phosphate, Monobasic
Calcium Sulfate
Collagen
Cysteine
Dextrose Monohydrate
Ferric Citrate
Ferrous Sulfate Hexahydrate
Fetal Bovine Serum
Folic Acid
Fructose
Gelatin
Glucose
Glutamic Acid
Glycerol
Glycine
Lactose Monohydrate
Nicotinamide Adenosine Diphosphate
Magnesium Chloride
Magnesium Sulfate
Maltose
Mannitol
Niacin
Pectin

Potassium Acetate
Potassium Chloride
Potassium Phosphate dibasic
Potassium Phosphate monobasic
Potassium Sulfate
Potassium thiosulfate
Riboflavin
Sodium Bicarbonate
Sodium Chloride
Sodium Citrate
Sodium Phosphate dibasic anhydrous
Sodium Phosphate monobasic, monohydrate
Sodium Sulfate, anhydrous powder
Sorbitol
Sucrose
Tris Base
Tris HCl
Trypsin
Urea
Yeast Extract

Appendix E - Lab Incident Report Forms

Student Lab Incident Form		
Personnel Involved		
Name of Student:	Student Signature:	Date:
Person Completing Form:	Signature:	Date:
Accident Information		
Location of Accident:	Date and Time of Accident:	
Was there an injury?	Description of Injury:	
Witness:	Comments:	
Witness:	Comments:	
Medical care given:		

Reviewed By EHS/CHO?	Yes	No					

Employee Lab Incident Form		
Personnel Involved		
Name of Employee:	Employee Signature:	Date:
Person Completing Form:	Signature:	Date:
Accident Information		
Location of Accident:	Date and Time of Accident:	
Was there an injury?	Description of Injury:	
Witness:	Comments:	
Witness:	Comments:	
Medical care given:		

Reviewed By EHS/CHO?	Yes	No					

Appendix F -GHS Pictograms

GHS pictograms are visual representations of chemical hazards. These pictograms can be found on Safety Data Sheets (SDS), chemical labels and door signs throughout campus. Each pictogram represents one or more physical, health or environmental hazards.

Appendix G -Chemical Standard Operating Procedures

- **Acute Toxicity**
- **Carcinogens**
- **Reproductive Toxins**
- **Methylene Chloride**
- **Peroxide Formers**
- **Corrosives**

Standard Operating Procedure –Acute Toxicity

Building and Lab Number	
Principal Investigator	
Principal Investigator Signature	
Date Adopted	

Definition

Acute toxicity refers to an adverse reaction to a chemical after a single chemical exposure or several exposures over a short period of time. The acute toxicity of chemicals is classified in terms of LD_{50} or LC_{50} values. This SOP applies to chemicals that are considered highly acutely toxic. Highly acutely toxic chemicals have one or more of the following lethal dose levels:

Dermal: LD_{50} <200mg/kg,

Oral: LD_{50} <50 mg/kg

Inhalation: LC_{50} <500 ppm

Safety Data Sheets for highly acutely toxic chemicals will have one or more of the following hazard statements listed:

H300: Fatal if swallowed

H310: Fatal in contact with skin

H330: Fatal if inhaled

Common examples of acutely toxic chemicals are sodium azide, chlorine gas, potassium cyanide and carbon monoxide.

Hazards

Highly acutely toxic chemicals are extremely poisonous and, in some cases, can result in death after a single exposure. Acute toxins exert their effect after a single or short-term exposure. The route of action can significantly affect the likelihood and extent of exposure. Dermal and inhalation risk can be greater under normal lab conditions than oral ingestion. Certain solvents, such as Dimethyl Sulfoxide (DMSO) can transport acute toxins through the skin.

Control of Hazards

General

Another less toxic chemical should be substituted whenever possible. The smallest possible amount should be used in experiment. Acute toxins should be ordered in the smallest quantities possible. Take extra care to avoid transferring the chemical to your mouth, skin or eyes through incidental contact. Another person should be either in the lab or close enough to intervene in the case of incident. **Students should not work with acute toxins. Professors or assistants in instruction must handle these chemicals whenever possible.**

Exposure Control

Fume Hood

All manipulation of highly acutely toxic chemicals must be carried out in a fully functional fume hood, including weighing.

