LABORATORY CHEMICAL HYGIENE PLAN

COLLEGE OF SCIENCE

UTAH VALLEY UNIVERSITY™

Revision 2.0 (January 2018)

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1.0 INTRODUCTION

This Chemical Hygiene Plan (CHP) was developed in response to the federal Occupational Health and Safety Administration (OSHA) regulation, *Occupational Exposures to Hazardous Chemicals in the Laboratory* (29 CFR 1910.1450), commonly referred to as the "Laboratory Standard".

The purpose of the CHP is to provide every aspect for prudent work practices and procedures for the procurement, storage, handling and disposal of chemicals in the laboratory, in order to protect all personnel from the potential health hazards of the chemicals they may encounter in the laboratory.

All faculty, lab managers, staff, student employees and research students who work with hazardous chemical must become familiar with the CHP. New employees and research students should review the CHP and receive safety training before beginning work with hazardous chemicals. The CHP is available on line in the document section of the laboratory safety web page at http://www.uvu.edu/csh/lab-safety.html. In addition a Hazard Communication poster has been prominently posted in all laboratories summarizing the CHP and listing the site for the laboratory web page.

2.0 SCOPE AND APPLICATION

The Utah Valley University (UVU) College of Science (CSH) is committed to providing a safe laboratory environment for its faculty, lab managers, staff, student employees, research students and visitors. The goal of the Laboratory Safety Program is to minimize the risk of injury or illness to laboratory workers by ensuring that they have the training, information, support and equipment needed to work safely in the laboratory.

The three basic elements of the Laboratory Safety Program are:

1. The departmental safety program led by the Chemical Hygiene Coordinator.
2. Laboratory safety support and training by the Chemical Hygiene Coordinator.
3. Instruction and oversight by an individual's Faculty/Laboratory Manager.

The CHP applies to all faculty, lab managers, staff, student employees, and research students who work with hazardous chemicals in any laboratory in the CSH. The policies and procedures established in the CHP will be incorporated as the standard of practice for the COS. Compliance with these policies and procedures and those of any regulatory agency will be required of all faculty, lab managers, staff, student employees, and research students as a condition of working in a laboratory.

3.0 ROLES AND RESPONSIBILITIES

3.1 Deans and Department Chairs

- Ensure that safety is adequately budgeted for the CSH/department.

- Communicate safe work practices regularly within the CSH/department.
- Assist the Faculty/Lab Manager or any other personnel with the safety process as needed or as requested.
- Uphold and enforce the policies and procedures contained in the CHP.
- Assist and back-up the Chemical Hygiene Coordinator in the implementation of the CHP.

3.2 Chemical Hygiene Coordinator (CHC)

- Establish and implement the CHP.
- Review and update the CHP at least annually.
- Investigate accidents and chemical exposures within the (COS).
- Attend departmental and university-wide safety meetings.
- Act as a liaison between COS and UVU Risk Management for laboratory safety issues.
- Maintain records of training, exposure monitoring and medical examinations.
- Ensure all faculty, staff, student employees, and research students receive laboratory safety training.
- Review and approve use of particularly hazardous substances (PHS).
- Work with administrators and other employees to develop and implement appropriate chemical hygiene policies and practices.
- Monitor procurement and use of chemicals in the lab, including determining that facilities and training levels are adequate for the chemicals in use,
- Perform regular, formal chemical hygiene and housekeeping inspections including inspections of emergency equipment,
- Help faculty and lab managers develop precautions and adequate facilities,
- Maintain current knowledge concerning the legal requirements of regulated substances in the laboratory,
- Maintain overall responsibility for the laboratory operation,
- Ensure that workers know and follow the chemical hygiene rules,
- Determine the proper level of personal protective equipment, ensure that such protective equipment is available and in working order,
- Monitor the waste disposal program

3.3 Faculty / Lab Managers

- Attend the laboratory safety training conducted by the CHP if faculty member/lab manager is teaching any laboratory involving hazardous chemicals our supervising research students that will be using any hazardous chemicals.
- Ensure laboratory safety training conducted by the CHC is given to new student employees, research students before given unsupervised access to any laboratory, and is followed up at the work level.

