BRIGHAM YOUNG UNIVERSITY

CHEMISTRY AND BIOCHEMISTRY DEPARTMENT

CHEMICAL HYGIENE AND SAFETY PLAN

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Table of Contents

1. OVERVIEW 3

1.1 PURPOSE 3
1.2 SCOPE 3
1.3 RESPONSIBILITIES 3
1.3.1 Department Chair 3
1.3.2 Department Safety Consultant (DSC) 4
1.3.3 Principal Investigator (PI)/ Laboratory Supervisor (LS) 4

2. TERMS AND DEFINITIONS 5

3. SAFETY CONTROLS 6

3.1 ELIMINATION 6
3.2 SUBSTITUTION 6
3.3 ENGINEERING 6
3.4 ADMINISTRATIVE 6
3.5 PPE 7

4. ELIMINATION/ SUBSTITUTION 7

4.1 SOPS 7
4.2 SDSS 7

5. ENGINEERING CONTROLS 8

5.1 FUME HOODS 8
5.1.1 Use 8
5.1.2 Maintenance 10
5.1.3 Location 10
5.2 EYE WASH STATION 10
5.2.1 Use 10
5.2.2 Maintenance 11
5.2.3 Location 11
5.3 SAFETY SHOWERS 11
5.3.1 Use 11
5.3.2 Maintenance 12
5.3.3 Location 12
5.4 SPILL KITS 13
5.4.1 Use 13
5.4.2 Maintenance 13
5.4.3 Location 13
5.5 SAFETY CARRIERS 13
5.5.1 Use 13
5.5.2 Maintenance 14
5.5.3 Location 14

6. ADMINISTRATIVE CONTROLS 14

6.1 TRAININGS 14
6.2 ACCIDENT REPORTING 15
6.3 RECORD KEEPING 15
6.4 WASTE DISPOSAL 16

7. PERSONAL PROTECTIVE EQUIPMENT 19

7.1 BODY PROTECTION 19
7.2 HAND PROTECTION 20
7.3 EYE/FACE PROTECTION 20

APPENDIX A – STANDARD OPERATING PROCEDURE TEMPLATE 20

1. Overview

1.1 Purpose

The Chemistry/Biochemistry Department at Brigham Young University has developed a Chemical Hygiene Plan (CHP) to explain the policies and procedures that will promote the safe operation of the institution's teaching and research laboratories. In addition, the CHP satisfies the requirements of the U.S. Department of Labor, Occupational Safety and Health Administration (OSHA), 29 CFR Part 1910.1450, Occupation Exposures to Hazardous Chemicals in Laboratories. This Hygiene Plan is designed for those individuals that work within the Chemistry/Biochemistry Department at Brigham Young University, Provo, Utah.
This department plan establishes the minimum requirements and procedures that individuals working in laboratories or using hazardous materials must follow to protect individuals and property. Many of the health hazards associated with storing, handling, and using hazardous materials are outlined in the University Laboratory and Chemical Safety Program (BYU LSCP).

Many policies and practices may not be part of the CHP, but the policies and practices may be crucial to the planning process to maintain a safe environment for employees and students. Individual laboratories within the Chemistry/Biochemistry Department should have their own Chemical Hygiene Plan, in accordance with OSHA 1910.1450 and OSHA 1910.1030, but may use this document as a reference. If this is used as a reference than individual labs should have Standard Operating Procedures (SOP) to supplement anything that may be lacking. As such, questions regarding potential hazards should be addressed to the principal investigator or laboratory supervisor.

1.2 Scope

The CHP provides specific laboratory practices designed to minimize the exposure of employees to hazardous substances. Employees should follow the practices specified in the CHP to minimize their health and safety risks.

It is prudent to minimize all chemical exposures because most laboratory chemicals present hazards of one type or another. Employees will follow general precautions for handling all laboratory chemicals. Specific guidelines for chemicals should be found in their corresponding Safety Data Sheet (SDS).

Employees are cautioned against the underestimation of risk; exposure to hazardous substances should be minimized. The decisions to use a particular substance will be based on the best available knowledge of each chemical's particular hazards and the availability of proper handling facilities and equipment. Substitutions either of chemicals, demonstrations, or experiments, will be made where appropriate to reduce hazards without sacrificing instructional objectives. If the risk outweighs the benefit, then the experiment or procedure should be reevaluated.

1.3 Responsibilities

1.3.1 Department Chair

The Department Chair and Associate Chairs have the overall responsibility for ensuring that wok performed within the Chemistry/Biochemistry Department is compliant with health and safety regulations. The following points demonstrate specific ways that this is accomplished:

- Approve/Create Safety Policies
- May review, approve, or disallow any laboratory SOP that uses highly hazardous materials.
- Provide laboratories with exposure controls and other necessary safety equipment.
- Review and approve use of restricted chemicals. Including: highly toxic, explosive, unstable, highly reactive, regulated, or otherwise dangerous chemicals used in the department (refer to Attachment

#12 – Restricted Chemicals).

- Enforce laboratory safety through implementing findings of the annual lab inspections by Risk Management and, if necessary, disciplinary actions (e.g., Chemistry Laboratory Safety Progressive Warning Policy).

1.3.2 Department Safety Consultant (DSC)

Under the authority delegated by the Department Chairs the DSC is responsible for promoting and maintaining a safe workplace as well. The DSC works with PIs and Risk Management in the adaptation and implementation of the Chemical Hygiene Plan. Specific responsibilities include:

- Act as the safety conscience of the Chemistry and Biochemistry Department.
- Review the Chemical Hygiene Plan annually for the department.
- Assist each faculty member in implementing and complying with university safety and health policies.
- Ensure proper compliance with Federal and State laboratory and safety regulations.
- Conduct informal lab assessments to promote compliance with existing policies.
- Communicate information on health and safety policies to faculty and staff.
- Conduct or coordinate routine safety training sessions for students and visitors upon request.
- Assist laboratory personnel with evaluating, preventing, and controlling hazards.
- Coordinate laboratory hazard assessments with Risk Management.