Safety Shower and Eye Wash

A functional safety shower and eyewash station must be available within the lab or in a very nearby location (for example immediately across the hall).

Personal Protective Equipment (PPE)

Gloves

Disposable nitrile gloves must always be worn when handling acute toxins. This type of glove is intended for incidental contact only, not for prolonged exposure. If gloves are exposed, they should be removed immediately. If dermal toxicity is a concern, two layers of glove should be worn.

Eyewear

Safety glasses or goggles must be used at all times while using acute toxins.

Skin and Body Protection

A properly fitted lab coat is required when dealing with acute toxins. Long pants, long sleeved shirt and closed toe shoes are also required.

Emergency Procedures

Exposure

If immediate emergency medical attention is required, contact 911. For minor exposures contact the Environmental Health and Safety Department and/or the Chemical Hygiene Officer. **Bear in mind that contact with even small amounts of acutely toxic materials can constitute a serious emergency.**

Skin Contact

Flush skin with cool water for 15 minutes. Use the closest available source of water. Remove any contaminated clothing. For a large exposure, immediately activate and use the safety shower.

Eye Contact

Activate the closest eye wash and flush eyes while holding eyelids open. Continue flushing eyes for at least 15 minutes.

Inhalation

Immediately move outside to fresh air.

Ingestion

Immediately obtain medical attention.

Spill

A spill or release of a highly acutely toxic chemical can present a serious hazard depending on the specific chemical, amount, location and state of matter. Depending on the amount of the spill and the nature of the chemical, spills may be cleaned up by the Principal Investigator. **Students should never attempt to clean up a spill of an acute toxin.**

Small Spill

What constitutes a small spill is dependent upon the level of toxicity of the chemical. The PI must take this into account. A 1 gram spill of a chemical with an LD_{50} of 45 mg/kg is less serious than a 200 mg spill of a chemical with an LD_{50} of 0.5 mg/kg. Route of toxicity is also a major factor. Any chemical that is an inhalation toxin spilled outside of a fume hood is a serious emergency. If the PI determines it safe, they can clean up the spill on their own. All contaminated materials (including pads, towels etc) should be treated as hazardous waste.

Large Spill
Lab workers should exit the lab and contact the person in charge of the lab as well as EHS and/or the Chemical Hygiene Officer.

Storage and Transport

Storage Notes
All highly acutely toxic chemicals must be stored in a secure designated area such as a locked cabinet or lab. A sign must be posted on the lab door or specific storage area that states "Particularly Hazardous Substances (PHS) are stored and used in this area. PHS include carcinogens, reproductive toxins and acute toxins. Authorized persons only." This can be stated on the door card for the lab. The chemical should be stored in an unbreakable secondary container.

Transport
Acute toxins must be transported in an unbreakable secondary container.

Designated Work Area

Highly acutely toxic chemicals are considered to be Particularly Hazardous Substances (PHS). This means that a special area must be designated for their use. This area could be an entire lab, a fume hood or a particular bench area. A sign must be posted stating "Particularly Hazardous Substances (PHS) are stored and used in this area. PHS include carcinogens, reproductive toxins and acute toxins. Authorized persons only." This statement can be on the door card for the lab.

Waste Disposal

Highly acutely toxic chemicals must be disposed of as hazardous waste. Contact EHS or the CHO to establish the best way to handle the particular waste. In some cases, anything that has come

into contact with the chemical must be disposed of as hazardous waste. For example, if it comes into contact with a glove or kimwipe, they may need to be disposed of as hazardous waste. In some cases, an empty container which held a highly acutely toxic chemical is itself hazardous waste.

Standard Operating Procedure – Carcinogens

Building and Lab Number	
Principal Investigator	
Principal Investigator Signature	
Date Adopted	

Definition

Carcinogens are found in the following lists:

- OSHA list of regulated carcinogenic chemicals (29 CFR 1910 Subpart Z).
- List of substances "known to be a carcinogen" in the National Toxicology Program *Report on Carcinogens*. Chemicals that are on the "reasonably anticipated to be carcinogen" list may be considered carcinogens if statistically significant tumor incidence has occurred in animal models.
- International Agency for Research on Cancer (IARC) Group 1 carcinogens. Group 2A or 2B carcinogens may also be considered select carcinogens if statistically significant tumor incidence has occurred in animal models.