- Ensure employees and students are given training that includes safe work practices on equipment, tools, machines, processes, etc.
- Personally conduct or designate a qualified personnel to conduct regular inspections of the workplace.
- Conduct regular laboratory safety discussions especially prior to the start of any new project or experiment in the laboratory.
- Uphold and enforce the policies and procedures contained in the CHP. This includes influencing safe behavior by positive reinforcement such as recognition of worker's safe work performance. Enforcement action can also influence safe behavior when applied towards workers who blatantly perform unsafe acts, or who continually perform in an unsafe manner
- Investigate all incidents and take immediate corrective action to prevent re-occurrence
- Provide safety meetings on a regular basis and require attendance of all students

3.4 Student Employees and Research Students

- Attend the laboratory safety training conducted by the CHC before given unsupervised access to any laboratory.
- Uphold and enforce the policies and procedures contained in the CHP., and if they are unsure of what is the correct/safe way to perform a task or a job, they are to ask their instructor, lab manager, or teaching assistant
- Must immediately report all unsafe equipment or tools to their instructor, lab manager, or immediate supervisor or manager. This includes reporting unsafe behavior of other workers, if these workers are approached and remain unwilling to correct their unsafe actions or conditions.
- Are to uphold the policies and procedures outlined in the CHP and any other specific safe work practices that each individual department within the CSH has established
- If injured on the job, or become ill, immediately inform their supervisor, faculty mentor, and/or the CHC.

4.0 CHEMICAL AND HAZARD IDENTIFICATION

In order to ensure chemical safety in the workplace, information about the identities and hazards of the chemicals must be available and understandable to workers. OSHA's Hazard Communication Standard (HCS) requires the development and dissemination of such information:

- Chemical manufacturers and importers are required to evaluate the hazards of the chemicals they produce or import, and prepare labels and safety data sheets to convey the hazard information to their downstream customers;

- All employers with hazardous chemicals in their workplaces must have labels and safety data sheets (SDS) for their exposed workers, and train them to handle the chemicals appropriately.

4.1 Global Harmonized System of Classification and Labeling of Chemicals

The HCS is now aligned with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS). This update to the Hazard Communication Standard (HCS) will provide a common and coherent approach to classifying chemicals and communicating hazard information on labels and SDSs.

4.2 Hazard Classification

Under the HCS, any chemical that presents a physical hazard or a health hazard is considered a hazardous chemical. The HCS definitions for physical and health hazards are:

- **Physical hazard:** a chemical for which there is scientifically valid evidence that it is a combustible liquid, a compressed gas, explosive, flammable, an organic peroxide, an oxidizer, pyrophoric, unstable (reactive) or water-reactive.
- **Health hazard:** a chemical for which there is statistically significant evidence based on at least one study conducted in accordance with established scientific principles that acute or chronic health effects may occur in exposed employees. The term "health hazard" includes chemicals which are carcinogens, toxic or highly toxic agents, reproductive toxins, irritants, corrosives, sensitizers, hepatotoxins, nephrotoxins, neurotoxins, agents which act on the hematopoietic system, and agents which damage the lungs, skin, eyes, or mucous membranes.

4.3 Labels

4.3.1 Primary Containers

Chemical Manufacturers must label all chemicals using the format established in the HCS. The manufacturer's label should be kept intact. The Tables must contain the following elements:

- Name, Address and Telephone Number of the chemical manufacturer, importer or other responsible party.
- **Product Identifier** is how the hazardous chemical is identified. This can be (but is not limited to) the chemical name, code number or batch number. The manufacturer, importer or distributor can decide the appropriate product identifier.
- **Signal Words** are used to indicate the relative level of severity of the hazard and alert the reader to a potential hazard on the label. There are only two words used as signal words, “Danger” and “Warning.” Within a specific hazard class, “Danger” is used for the more severe hazards and “Warning” is used for the less severe hazards. There will only be one signal word on the label no matter how

HCS Pictograms and Hazards

Health Hazard  • Carcinogen • Mutagenicity • Reproductive Toxicity • Respiratory Sensitizer • Target Organ Toxicity • Aspiration Toxicity	**Flame**  • Flammables • Pyrophorics • Self-Heating • Emits Flammable Gas • Self-Reactives • Organic Peroxides	**Exclamation Mark**  • Irritant (skin and eye) • Skin Sensitizer • Acute Toxicity (harmful) • Narcotic Effects • Respiratory Tract Irritant • Hazardous to Ozone Layer (Non-Mandatory)
Gas Cylinder  • Gases Under Pressure	**Corrosion**  • Skin Corrosion/ Burns • Eye Damage • Corrosive to Metals	**Exploding Bomb**  • Explosives • Self-Reactives • Organic Peroxides
Flame Over Circle  • Oxidizers	**Environment** **(Non-Mandatory)**  • Aquatic Toxicity	**Skull and Crossbones**  • Acute Toxicity (fatal or toxic)

many hazards a chemical may have. If one of the hazards warrants a “Danger” signal word and another warrants the signal word “Warning,” then only “Danger” should appear on the label.