1.3.3 Principal Investigator (PI)/ Laboratory Supervisor (LS)

Each Principal Investigator plays a critical role in the implementation of the Chemical Hygiene Plan. The PI has the primary responsibility for compliance in safety in their lab, their responsibilities include:

- Be aware of the sections of this Hygiene Plan and read all sections that pertain specifically to your lab and implement the provisions and requirements.
- Develop SOPs that are lab specific, covering any processes that are not covered under the department's hygiene plan.
- Ensure laboratory workers have appropriate safety training. See the training requirements in the next section.
- Document required training and when training was completed (see Attachments 8a and 8b, TRAINING DOCUMENTATION FORM). Keep records of each student or employee working in your lab.
- Identify hazardous conditions or operations in the lab which are beyond what is taught in Chemistry 201/601. Perform a lab hazard assessment including specific processes.
- PI/Lab Supervisor is responsible for guest safety in their laboratory. Ensure guests are accompanied and they wear appropriate personal protective equipment and are aware of hazards specific to the laboratory.
- Oversee safety compliance of university safety policies and this safety plan with each graduate student, TA, or undergraduate student, employee, or lab guest who works in your laboratory.
- Report significant laboratory accidents and injuries to Risk Management and Safety through submitting a Supervisor Incident Report Form found on the Risk Management website under Insurance Department tab. If you have questions about the form, contact Risk Management.

- Investigate near misses and/or accidents that occur in the laboratory and revise written SOP(s) as necessary to prevent future accidents.
- Notify the Chemistry Department Consultant if you encounter a need for safety equipment that you cannot address.
- Request necessary approval for the use of restricted chemicals and gases from Risk Management and the Department office.
- Conduct and document periodic and an annual safety review of your laboratory.
- Discuss safety topics at the beginning of the heavy research period and/or semester.

2. Terms and Definitions

Benson Building (BNSN) - Building on Brigham Young University campus housing the Chemistry and Biochemistry department and many labs.

Nichols Building (NICB) - Building on Brigham Young University campus where the Central Chemistry Stockroom (CCS) is located. Connected to the Benson building.

Code of Federal Regulations (CFR) - The codification of the general and permanent rules and regulations published in the Federal Register by the executive departments and agencies of the federal government of the United States.

Occupational Safety and Health Administration (OSHA) - Federal administration established after the passing of the Occupational Safety and Health Act of 1970. Regulates lab practices with the Lab Standard (29 CFR 1910.1450).

Environmental Protection Agency (EPA) - Established in 1970, this federal agency is responsible for the protection of human health and the environment.

Resource Conservation and Recovery Act (RCRA) - The principal federal law in the United States governing the disposal of solid waste and hazardous waste. Established in 1976, this Act gives the EPA the authority to control hazardous waste from cradle to grave.

Personal Protective Equipment (PPE) - Equipment worn to minimize exposure to hazards and decrease risk of injury.

Principal Investigator (PI) – The principal investigator is the individual responsible for the management, preparation, and administration of a research grant and/project. In this department, often times, the professor doing research in the lab is designated as the PI.

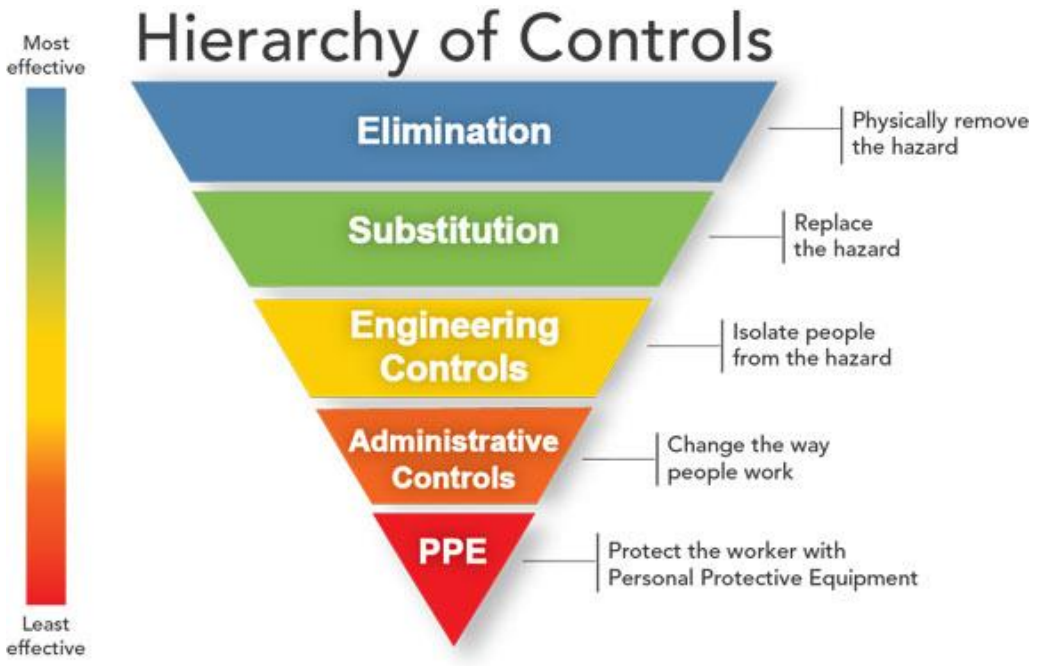
Radio-Frequency Identification (RFID) - RFID tags are used as a tool for chemical inventory across the Brigham Young University campus. This 1 in. X 1 in. tag will be placed on all hazardous chemicals that are ordered onto campus and are needed to complete chemical inventory for labs. For this reason, please do not remove them.

Safety Data Sheet (SDS) - Information provided with chemicals and substances that are hazardous.

Standard Operating Procedures (SOP) - Steps and instructions on how to complete a task, procedure, experiment, etc.

3. Safety Controls

Controlling exposures to occupational hazards is the fundamental method of protecting workers. Traditionally, a hierarchy of controls has been used as a means of determining how to implement feasible and effective control solutions. In this section each step of the hierarchy will be defined. The Hierarchy of Controls will also serve as a framework, of sorts, for this Hygiene Plan.



3.1 Elimination

As defined in the graphic above, elimination is the action of completely removing a hazard from the work area. This will completely remove any risk associated with an experiment, procedure, or lab practice. It is the most effective safety measure as it completely takes the hazard out of the picture.

3.2 Substitution

Substitution, the second most effective hazard control, involves replacing something that produces a hazard with something that does not produce a hazard or produces a lesser hazard.

Elimination and Substitution are often grouped together, but for the purposes of this Hygiene Plan they will be their own categories of safety measures. There are specific safety measures that fall into each category.