Carcinogens will have one of the following hazard statements on their SDS sheets:

H350: May cause cancer

H351: Suspected of causing cancer

Common examples of carcinogens include acrylamide, cadmium and cadmium compounds, benzene, perfluorooctanoic acid (PFOA) and chromium (VI) compounds.

Hazards

Carcinogens are substances that are either known or suspected to induce cancer or increase the rate of incidence of cancer after exposure.

Control of Hazards

General

Select less hazardous chemicals whenever possible. Order in the smallest possible amounts. Carcinogens should be handled in a fume hood. Take extra care to avoid transferring the chemical to your mouth, skin or eyes through incidental contact.

Exposure Control

Fume Hood
All manipulation of carcinogens must occur in a fully functional fume hood.

Safety Shower and Eye Wash
A functional safety shower and eyewash station must be available within the lab or in a very nearby location (for example immediately across the hall).

Personal Protective Equipment (PPE)

Gloves
Disposable nitrile gloves must always be worn when handling carcinogens. This type of glove is intended for incidental contact only, not for prolonged exposure. If gloves are exposed, they should be removed immediately.

Eyewear
Safety glasses or goggles must always be worn when handling carcinogens.

Skin and Body Protection
A properly fitted lab coat is required when dealing with carcinogens. Long pants, long sleeved shirt and closed toe shoes are also required.

Emergency Procedures

Exposure
If immediate emergency medical attention is required, contact 911. For minor exposures contact the Environmental Health and Safety Department and/or the Chemical Hygiene Officer.

Skin Contact
Flush skin with cool water for 15 minutes. Use the closest available source of water. Remove any contaminated clothing. For a large exposure, immediately activate and use the safety shower.

Eye Contact
Activate the closest eye wash and flush eyes while holding eyelids open.

Inhalation
Immediately move outside to fresh air.

Spill

Small Spill
A small spill can be cleaned up by experienced lab personnel (PI or AI) using absorbent pads available in spill kits. Spills should only be cleaned up if the person in charge understands the hazards involved and is comfortable handling the spill without assistance. All contaminated materials (including pads, towels etc) should be treated as hazardous waste.

Large Spill
Lab personnel should not attempt to clean up a large spill. Exit the lab or room where the spill has occurred, notify EHS and/or the Chemical Hygiene Officer and restrict access to the room until CHO and EHS arrive to assess.

Storage and Transport

Storage Notes
Carcinogens must be stored in a secure designated area such as a locked cabinet or lab. A sign must be posted on the lab door or specific storage area that states “Particularly Hazardous Substances (PHS) are stored and used in this area. PHS include carcinogens, reproductive toxins and acute toxins. Authorized persons only.” The statement can be on the door card for the lab. The pure chemical or stock solution should be stored in an unbreakable secondary container.

Transportation
Carcinogens should be transported in an unbreakable secondary container.

Designated Work Area

Carcinogens are considered to be Particularly Hazardous Substances (PHS). This means that a special area must be designated for their use. This area could be an entire lab, a fume hood or a particular bench area. A sign must be posted stating “Particularly Hazardous Substances (PHS) are stored and used in this area. PHS include carcinogens, reproductive toxins and acute toxins. Authorized persons only.” This statement can be on the door card for the lab.

Waste Disposal

Carcinogens must always be handled as hazardous waste.

Standard Operating Procedure – Reproductive Toxins

Building and Lab Number	
Principal Investigator	
Principal Investigator Signature	
Date Adopted	

Definition

Reproductive toxins affect either sexual function and fertility or the development of the offspring. Some chemicals are known by extensive evidence, while others are only suspected. Under the Globally Harmonized System (GHS), a lower numerical category represents a higher degree of evidence. The GHS also classifies germ cell mutagenicity separately from other reproductive hazards. Reproductive toxins will have at least one of the following hazard statements on their SDS:

H360: May damage fertility or the unborn child.

H361: Suspected of damaging fertility or the unborn child.

H362: May cause harm to breast-fed children.

Germ cell mutagens will have one of the following hazard statements on their SDS:

H340: May cause genetic defects.