- **Hazard Statements** describe the nature of the hazard(s) of a chemical, including, where appropriate, the degree of hazard. For example: “Causes damage to kidneys through prolonged or repeated exposure when absorbed through the skin.” All of the applicable hazard statements must appear on the label. The hazard statements are specific to the hazard classification categories, and chemical users should always see the same statement for the same hazards no matter what the chemical is or who produces it.
- **Precautionary Statements** describe recommended measures that should be taken to minimize or prevent adverse effects resulting from exposure to the hazardous chemical or improper storage or handling. There are five types of precautionary statements:
    1) General
    2) Prevention (to minimize exposure)
    3) Response (in case of accidental spillage or exposure emergency response, and first-aid)
    4) Storage
    5) Disposal.
- **Pictograms** are graphical representation of the hazard of the chemical. The table below shows the symbol for each pictogram, the written name for each pictogram, and the hazards associated with each of the pictograms.

4.3.2 Secondary Containers

Secondary containers are defined as:

- A chemical transferred to another container for storage.
- A dilution of a liquid chemical transferred to another container for storage.
- A solution made from a solid transferred to another container for storage.
- Mixtures of multiple chemicals transferred to another for storage.

When a chemical, a dilution, a solution, or a mixture is transferred to another container for storage, the new container should be labeled with the name of the product, the chemical constituents, hazard warnings, and appropriate pictogram(s) (unless for immediate use) in accordance with the HCS. At a minimum the secondary container will have:

- A lid that can be secured to the secondary container
- The full name of the chemical (No chemical formulas or abbreviations)
- The Signal Word (Danger or Warning)
- The GHS pictograms
- The GHS hazard statements

4.4 Safety Data Sheets

Safety Data Sheets received with chemical shipments must be maintained and readily accessible to laboratory workers. Where there is less than ten chemicals in a specific laboratory, hard copies of the SDSs will be maintained in that laboratory. For all other laboratories faculty, lab managers, student employees, research students can access SDSs online. In case of power failure and/or the internet has gone done the CHC will maintain a library on a CD of the SDSs for all chemicals used on UVU's campus. All maintained SDS must be in compliance with the current HCS.

5.0 CHEMICAL HAZARDS AND EXPOSURE

The decisions one makes concerning the use of chemicals in the laboratory should be based on an objective analysis of the hazards, rather than merely the perception of the risks involved. Once this has been accomplished, a reasonable means of controlling the hazards through experimental protocol, work practices, ventilation, use of protective clothing, etc., can be determined.

In order to assess the hazards of a particular chemical, both the physical and health hazards of the chemical must be considered

5.1 Physical Hazards

Physical hazards include chemicals that are flammable/combustible, corrosive, explosive, and/or reactive. The best ways to prevent incidents involving these chemicals is to make sure they are stored (Section 6.0) and used/handled (Section 8.0) properly.

5.2 Health Hazards of Chemicals

Before using any chemical, the safety data sheet (SDS) or other appropriate resource should be reviewed to determine what conditions of use might pose a hazard. Accidents with hazardous chemicals can happen quickly and may be quite severe. The key to prevention of these accidents is awareness.

5.2.1 Toxic Effects of Chemical Exposure

There are several things to consider when discussing the toxic effects of chemical exposure

- **Dose** – How much of the chemical were you exposed to.
- **Exposure** – How long were you exposed to the chemical.
- **Locality** – The injury involves the area of the body that was exposed to the chemical.
- **Systemic** – Tissues or organs unrelated to the exposure site are affected.
- **Acute** – Effect result from a single, short exposure. The effects usually appear quickly and are often reversible.

- **Chronic** – Toxicity results from repeated exposure of a long period of time.

All of these are address on the SDS.

5.2.2 Routes of Entry

There are basically four ways for chemicals to enter the body.

1) **Absorption** – The simplest way for chemicals to enter the body is through direct contact with the skin or eyes.

   Skin contact with a chemical may result in a local reaction, such as a burn or rash, or absorption into the bloodstream. Absorption into the bloodstream may then allow the chemical to cause toxic effects on other parts of the body. The SDS usually includes information regarding whether or not skin absorption is a significant route of exposure. Symptoms of skin exposure include dry or whitened skin, redness and swelling, rashes or blister, and itching.

   Chemical contact with eyes can be particularly dangerous, resulting in painful injury or loss of sight. Symptoms of eye exposure include major eye burning/itching, redness, extreme tear production.