3.3 Engineering

This safety control is defined as any physical object that removes hazardous conditions from the working area or places a barrier between the worker and the hazard. While still effective in mitigating hazards engineering controls need maintenance and there is always risk of it malfunctioning or not working properly. Any engineering control measures must be maintained and serviced regularly. Engineering controls should also not interfere with work activities or impose on worker comfort.

3.4 Administrative

Administrative controls are trainings, procedures, policies, or shift designs that lessen the threat of a hazard to an individual. Administrative controls typically focus on changing behaviors of people rather than removing the actual hazard from the working environment.

3.5 PPE

PPE is equipment worn to minimize exposure to hazards that cause serious workplace injuries and illnesses. Causes of such injuries may be from contact with chemical, radiological, physical, electrical, mechanical, or other workplace hazards. While effective when used correctly, PPE may malfunction, be worn incorrectly, or be forgotten by the worker. PPE is always recommended to be used in conjunction with other safety controls.

4. Elimination/ Substitution

4.1 SOPs

An SOP is a set of written instructions that document an activity followed by an organization. The development and use of SOPs provides individuals with the information to perform a job properly and safely, and facilitates consistency in the quality and integrity of a product or end-result. For this department, specifically, SOPs are written safety and health guidelines to be followed when laboratory work involves the use of hazardous chemicals. They are ***required*** as a part of a laboratory-specific Chemical Hygiene Plan. It is a responsibility of the PI or laboratory supervisor to determines which laboratory activities need an SOP. The OSHA Laboratory Standard [29 CFR 1910.1450(e)(3)(i)] explicitly requires "standard operating procedures relevant to safety and health considerations to be followed when laboratory work involves the use of hazardous chemicals." SOPs must be written to fulfill this requirement.

There is an online database of SOPs available through the department's website. PIs and lab workers are encouraged to update this database for use in their lab and a collaborative effort between labs. Some labs may be conducting a similar procedure and could use an already existing SOP. This site can be accessed through this link: https://sop.chem.byu.edu/

An outline for what is required in an SOP and how to create one can be found in Appendix A.

4.2 SDSs

The OSHA Laboratory Standard [29 CFR 1910.1450] defines a hazardous chemical as "any element, chemical compound, or mixture of elements and/or compounds which is a physical or health hazard." Examples of substances that can cause physical hazards include; combustible liquid, a compressed gas, explosive, flammable, an organic peroxide, an oxidizer, pyrophoric, unstable (reactive) or water-reactive. These chemicals can usually be safely used if the specific hazard(s) are understood, and measures are taken to address the hazards. If appropriate precautions are not taken, a fire, an explosion, unwanted corrosion, personal injury, or property damage could occur. Examples of substances that can cause health hazards include; carcinogens, irritants, reproductive toxins, teratogens, corrosives, sensitizers, radioactive material, neurotoxins, biohazards, hepatotoxins, nephrotoxins, hematotoxins, agents that damage the lungs, skin, eyes, or mucous membranes.

In most cases, the label on the chemical bottle will indicate if the chemical is hazardous, and what hazards it does pose. Look for key words like caution, hazardous, toxic, dangerous, corrosive, irritant, carcinogen, etc. Old containers of hazardous chemicals (before 1985) may not contain hazard warnings and should be researched before use to determine what hazards may be present when using the chemical. If you are not sure a chemical you are using is hazardous, review the SDS or contact your supervisor, instructor, or the Risk Management Department.

SDSs are crucial for lab safety and the safe handling of chemicals and should be consulted often, especially in cases where a new or unknown chemical is required for a procedure. They are also required to be kept and maintained for any new chemical that comes into a lab [29 CFR 1910.1450(h)(1)(ii)], existing chemical in the

lab, and any chemical that is created in a lab and is to be moved out of the producing lab [29 CFR 1910.1450(h)(2)(iii)]. The location and availability of known reference material on the hazards, safe handling, storage, and disposal of hazardous chemicals must be found in the laboratory including, but not limited to, Safety Data Sheets [29 CFR 1910.1450(f)(3)(v)]. Either printed or kept online, the location of this information must be made known and made available to all lab workers.

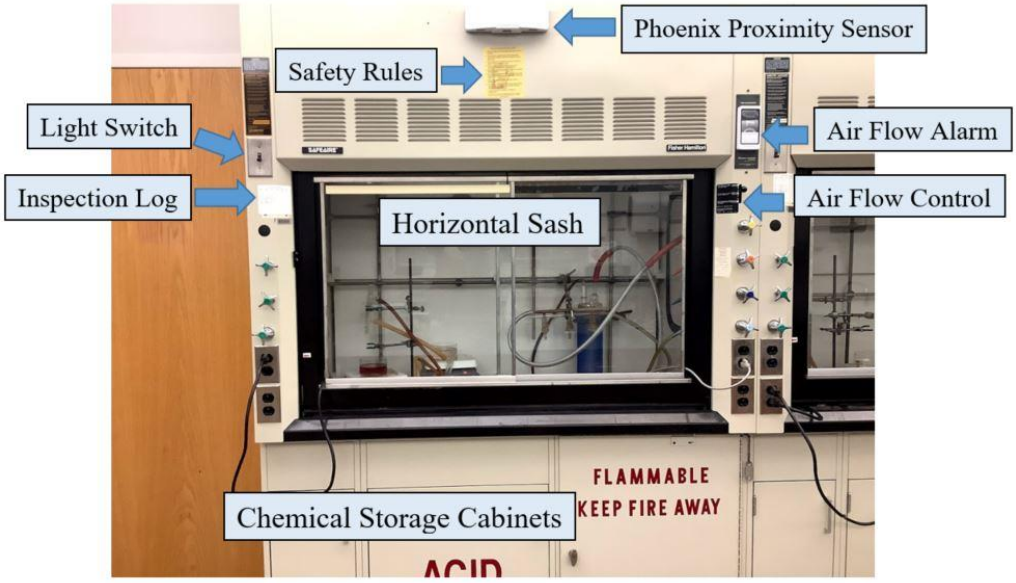
There is an online SDS database available through the department's website. This database is updated as chemicals arrive on campus, before they are delivered to the ordering lab. This site can be accessed through this link: https://chemmanagement.ehs.com/9/e22bd9b4-39d0-4cd9-9a1d-1b9448f105ef/ebinder/?nas=True

5. Engineering Controls

5.1 Fume Hoods

Laboratory hoods are designed to protect the individual from exposure to chemical hazards. Fume hoods are the most important components used to protect laboratory personnel from exposure to hazardous chemicals and agents. Large volumes of air are drawn through the face and out the top into an exhaust duct to contain and remove contaminants from the laboratory. A well-designed hood, when properly installed and maintained, offers a substantial degree of protection to the user and other people in the laboratory. Protection is contingent on proper use and understanding the limitations.