H341: Suspected of causing genetic defects.

Common examples of reproductive toxins include solvents such as toluene and dimethylformamide and heavy metals such as lead and cadmium.

Hazards

Reproductive toxins cause adverse effects to normal sexual function and fertility or the development of offspring. These chemicals can have a variety of negative effects including heritable gene mutations in germ cells or effects on fetuses (teratogenesis). Adverse effects on the child through lactation are also possible.

Control of Hazards

General

Select less hazardous chemicals whenever possible. Order in the smallest possible amounts. Reproductive toxins should be handled in a fume hood. Take extra care to avoid transferring the chemical to your mouth, skin or eyes through incidental contact.

Exposure Control

Fume Hood
All manipulation of reproductive toxins should occur in a fully functional fume hood.

Safety Shower and Eye Wash
A functional safety shower and eyewash station must be available within the lab or in a very nearby location (for example immediately across the hall).

Personal Protective Equipment (PPE)

Gloves
Disposable nitrile gloves must always be worn when handling reproductive toxins. This type of glove is intended for incidental contact only, not for prolonged exposure. If gloves are exposed, they should be removed immediately.

Eyewear
Safety glasses or goggles must always be worn when handling reproductive toxins.

Skin and Body Protection
A properly fitted lab coat is required when dealing with reproductive toxins. Long pants, long sleeved shirt and closed toe shoes are also required.

Emergency Procedures

Exposure

If immediate emergency medical attention is required, contact 911. For minor exposures contact the Environmental Health and Safety Department and/or the Chemical Hygiene Officer.

Skin Contact
Flush skin with cool water for 15 minutes. Use the closest available source of water. Remove any contaminated clothing. For a large exposure, immediately activate and use the safety shower.

Eye Contact
Activate the closest eye wash and flush eyes while holding eyelids open. Continue flushing eyes for at least 15 minutes.

Inhalation
Immediately move outside to fresh air.

Ingestion
Immediately obtain medical attention.

Spill

Small Spill
A small spill can be cleaned up by experienced lab personnel (PI or AI) using absorbent pads available in spill kits. Spills should only be cleaned up if the person in charge understands the hazards involved and is comfortable handling the spill without assistance. All contaminated materials (including pads, towels etc) should be treated as hazardous waste.

Large Spill
Lab personnel should not attempt to clean up a large spill. Exit the lab or room where the spill has occurred, notify the Chemical Hygiene Officer (CHO) and EHS and restrict access to the room until CHO and EHS arrive to assess.

Storage and Transport

Storage Notes

Reproductive toxins must be stored in a secure designated area such as a locked cabinet or lab. A sign must be posted on the lab door or specific storage area that states “Particularly Hazardous Substances (PHS) are stored and used in this area. PHS include carcinogens, reproductive toxins and acute toxins. Authorized persons only.” This can be stated on the lab door card. The chemical should be stored in an unbreakable secondary container.

Transportation

Reproductive toxins should be transported in an unbreakable secondary container.

Designated Work Area

Acute toxins are considered to be Particularly Hazardous Substances (PHS). This means that a special area must be designated for their use. This area could be an entire lab, a fume hood or a particular bench area. A sign must be posted stating “Particularly Hazardous Substances (PHS) are stored and used in this area. PHS include carcinogens, reproductive toxins and acute toxins. Authorized persons only.” This statement can be on the lab door card.

Waste Disposal

Reproductive toxins must always be handled as hazardous waste.

Standard Operating Procedure – Methylene Chloride

Building and Lab Number	
Principal Investigator	
Principal Investigator Signature	
Date Adopted	

General Information

Methylene chloride (also called dichloromethane or DCM) is a common laboratory solvent used for reactions, chromatography, extractions and other purposes. The EPA has determined that methylene chloride is both an acute and chronic toxin, affecting the central nervous system and liver through inhalation and dermal exposure. The EPA, the International Agency for Research on Cancer (IARC) and other organizations also consider methylene chloride to be a carcinogen. New EPA regulations for use of methylene chloride in laboratories will take effect in 2025.