NOTE: **Chemicals should NOT be stored in a hood. Cabinets below the hood are designed for chemical storage.**



5.1.1 Use

Variable Air Volume Chemical Fume Hoods

All of the exhaust hoods are designed to protect workers from chemical vapors and to optimize the air flow required to do this job. The air flow regulator for each hood and room is controlled by microprocessors located in the corridor. The microprocessors are then tied to a master control which regulates the speed of the building's supply and exhaust fans. The energy required to condition building air is wasted when hood sashes are left open unnecessarily.

Use the hoods correctly or they will not give you the protection that you are expecting. If your head is in the hood, you are not protected from the fumes in the hood–you are in the fumes. If you have the sash up and the sliding glass doors open, you are exposing yourself to the fumes you are trying to avoid.

All chemical fume hoods have the following characteristics.

1. Vertical and horizontal sliding sashes have detectors to indicate when they are open or closed, and these automatically adjust exhaust and supply air flow to compensate for changing openings.
2. The hoods have both infrared and motion detectors with which they can determine “in use" status. When someone approaches a hood, air flow increases. When they walk away, in a few seconds to minutes (programmable) the hood air flow will drop to a lower level (programmable) in order to conserve energy.
3. An alarm will sound if air flow drops below a set velocity. Do NOT mute the alarm on a hood or continue to use it. The alarm is sounding for a reason and necessary repairs should be made so that it is not necessary to mute the alarm.
4. There may be an exception when the hoods are turned to EMERGENCY for forced ventilation. Putting the hood on emergency usually activates the alarm and in this case the alarm may be muted for the duration of the emergency use of the ventilation system.
5. Each hood has a bypass feature which allows it to still move minimal amounts of air with the sashes closed. The hoods are designed to be normally closed. Hoods left open overnight or for extended periods cause unnecessary filtering, cooling and/or heating of building air. Close hood sashes when experiments in the hood are not being accessed.
6. The building exhaust, air supply, and hood systems are connected to the emergency power generator system that will provide minimal ventilation and exhaust during a main power outage.
7. Hood sashes should be closed (and the building evacuated) during a power outage. The ALARMS ON THE HOODS WILL AUTOMATICALLY ACTIVATE.
8. Hoods are equipped with baffles which are manually adjustable with a lever from the front of the hood.
9. Hood sashes can be raised above the level of the normal "stop" to insert apparatus. THIS WILL NORMALLY ACTIVATE THE ALARM SYSTEM because the air flow is not adequate. Do not leave the sash above this "stop" when performing experiments. Hoods cannot maintain the necessary 100-ft. per second airflow in the fully open position.
10. If you need extra ventilation in a laboratory due to a spill or other problem, the hoods may be raised to the stop, turned to EMERGENCY operation, and muted.
11. Do NOT open the sliding windows as well as raise the sash. This will recirculate bad air into the laboratory.
12. Hoods are tested semiannually for Snorkel Fume Exhausts

The snorkels installed in many labs are adjustable devices, and each unit is furnished with a "normally-closed-when-not-in-use" butterfly valve. Some of these valves may be accessible only above the ceiling tile and are not intended for frequent changes. The flexible ducting is stainless steel. Other flexible ducting can be installed if needed. Several labs have a snorkel on/off switch to control all locations in the room.

Specialty Hoods for Particularly Hazardous Substances

Various types of hoods are designated for specific hazardous substances. A few of these substances are: perchloric acid, fluorine, and select carcinogens.

Perchloric acid hoods are stainless steel hoods with a special wash-down feature that allows for the safe removal of any organic perchlorates that may have formed in the course of perchloric acid digestions. The hood is designed to have a completely separate venting. All waste generated while working in this hood needs to be handled through Materials Management (2- 6452). Do not pour waste into the drain or the water wash system of the hood!

A fluorine hood is for working with fluorine gas. It is a stainless steel hood with completely separate venting designed to prevent the mixing of the fluorine gas with any other materials. Such mixing could result in an explosion due to incompatibilities.

Carcinogen hoods are located in an isolated area where a shower for decontamination, a changing area, and a warning light to allow others to avoid the area while work is being conducted. This is a stainless steel hood with completely separate venting.

Biosafety Cabinets (BSCs) are special hoods for work with pathogenic microorganisms. Each is designed with HEPA filtration to remove microorganisms.

5.1.2 Maintenance

Fume hoods and other protective equipment that are "in service" shall be maintained so that they function properly. Lab fume hoods are to be inspected regularly to ensure proper functioning and adequate performance. Engineering controls and personal protective equipment must be used in accordance with manufacturer recommendations. When necessary, the repair of these items is coordinated through Risk Management and/or the Physical Facilities Department to ensure a timely and effective repair process.

5.1.3 Location

Fume hoods are located in each lab in the department that requires such engineering controls. When working in a lab be sure to know exactly where the hood is and how to properly use it.

5.2 Eye Wash Station

Use in an emergency to flush chemicals which have accidentally come in contact with laboratory personnel. Eye wash stations are for use with minor splashes to the face or body. When treating chemical exposure with an eye wash station, immediately flush with copious amounts of water for a minimum of 15 minutes. Do not hesitate to use the safety showers when an accident occurs. Although there is not currently a drain below the shower and eye wash station, cleaning up the water is a small price compared to a small accident getting worse.

5.2.1 Use

In the event of a chemical splashing in your face or on an isolated part of your body, use the eye wash station to flush the area and wash away the chemical. Place the exposed area right above the eye wash spouts and press the activation handle forward. This will spray water from the spouts and will flush out the chemical. No matter the substance, always flush the area with water for at least 15 minutes. Water will dispel from the drainpipe so make sure the drain bucket is underneath the pipe at all times.

The area around the eye wash station is **NOT** A STORAGE AREA and must be kept clear at all times. This will allow for easy access to the eye wash and shower in the event of an emergency.

5.2.2 Maintenance

Eye wash stations are checked once a week to assure they are working properly. This is also done to ensure that water is cycled through the pipes to prevent stagnant water and mineral build up. In depth inspections should be conducted once a year and are done through Risk Management. If you have questions about eye wash station maintenance, or need to request an inspection, please contact Risk Management.