GHS Hazards[3]

Hazard Class and Category	Hazard Statement	Pictogram
Skin Corrosion/Irritation (Category 2)	Causes skin irritation.	
Serious Eye Damage/Eye Irritation (Category 2)	Causes serious eye irritation.	
Carcinogenicity (Category 1B)	Suspected of causing cancer.	
Specific Target Organ Toxicity-Single Exposure (Category 3) Central nervous system	May cause drowsiness or dizziness.	

[3] https://www.fishersci.com/shop/products/methylene-chloride-stabilized-certified-acs-fisher-chemical-7/D374

Specific Target Organ Toxicity-Repeated Exposure (Category 2) Liver, Kidney, Blood	May cause damage to organs through prolonged or repeated exposure.	

Control of Hazards

General

Select less hazardous chemicals whenever possible. Order in the smallest possible amounts. Methylene chloride must be handled in a fume hood. Avoid inhalation. Take care to avoid transferring the chemical to your mouth, skin or eyes through incidental contact.

Exposure Control

Fume Hood
All manipulation of methylene chloride must occur in a functioning fume hood.

Safety Shower and Eye Wash
A functional safety shower and eyewash station must be available within the lab or in a very nearby location (for example immediately across the hall).

Personal Protective Equipment (PPE)

Gloves
Disposable nitrile gloves must always be worn when handling methylene chloride. This type of glove is intended for incidental contact only, not for prolonged exposure. If gloves are exposed, they should be removed immediately.

Eyewear
Safety glasses or goggles must always be worn when handling methylene chloride.

Skin and Body Protection
A properly fitted lab coat is required when dealing with methylene chloride. Long pants, long sleeved shirt and closed toe shoes are also required.

Emergency Procedures

Exposure

If immediate emergency medical attention is required, contact 911. For minor exposures contact the Environmental Health and Safety Department and/or the Chemical Hygiene Officer.

Skin Contact
Flush skin with cool water for 15 minutes. Use the closest available source of water. Remove any contaminated clothing. For a large exposure, immediately activate and use the safety shower.

Eye Contact
Activate the closest eye wash and flush eyes while holding eyelids open. Continue flushing eyes for at least 15 minutes.

Inhalation
Immediately move outside to fresh air.

Spill
Methylene chloride presents an inhalation hazard. Take care to avoid breathing vapors. Keep people from entering the spill area.

Small Spill
A small spill (<100 mL) can be cleaned up by experienced lab personnel (PI or AI) using absorbent pads available in spill kits. Spills should only be cleaned up if the person in charge understands the hazards involved and is comfortable handling the spill without assistance. All contaminated materials (including pads, towels etc) should be treated as hazardous waste. Methylene chloride is an inhalation risk. Avoid breathing vapors.

Large Spill
Lab personnel should not attempt to clean up a large spill (>100 mL). Exit the lab or room where the spill has occurred, notify EHS and the Chemical Hygiene Officer (CHO). Restrict access to the room until EHS arrives to assess.

Storage and Transport

Storage Notes
Methylene chloride is a suspected carcinogen. This makes it a “Particularly Hazardous

Substance" (PHS). It must be used and stored in a designated area. This can be a particular area in a lab or an entire lab. A sign must be posted on the lab door or specific storage area that states "Particularly Hazardous Substances (PHS) are stored and used in this area. PHS include carcinogens, reproductive toxins and acute toxins. Authorized persons only." This can be stated on the lab door card. Methylene chloride should be stored in a secondary container.

Transportation

Methylene chloride should always be transported in an unbreakable secondary container or bottle carrier.

Designated Work Area

Methylene chloride is considered to be a Particularly Hazardous Substances (PHS). This means that a special area must be designated for their use. This area could be an entire lab, a fume hood or a particular bench area. A sign must be posted stating "Particularly Hazardous Substances (PHS) are stored and used in this area. PHS include carcinogens, reproductive toxins and acute toxins. Authorized persons only." This can be stated on the lab door code.

Waste Disposal

Methylene chloride must always be handled as hazardous waste.

Standard Operating Procedure –Peroxide Forming Chemicals

Building and Lab Number	
Principal Investigator	
Principal Investigator Signature	
Date Adopted	

Definition

Peroxides can form from the autoxidation (reaction with oxygen in the air) of many chemicals. Chemicals are classified into three main groups depending upon the conditions necessary to produce dangerous levels of peroxides. Peroxide forming chemicals are not formally identified under the GHS classification system, though organic peroxides themselves are included. Examples of each class are shown below. These lists are not comprehensive.