5.2.3 Location

Eye wash stations are located in each lab in the department that requires such engineering controls. They are often immediately inside the lab by the door, or located in one of the corners at the front of the lab. Although the design may be different from lab to lab, the function of the eye wash station is the same. When working in a lab be sure to know exactly where the eye wash station is and how to properly use it.

NOTE: **Do <u>NOT</u> store chemicals, lab equipment, or garbage around the Eye Wash/ Safety Shower station. This will prevent easy and quick access to it in the event of an emergency.**

<u>5.3 Safety Showers</u>

Use in an emergency to flush chemicals which have accidentally come in contact with laboratory personnel. Safety showers should be used when a major chemical splash occurs. When treating chemical exposure with a safety shower, immediately flush with copious amounts of water for a minimum of <u>15 minutes</u>. Do not hesitate to use the safety showers when an accident occurs. Although there is not currently a drain below the shower and eye wash station, cleaning up the water is a small price compared to a small accident getting worse.

5.3.1 Use

In the event of a major chemical splashing in or on a large part of your body, use the safety shower station to flush the area and wash away the chemical. To prevent further spread of the chemical, you may need to

remove articles of clothing to fully wash the effected body parts. For this reason, there is a curtain that can be drawn for privacy. When the activation handle is pulled, water will fall from the shower head and completely cover the user in water. No matter the substance, remain under the water for a minimum of 15 minutes. Do not hesitate to use the safety showers when an accident occurs. Although there is not currently a drain below the shower and eye wash station, cleaning up the water is a small price compared to a small accident getting worse.

The area around the eye wash station is **NOT** A STORAGE AREA and must be kept clear at all times. This will allow for easy access to the eye wash and shower in the event of an emergency.

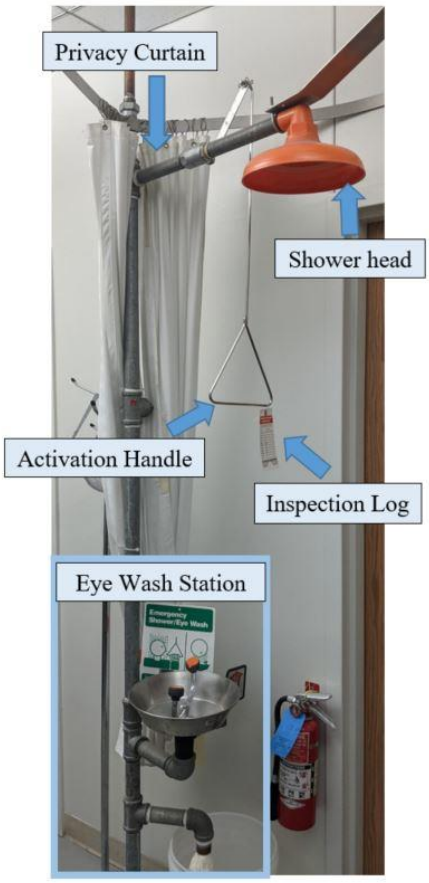
5.3.2 Maintenance

Safety shower stations are checked once a week to assure they are working properly. This is also done to ensure that water is cycled through the pipes to prevent stagnant water and mineral build up. In depth inspections should be conducted once a year and are done through Risk Management. If you have questions about safety shower station maintenance, or need to request an inspection, please contact Risk Management.

5.3.3 Location

Safety shower stations are located in each lab in the department that requires such engineering controls. They are often immediately inside the lab by the door, or located in one of the corners at the front of the lab. Safety showers are part of the same set up as eye wash stations. Although the design may be different from lab to lab, the function of the safety shower is the same. When working in a lab be sure to know exactly where the safety shower is and how to properly use it.

NOTE: **Do NOT store chemicals, lab equipment, or garbage around the Eye Wash/ Safety Shower station. This will prevent easy and quick access to it in the event of an emergency.**



5.4 Spill Kits

A spill kit should be made available in every lab that works with, produces, or uses chemicals for any reason. Be sure to have a spill kit on hand that will contain and clean up the specific chemicals in your lab.

5.4.1 Use

A basic chemical spill kit consists of a broom and dustpan, citric acid, sodium bicarbonate, gloves, scoop, kitty litter, and a storage bucket. The broom and dust pan are for sweeping up any glass or material from the container a chemical was in. They are *not* to be used to sweep up the chemical itself. This would be improper clean-up and, if the chemical was a powder, would suspend it in the air and put the person cleaning up at risk of further exposure. The citric acid is to neutralize bases and the sodium bicarbonate is for neutralizing acids. Be sure to consult an SDS for the spilled chemical before attempting clean-up so you know which one to use and how to deal with it properly. The gloves are PPE for chemical clean-up. The scoop is to use with the chemicals in the kit (citric acid, and sodium bicarbonate). The kitty litter is to be used to absorb the spill when needed.

There are specific kinds of chemical spill kits for specific chemical spills. The above information is for general use and purposes. There are specific spill kits for Hydrofluoric Acid and Mercury. These kits will have chemicals compatible with cleaning up those chemicals. If you are in a lab that uses those chemicals, be sure to have those specific kits on hand.

5.4.2 Maintenance

It is the responsibility of the lab and lab workers to maintain and stock the needed materials for their chemical spill kits. Resources can be found through BYU Risk Management, or on the chemistry department website, under the Safety tab.

5.4.3 Location

Spill kits should be kept in the lab where chemical hazards are present. They should be stored in an area that allows easy and quick access in the event of an emergency. When starting to work in a lab, or when completing trainings, make sure the location and contents of the chemical spill kit is known to everyone doing work in the lab.

5.5 Safety Carriers

Hazards can arise when transporting chemicals between labs, not just when they are in use in the lab. When transporting chemicals in glass containers, they should be carried in safety carriers. Each lab should have one or two, for use by lab personnel. However, they can be loaned out from CCS.

5.5.1 Use

A safety carrier should be used whenever you are transporting *liquid* chemicals that are in a *glass* bottle. This specific engineering control is intended to contain a spill if the chemical bottle does break while it is being transported. A lid should always be used with a safety carrier. It will not guarantee the bottle will not break. They should be used while transporting any chemicals outside of the lab, in public spaces. A safety carrier does not need to be used if a cart with a lip is available. This kind of cart will not only prevent a chemical bottle from falling off during transport, but will contain the spill within the lip of the cart of easy clean up and disposal. Any time a chemical is transported out of the lab, carried from another lab through a public space, or purchased from CCS and brought back to the lab, a cart with a lip, or a safety carrier must be used.

5.5.2 Maintenance

Safety carriers should be in good condition, without any cracks or holes. There is often a hole in the lid so it can fit around any neck a bottle has. However, other than that, the carrier should be solid and without cracks. A lid should be used at all times when a carrier is being used. This lid should fit well on the body of the carrier and should clip on securely. If a safety carrier is not in good condition, it is the responsibility of the lab to replace it. This is a measure to protect the person carrying the chemical as well as protecting those around them in public areas.

5.5.3 Location

Safety carrier should be kept in a known location in the lab. Everyone in the lab should know where these are so they can use them when needed.

6. Administrative Controls

Administrative controls are trainings, procedures, policies, or shift designs that lessen the threat of a hazard to an individual. Administrative controls typically focus on changing behaviors of people rather than removing the actual hazard from the working environment. Examples covered in this section are trainings, accident reporting, record keeping, and waste disposal policies.

6.1 Trainings

Each person doing work in a lab must be trained on how to properly, and safely execute lab procedures. There are responsibilities on the worker, the PI, and the university to assure this training happens. This section is split up into section explaining ways to deliver training for, and to, lab employees.

General Laboratory Safety Training

Ensure individuals (students, laboratory personnel) are trained on lab safety practices prior to their initial work assignment. Training will follow SOPs and OSHA (Federal) standards within the laboratories. Access to Safety training guides are found at Risk Management's website under trainings as well as the Departments website under Safety.

- Confirm that students have taken Safe Chemical Practices, Chem 201 for Undergrads, Chem 601 for Graduates. Chem 201/601 satisfies requirements for general lab safety training.
- Ensure individuals receive specific training for use of particularly hazardous substances like: select carcinogens, reproductive toxins, substances with high degree of acute toxicity, biological hazards, radioactive isotopes, high powered lasers, and strong magnetic fields.
- The PI determines what training will be performed and documented. See Attachments #8A &8B for training documentation form and a comprehensive list of all trainings offered through BYU.

Safety Education

PI/Lab supervisors are responsible to know the hazards of their work area(s), both the obvious dangers and those that may be brought about by inexperienced workers. The PI/lab supervisor will outline a safety training plan based on the hazards determined in their lab.

The safety education will include general laboratory safety, safe working practices, and safety rules specific to the labs. Continuing safety education should include familiarization to this document and safety topics found in SOPs specific for each lab. Personnel are responsible to:

- Know and observe accepted safety rules and procedures for their work area.
- Report any unsafe conditions or practices as soon as possible to the immediate supervisor for corrective action.
- Wear and/or use personal protective apparel (PPE)/equipment, as required, in the performance of job duties.
- Personnel are responsible to inform their supervisor if the safety apparel/equipment is lost, stolen, or becomes inoperable.
- Inspect work areas and equipment daily to keep them in proper operating condition.
- Report use of any medications which may impair his/her ability to safely perform job duties.
- Develop and maintain a safe working attitude.
- Set a safe example for co-workers.
- Avoid taking chances or unnecessary risks.
- Encourage the safe way to do things.
- Know how to use a fire extinguisher.
- Know basic first aid.

Safety Meetings

PI/Lab supervisors are responsible to discuss safety issues in their regularly scheduled laboratory meetings. If regularly scheduled meetings are not held, PI/Lab supervisors are responsible to hold periodic safety meetings with their personnel. Refer to Attachments #1, 2, 8A-B and 13 for safety training resources. The department safety consultant will be a resource for additional safety information.

6.2 Accident Reporting

An accident resulting in an injury requiring medical attention is to be reported to the PI/lab supervisor ***and*** Risk Management. Record information about the accident; who was effected, location, time, details – chemical exposure name of chemical, biological exposure – biological agent or blood, witnesses to the accident, time occurred, and other information which might assist with the investigation.

Follow all First-Aid procedures for different varieties of accidents. These emergency procedures should be covered in lab trainings, trainings found on BYU's MyAbsorb database, or in the procedure's SOP. If there is a hazard present in the lab that *could* cause an injury, all lab personnel should be trained on how to respond to that injury.

An injury/incident reporting form can be found through the Chemistry Safety website (https://safety.chem.byu.edu/) or can be directly linked to here; https://incident.byu.edu/forms/

6.3 Record Keeping

Records are kept for just about everything in a lab setting. From where safety showers are, to what chemicals are used in the lab, to unwanted lab material. The main thing each lab is responsible for keeping record of is trainings and chemicals being disposed of (Unwanted Lab Material). It is required by OSHA to keep track of what trainings each worker has had and if it is up to date. Under RCRA, all labs that produce or dispose of chemicals must keep track of what they are disposing (See section 6.4 of this document).

Trainings

BYU has a database of trainings called MyAbsorb (https://byu.myabsorb.com/#/dashboard) where trainings are offered and where records of who has completed what trainings is kept. Not everyone can access these reports,

however, the PI or supervisor of any lab can look up who has done what trainings. It is their responsibility to keep up on these reports and assure everyone in their lab is up to date on applicable trainings in their lab.

Learn how to run these reports here; https://byu.myabsorb.com/#/online-courses/bdb6a150-0e61-4f83-a8de-f13af252def4, and here; https://byu.myabsorb.com/#/online-courses/048a6f0c-dde5-42b8-a84c-6bc388672c1c

These will teach you how to navigate the site and how to run reports on specific people.

ULM

As a lab disposes of chemicals and material in their designated ULM container, a record of what is put in there should be kept. Information on ULM logs, containers, requesting a ULM pick-up, can be found here; https://risk.byu.edu/ehs/environmental/unwanted-laboratory-material-management, or can be linked to from the Chemistry safety site.

A log and a record must be kept for ULM containers for the safety of those in your lab as well as those picking up the container for disposal. Many times, materials put in the ULM containers are mixed and contain different chemicals that could become reactive if not treated properly.

6.4 Waste Disposal

Nearly everything we do leaves behind some kind of waste. Households create ordinary garbage. Industrial and manufacturing processes create both solid waste and hazardous waste. The EPA regulates all this waste under the RCRA. RCRA's goals are to: “protect us from the hazards of waste disposal; conserve energy and natural resources by recycling and recovery; reduce or eliminate waste; and clean up waste which may have spilled, leaked, or been improperly disposed of.” Hazardous waste comes in many shapes and forms, from laboratory wastes to used antifreeze to spent fluorescent bulbs. RCRA tightly regulates all hazardous waste from cradle to grave. These regulations are found in the Code of Federal Regulations under 40 CFR Parts 260 - 299.