Class A Peroxide Formers- Chemicals that can form explosive peroxides without concentration. These are the most dangerous of the peroxide formers.

Butadiene (liquid monomer)	Isopropyl ether	Sodium amide (sodamide)
Chloroprene (liquid monomer)	Potassium amide	Tetrafluoroethylene (liquid monomer)
Divinyl ether	Potassium metal	Vinylidene chloride

Class B Peroxide Formers- Chemicals that can form explosive peroxides with concentration or distillation. These are the most common peroxide formers used at Bates.

Acetal	Diethylene glycol dimethyl ether (diglyme)	4-Methyl-2-pentanol
Acetaldehyde	Diethyl ether (ether)	2-Pentanol
Benzyl alcohol	Dioxanes	4-Penten-1-ol
2-Butanol	Ethylene glycol ether acetates (glyme)	1-Phenylethanol

Cumene	Furan	2-Phenylethanol
Cyclohexanol	4-Heptanol	Tetrahydrofuran (THF)
Cyclohexene	2-Hexanol	Tetrahydronaphthalene (tetralin)
2-Cyclohexen-1-ol	Methylacetylene (gas)	Vinyl ethers
Decahydronaphthalene (decalin)	3-Methyl-1-butanol	Other secondary alcohols
Diacetylene (butadine, gas)	Methyl cyclopentane	
Dicyclopentadiene	Methyl isobutyl ketone	

Class C Peroxide Formers- Highly reactive and can auto-polymerize due to internal peroxide formation. The peroxides formed are extremely shock sensitive.

Acrylic acid	Chlorotrifluoroethylene (gas)	Vinylacetylene (gas)
Acrylonitrile	Methyl methacrylate	Vinyladiene chloride
Butadiene (gas)	Styrene	Vinyl chloride (gas)
Chlorobutadiene	Tetrafluoroethylene (gas)	Vinyl pyridine
Chloroprene	Vinyl acetate	

Hazards

Peroxide forming chemicals may themselves present numerous hazards such as flammability, toxicity or corrosivity. This SOP is concerned with the ability of these chemicals to form peroxides over time. Organic peroxides present an explosion risk.

Control of Hazards

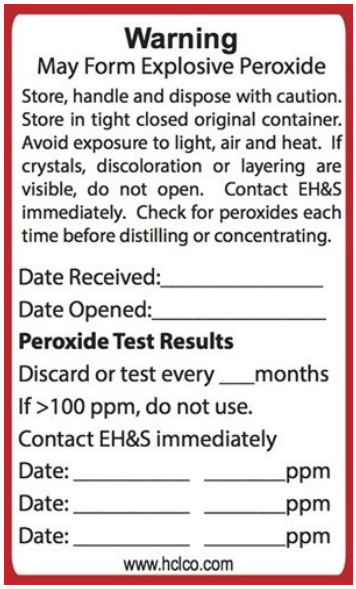
General

The smallest possible amount should be ordered. When placing an order for a peroxide former, the user and ordering agent should consider whether the quantity will be used within one year at a maximum. Peroxide formers should be ordered with inhibitor (BHT or similar) whenever available.

Peroxide Testing and Record Keeping Outline

Peroxide formers should have a peroxide former label applied when received (label shown below). The dates that the peroxide former is received and opened should be written on the label. The Chemical Hygiene Officer will also record the date of receipt of the peroxide former on a spreadsheet. Peroxide formers must be tested on a regular basis and disposed of within a set period of time. The interval between tests and the amount of time a peroxide former can be retained depends upon the class of the peroxide former. Test results should be recorded on the label. Use the chart below to determine proper testing interval and safe storage time.