Within your work area, the following practices must be followed for proper management and collection of hazardous waste:

- To determine if your unwanted materials pose a significant risk requiring management as hazardous waste, you must contact Environmental Management.
- To determine if chemical deactivation or drain disposal is an option, you must contact Environmental Management.
- Label containers of hazardous chemical wastes with the identity of the chemical(s) AND the words “Hazardous Waste”.
- Keep all containers of hazardous chemical wastes closed at all times when they are not in use.
- Store hazardous waste containers within the room in which they are generated in.
- Recommended practices that should be followed:
  - -Always maintain a neat and orderly workplace.
  - -Use secondary containment bins or trays to store your chemical waste containers in.
  - -Store your waste containers in a designated place.

Chemical Management personnel collect waste from laboratories. They can be contacted through the Risk Management website. All waste containers must be labeled appropriately. EPA regulations state that lids must be screwed on waste containers when waste is not being added or removed.

Chemical Waste

The following federal regulations apply to hazardous waste generated in laboratories. Any violation of these regulations may result in significant fines and loss of federal grants.

- No more than 55 gallons of waste may be stored in a laboratory. For acutely hazardous waste, this limit is reduced to one quart. Please contact Environmental Management if you have questions about whether your waste is acutely hazardous waste or not.
- Full containers must be marked with the date on which it was filled and they must be removed from the laboratory within three days (not three business days).
- The laboratory must be "under the control of the operator". This simply means that when nobody is in the lab the door must be locked.
- Waste containers must be in good condition and compatible with the type of waste being stored in them. Leaking containers are not acceptable.
- Containers must be closed at all times except when adding or removing waste. "Closed" means that no waste can evaporate out of the container and that no waste would spill if the container were to tip over.
- The container must be labeled with a description of its contents. This description must be in English and must include the chemical name. Chemical structures and/or formulas are not appropriate substitutes for their names. All components of the waste must be listed.
- Incompatible wastes must be kept segregated.
- Training is required for anybody generating and handling hazardous waste. If you have not been trained on hazardous waste regulations, contact Environmental Management immediately. Environmental Management will provide training during a laboratory staff meeting or at any time that is convenient for you.

The following are additional rules for our convenience in disposing of your waste.

- Please contact Environmental Management when the container is about to become full to request a pickup. Fill all waste containers to NO MORE than 90% capacity.
- Do not put solid waste into liquid waste containers. For example, paper towels should be stored in a plastic bag or in a solid waste container; they should not be placed into a container for liquids.
- Spill cleanups should be managed as hazardous waste. Place all of the contaminated items (paper towels, gloves, etc.) into a zip-lock bag. Label the bag with the material that was cleaned up and mark it with the date.
- Do not use red biohazard bags for chemical waste. They are to be used for biohazardous material only. If you are not sure whether your waste is biohazardous please contact Environmental Management.
- DO NOT GENERATE A MIXED WASTE. See section on mixed wastes below.

Biological Waste

General biohazardous waste in the lab is defined as waste contaminated or potentially contaminated with pathogenic microorganisms, sharps, and animal remains, or liquids with Biological Contamination.

- Environmental Management will not dispose of liquid biohazardous waste. This waste may be autoclaved or disinfected with bleach and flushed down the drain. It is also recommended to disinfect the sink with additional bleach after disposing of biohazardous waste.
- Urine and blood are not to be put into biological waste containers. If these fluids do not contain infectious agents, they may be discarded into the sanitary sewer. Sanitary sewer lines should be disinfected once per day or following disposal with a 1/10 dilution of household bleach. Fluids known to

have infectious agents should be disinfected with an appropriate chemical disinfectant or autoclaved before disposal. The autoclaved liquid may then be discarded into the sanitary sewer.
- Preserving solutions may not be flushed down the drain. The specimens must be removed from the solution and are disposed of as solid biological waste. The solution may then go to Environmental Management for hazardous waste disposal. See section on chemical waste.

Infectious waste may be autoclaved and discarded to the regular trash. A log of each autoclaved load must be maintained. A log should include information on the type of waste, operators name, temperature or pressure of the load, the date, and the duration of the cycle. Additionally, autoclaves must be checked once per week or once per load with a spore suspension or spore strip. After autoclaving, the waste should be placed in an opaque plastic bag or box and prominently marked as autoclaved waste. If the biohazard bag is still visible, the material is not properly packaged. E230 BNSN has an area designated for infectious waste.

Solids with Biological Contamination

- Biohazardous waste must be packaged in either a red biohazard bag or a bag which is labeled as biohazardous and displays the international biohazard symbol.
- In order to minimize our exposure to biohazards, we ask that bags of solid waste be closed and tied off before we pick them up.
- Keep all sharp materials separate. We will not accept biohazard bags that contain glass, needles, or blades.
- There may not be any liquids in the solid waste.
- Low-risk biohazard agents may be autoclaved and disposed of as regular trash. Before discarding make sure that the red biohazard bag is not visible. Place the waste in either an opaque plastic bag or in a cardboard box before discarding to the dumpster. The landfill employees really do not like to see red biohazard bags!
- If you do not have access to an autoclave, Environmental Management will accept your low-risk biohazard waste for disposal.
- High-risk biohazard agents must be both autoclaved and received by Environmental Management.
- Animal remains or specimens that are not preserved must be frozen. Environmental Management will only pick up frozen waste.
- "Sharps" include all needles and blades and must always be managed as biohazardous, even if they were only used with chemicals. They must be placed in an appropriate sharps container. Do not over-fill the container; it must be closed before we will pick it up. Broken glass may be managed as "sharps", but technically it does not have to be. See the section on glass below.
- DO NOT GENERATE ANY MIXED WASTE. See section on mixed waste below.

Glass

Some empty bottles, such as those that contained acutely hazardous materials must be managed as hazardous waste. However, most glass waste may be disposed of as regular trash. An empty container, defined as having less than 3% of the original volume, can be discarded into the normal trash. Do not ever put glass (especially broken glass) into the regular waste containers. This has caused accidents where custodians have cut themselves while removing waste. Attach a label to the **box or bucket,** that has a lid that can cover the top**,** which informs the custodians to place the container directly into the dumpster.