Peroxide Former Class	Class A	Class B	Class C
Safe Storage Period			
Open and Uninhibited	3 Months	12 Months	24 Hours
Open and Inhibited	12 Months	12 Months	12 Months
Unopen	12 Months	12 Months	12 Months
Testing Frequency			
	3 Months	3 Months	3 Months



Testing Procedures

Visual Inspection

Always visually inspect the contents and outside of the container before testing. Cloudiness or crystals within the container or around the cap could indicate peroxide formation. **Do not handle, move or open container. Notify EHS and the Chemical Hygiene Officer immediately.**

Test Strips

Peroxide formers should be tested using test strips provided by the Chemical Hygiene Officer. The range for these strips is 1-100 ppm. Any chemical that tests higher than 50 ppm should be disposed of as hazardous waste. If a test indicates peroxides at 100 ppm, EHS and the Chemical Hygiene Officer should be contacted immediately. Record test result on the label.

Exposure Control

Fume Hood

The hazards associated with peroxide formers varies. Take necessary precautions based on the specific chemical. Peroxide formers typically should be handled in a fume hood.

Safety Shower and Eye Wash

A functional safety shower and eyewash station must be available within the lab or in a very nearby location (for example immediately across the hall).

Personal Protective Equipment (PPE)

Gloves

Nitrile gloves must be worn at all times handling or testing peroxide formers. However, these gloves will only provide brief protection if exposed to chemicals. If gloves are exposed, they should be removed immediately.

Eyewear

Safety glasses should always be worn when testing or handling peroxide formers.

Skin and Body Protection

A properly fitted lab coat is required when testing or handling peroxide formers. Long pants, long sleeved shirt and closed toe shoes are also required.

Emergency Procedures

Hazards of peroxide formers vary. These first aid measures apply to many chemicals.

Exposure

If immediate emergency medical attention is required, contact 911. For minor exposures contact the Environmental Health and Safety Department and CHO.

Skin Contact
Flush skin with cool water. Use the closest available source of water. Remove any contaminated clothing. If necessary, utilize safety shower.

Eye Contact
Activate the closest eye wash and flush eyes while holding eyelids open. Continue flushing eyes for at least 15 minutes.

Inhalation
Immediately move outside to fresh air.

Ingestion
Immediately obtain medical attention.

Spill
Depending on the size of the spill and the nature of the chemical, lab personnel may be able to clean up a spill on their own. Peroxide formers may exhibit many different hazards. The hazards must be considered before a clean up is attempted. **Students should never clean up a spill unsupervised.**

Storage and Transport

Storage Notes
Peroxide formers should be stored in a dark location with the top tightly closed to limit autoxidation and formation of peroxides.

Transport
Peroxide formers, like any other liquid chemical, should be transported using a bottle carrier.

Waste Disposal

Peroxide formers should always be handled as hazardous waste. It is critical that peroxide formers are disposed of within the time periods indicated in the above table.

Standard Operating Procedure –Corrosives

Building and Lab Number	
Principal Investigator	
Principal Investigator Signature	
Date Adopted	

Definition

Corrosives are chemicals that cause permanent visible damage to living tissue by chemical action. They can be solids, liquids or gases. Damage is rapidly visible, ranging from instantaneous response to response within several hours. Chemicals that have corrosive properties but do not cause permanent damage are classified as irritants by the GHS. Some corrosive chemicals also can damage or destroy metals.

The corrosivity of chemicals can be determined in a number of ways, including human and non-human animal data as well as chemical properties. Solutions with pH of 4.0 or lower or a pH of 9.0 or higher are considered corrosive. Solutions with a pH of 2.0 or lower or 12.5 or higher are considered to be highly corrosive and must be handled with extreme care.

Chemicals that are corrosive will have at least one of these hazard statements on their Safety Data Sheets (SDS):

H314: Causes severe skin burns and eye damage.

H318: Causes serious eye damage.

H290: May be corrosive to metals.

Common examples of corrosive chemicals are acids such as hydrochloric acid, acetic acid and sulfuric acid. Corrosive bases include chemicals such as sodium and potassium hydroxide. Strong oxidizers such as hydrogen peroxide are also corrosive. Some solids such as phenol can also be corrosive. Corrosive gases include chlorine and ammonia.

Hazards

The primary hazard of corrosives is their ability to permanently destroy living tissue at the point of contact.

Control of Hazards

General

Use the smallest quantity possible. Use less corrosive chemicals whenever possible. In the case of solutions, use the most dilute solution possible. Corrosive chemicals that are gases or give off corrosive fumes must be used inside a fume hood. Many strong acids and bases produce fumes. Do not add water to concentrated acids and bases. Acids and bases should be added to water slowly with stirring. Heat will be generated when mixing strong acids and bases with water.