Paper and Plastic

Most paper and plastic waste generated in the laboratory may be disposed of in the regular waste containers. In some cases, such as spill cleanups or contamination with very hazardous materials, it may become necessary to dispose of paper and plastic as hazardous waste. In such cases, do not place these materials into containers of liquid hazardous waste. They may be collected in containers designated for solids debris only.

Other

Environmental Management also collects and recycles the following miscellaneous wastes:

- Batteries
- Oil-bearing devices (such as transformers)
- Circuit boards
- Aerosol cans (empty or full)

Please detach these items from equipment that is to be discarded and contact Environmental Management for their disposal. There are other regulated wastes generated on campus that are typically managed by other entities (physical facilities, custodians, etc.) These wastes include computers and monitors, fluorescent lights, electronic ballasts, and others. Be aware that if your lab does generate any of these items for waste, they may not be discarded in the trash.

7. Personal Protective Equipment

PPE is equipment worn to minimize exposure to hazards that cause serious workplace injuries and illnesses. Causes of such injuries may be from contact with chemical, radiological, physical, electrical, mechanical, or other workplace hazards. While effective when used correctly, PPE may malfunction, be worn incorrectly, or be forgotten by the worker. PPE is always recommended to be used in conjunction with other safety controls.

All personnel must wear closed toe shoes (not open sandals) while in laboratories. Long pants are also required in all labs where chemicals or other hazardous materials are used. Loose-fitting or hanging clothing (ties or scarfs) are not recommended. Long hair should be pulled back away from the face and secured behind the head.

Never wear shorts or sandals into a laboratory. They do not provide adequate protection for students or researchers working with chemicals or other hazardous materials. Jewelry and ties can be a hazard, become caught on equipment or keep chemicals in close contact with the skin.

7.1 Body Protection

Laboratory coats and aprons may be required depending on the type of work being performed. Remove coats and aprons prior to leaving the laboratory. Properly fitting lab coats (not too large or too small) are essential for lab safety. The cuff is off the sleeve not extending past your wrist. Launder the lab coat when they become dirty.

All personnel must wear closed toe shoes (not open sandals) while in laboratories. Long pants are also required in all labs where chemicals or other hazardous materials are used. Loose-fitting or hanging clothing (ties or scarfs) are not recommended. Long hair should be pulled back away from the face and secured behind the head.

Never wear shorts or sandals into a laboratory. They do not provide adequate protection for students or researchers working with chemicals or other hazardous materials. Jewelry and ties can be a hazard, become caught on equipment or keep chemicals in close contact with the skin.

7.2 Hand Protection

Wear gloves made of the appropriate material (e.g. nitrile, latex, vinyl gloves) when handling chemical or biological hazards in the laboratory. Refer to the MSDS and the SOP or procedure for the specified type of gloves.

- Always wear disposable gloves when handling human blood, human blood products, or other human or animal body fluids or tissues.
- Wear gloves when handling or mixing any mutagenic, carcinogenic, teratogenic, toxic, or other hazardous compound.
- Double gloving is strongly encouraged when working with blood products and hazardous chemicals not compatible with the glove type.

Do not wear contaminated gloves in public areas of the building. The gloves may carry contaminates which can expose non-laboratory workers, visitors, and students to the very hazards that require gloves in the first place. Even if your gloves are clean, bystanders may question whether or not those gloves are contaminated. Therefore, we adopt the common protocol of removing gloves each time we leave our laboratory area. Remove used gloves properly and dispose in designated receptacles in the laboratory. Wash hands with soap and warm water for at least 15 seconds immediately after removing gloves.

7.3 Eye/Face Protection

Wear safety glasses, goggles, or face shields when working with corrosive materials or other hazardous or infectious substances that can splash into the eyes. The type of eye protection required depends on the hazard. Consult SDS and SOP information for the procedure you are working on to assure you are using the proper eye protection. It is the responsibility of individual students to wear adequate protective eyewear as specified in the protocol being performed.

For persons requiring corrective lenses, over-the-glasses style safety spectacles are available. Contact lenses may be worn in most lab environments provided that the same approved eye protection is worn as required. If chemical vapors or corrosive or irritant liquids contact the eyes while wearing contact lenses, follow the emergency procedure of washing the affected areas with water for 15 minutes, remove the contact lenses, and seek medical attention.

Appendix A – Standard Operating Procedure Template

2.1 Title of Procedure

Should indicate the specific chemical, task or experiment for which it was written.

2.2 Description

Include a general description of what activities are covered under this procedure. List any specific examples of when the procedure must be implemented or any exemptions when the procedure is not required. If authorization for this procedure is limited to designated staff, that fact should be noted in this section.

2.3 Procedure

Enumerate or list the safety steps to be followed in performing the procedure. The steps should be sufficiently detailed, and should include any prohibited activities or any potentially dangerous conditions.

2.4 Potential Hazards

Complete the hazard description table for each of the principal materials utilized in this procedure. Material Safety Data Sheets, when available, should be obtained and attached to the procedures template. Many operations can result in secondary materials or hazardous by- products. A discussion of these materials should be included in this section if they represent a significant, but different hazard than the other materials.

2.5 Engineering/Ventilation Controls

Identify the engineering controls, such as lab chemical fume hoods, implemented to minimize exposures to hazardous materials and processes.

2.6 Required Personal Protective Equipment

Conduct a comprehensive Personal Protective Equipment (PPE) evaluation for the referenced materials or operation. The determination should include both the type of equipment, as well as the clothing materials. Refer to your Lab's PPE Assessment Report. Questions regarding the selection or procurement process should be directed to the lab safety representative/officer.

2.7 Additional Precautions

Indicate and describe any management approvals, medical surveillance, training or specific permits that must be obtained in order to conduct this procedure. Questions regarding applicability of these categories should be directed to the lab safety representative/officer or EH&S.

2.8 Safety References

Additional chemical safety information, including MSDSs and other information, is available electronically as tools at https://safety.chem.byu.edu/. Add any lab- specific information as appropriate.

2.9 Waste Disposal

Refer to the *Unwanted Lab Material (Waste)* section on https://safety.chem.byu.edu/. As appropriate, list any additional equipment, supplies or procedures that are unique to the referenced materials or operations.

2.10 Emergency Procedures

List any additional emergency equipment, supplies or procedures that are unique to the referenced materials or operations. For example, an antidote such as calcium gluconate should be present whenever work is conducted with hydrofluoric acid.