Exposure Control

Fume Hood

All manipulation of corrosive chemicals, especially gases and liquids that generate fumes, must be carried out in a fully functional fume hood. Many acids and bases generate fumes that must be contained.

Safety Shower and Eye Wash

A functional safety shower and eyewash station must be available within the lab or in a very nearby location (for example immediately across the hall).

Personal Protective Equipment (PPE)

Gloves

Disposable nitrile gloves are the minimum level of protection that must be worn when handling corrosives. This type of glove is intended for incidental contact only, not for prolonged exposure. If gloves are exposed, they should be removed immediately.
Different gloves must be worn for continuous contact with corrosives, such as in the case of an acid or base bath. Butyl gloves designed for this purpose should be used.

Eyewear

Safety glasses or goggles should always be worn when handling corrosive liquids. A splash directly into an eye could result in catastrophic eye damage. When creating a large amount of dilute solution from concentrated acid or base, a face shield should be worn.

Skin and Body Protection

A properly fitted lab coat is required when dealing with corrosive liquids. Long pants, long sleeved shirt and closed toe shoes are also required.
When diluting a large quantity of a corrosive chemical or using an acid or base bath, a chemical apron should be worn.

Emergency Procedures

Exposure

If immediate emergency medical attention is required, contact 911. For minor exposures contact Environmental Health and Safety and/or the Chemical Hygiene Officer.

Skin Contact

Flush skin with cool water. Use the closest available source of water. Remove any contaminated clothing. If necessary, utilize safety shower.

Eye Contact

Activate the closest eye wash and flush eyes while holding eyelids open. Continue flushing eyes for at least 15 minutes.

Inhalation

Immediately move outside to fresh air.

Ingestion

Immediately obtain medical attention.

Spill

Depending on the size of the spill and the nature of the chemical, lab personnel may be able to clean up a spill on their own. **Students should never clean up a corrosives spill unsupervised.**
Small Spill (<100 mL for high concentration, <1 l for low concentration)
Depending on the quantity, concentration (if applicable) and other hazards, the PI or AI may clean up a spill on their own. Acid and base neutralizers are available in the spill kits. If the PI or AI determines it safe, they can clean up the spill and treat the clean-up materials as hazardous

waste.

Large Spill
Lab workers should exit the lab and contact the person in charge of the lab as well as Environmental Health and Safety and/or the Chemical Hygiene Officer.

Storage and Transport

Storage Notes
Corrosive liquids vary in their properties and therefore cannot all be stored in the same location.

Inorganic acids should always be stored in acid or base specific corrosive cabinets. Bottles should always be tightly closed to avoid fumes building up in the cabinet.

Oxidizing inorganic acids such as nitric acid should also be stored in corrosives cabinets, but should be stored separately from non-oxidizing acids such as hydrochloric acid.

Organic acids such as formic or acetic acid are flammable and should be stored with other flammable liquids. The lid should always be tightly closed to avoid build up of fumes.

Lower concentrations of acids (eg 1M Hydrochloric acid) can be stored outside of corrosives cabinets.

Solid corrosives such as sodium hydroxide may be stored outside of corrosives cabinets.

Corrosive gases such as hydrogen chloride are extremely hazardous and special consultation with EHS is required before use. Corrosive gases must always be stored inside of a functional fume hood.

Transport
Corrosive liquids must always be transported using a bottle carrier. Lecture bottles of corrosive chemicals must be transported using a lecture bottle carrier.

Waste Disposal

Corrosive chemicals should always be treated as hazardous waste.

Appendix H -CHP Revision History

Version	Description of Change	Revision Effective Date	Revision Completed By
A	Original Program	2022	Jonathan Witt
B	• Updated responsibilities. • New labeling for secondary containers. • Adopted new general lab safety measures. • Added peroxide former policy. • Added Standard Operating Procedures for PHS, methylene chloride. • Added information and guidelines concerning chemical exposures. • Updated incident report form. • Updated hazardous waste guidelines. • Updated training procedures. • Added lab inspections. • Added approval section. • Added lab safety committee.	September, 2025	Jonathan Witt, Wade Behnke