   Prevention is best achieved by using the appropriate personal protective equipment (PPE) (Section 9.0)

2) **Inhalation** – The respiratory tract is the most common route of entry for gases, vapors, particles, and aerosols (smoke, mists and fumes). These materials may be transported into the lungs and exert localized effects, or be absorbed into the bloodstream. Most chemicals have an odor that is perceptible at a certain concentration, referred to as the odor threshold; however, there is no relationship between odor and toxicity. Symptoms of exposure include headaches, increased mucus production, and eye, nose and throat irritation. Narcotic effects, including confusion, dizziness, drowsiness.
   Prevention is best achieved by using fume hoods when appropriate (Section 7.0) and keeping lids on chemicals.

3) **Ingestion** – Although direct ingestion of a laboratory chemical is unlikely, exposure may occur as a result of ingesting contaminated food or beverages, touching the mouth with contaminated fingers, or swallowing inhaled particles which have been cleared from the respiratory system. Immediate symptoms may include nausea or instant vomiting. Delayed symptoms may include extreme headache, dizziness, or narcotic effects.

Prevention is best achieved by following laboratory safe work practices (Section 8.0)

4) **Injection -** Injection may occur through mishaps with syringe needles, when handling animals, or through accidents with pipettes, broken glassware or other sharp objects that have been contaminated with toxic substances. Symptoms may include bleeding, nausea, extreme headache, dizziness, or narcotic effects.

   Prevention is best achieved by following laboratory safe work practices (Section 8.0) and disposing of sharps and broken glass appropriately (Section 10.0)

5.2.3 Permissible Exposure Limits (PEL)

Permissible Exposure Limits are established by OSHA. The PEL is how much chemical one can be exposed to before it is considered harmful to them. There are two PEL of concern:

1) **Time Weighted Average (TWA)** – How much chemical one can be exposed to over an eight hour period.
2) **Short Term Exposure Limit (STEL)** – How much a chemical one can be exposed to in a fifteen minute period. This is important if there is a spill. Chemicals with an extremely low STEL may require the use of a respirator during cleanup.

The TWAs and STELs of any chemical can be found in Section 8 of all SDSs.

6.0 CHEMICAL STORAGE

6.1 General Considerations

- Received chemicals shall be immediately moved to the designated storage area.
- Large glass containers shall be placed in carrying containers or shipping containers during transportation.
- The storage area shall be well-illuminated, with all storage maintained at or below eye level.
- Large containers (greater than a gallon) shall be stored no more than two feet from ground level.
- Chemicals shall be segregated by hazard classification and compatibility in a well-identified area, with local exhaust ventilation.
- Highly toxic chemicals or other chemicals whose containers have been opened shall be stored in unbreakable secondary containers.
- The storage area shall not be used as a preparation or repackaging area.

- Storage of chemicals at the lab bench, in the fume hoods, or other work areas shall be minimized. The container size shall be the minimum convenient. The amounts of chemicals at the lab bench shall be as small as practical. Chemicals in the workplace shall not be exposed to sunlight or heat.
- Stored chemicals shall be examined at least annually by the CHC or his/her designee for replacement, deterioration, and container integrity. The inspection should determine whether any corrosion, deterioration, or damage has occurred to the storage facility as a result of leaking chemicals.
- Periodic inventories of chemicals outside the storage area shall be conducted by the CHC. Unneeded items shall be properly discarded or returned to the storage area.

6.1.1 Segregation of Chemicals

Incompatible chemicals should not be stored together. Storing chemicals alphabetically, without regard to compatibility, can increase the risk of a hazardous reaction, especially in the event of container breakage. Table 1 is a recommended way chemicals should be segregated. The Central Stock Room will follow this table.

Table 1	
Inorganic	Organic
Metals, Hydrides	Acids, Amino Acids, Anhydrides, Peracids
Acetates, Halides, Iodides, Sulfates, Sulfites, Thiosulfates, phosphates, Halogens, Oxalates, Phthalates, Oleates	Alcohols, Glycols, Sugars, Amines, Amides, Imines, Imides
Amides, Nitrates (except Ammonium Nitrate),Nitrites, Azides	Hydrocarbons, Esters, Aldehydes, Oils
Hydroxides, Oxides, Silicates, Carbonates, Carbon	Ethers, Ketones, Ketenes, Halogenated Hydrocarbons, Ethylene Oxide
Sulfides, Selenides, Phosphides, Carbides, Nitrides	Epoxy Compounds, Isocyanates
Chlorates, Bromates, Iodates, Chlorites, Hypochlorites, Perchlorates, Perchloric Acid, Peroxides, Hydrogen Peroxide	Peroxides, Hydroperoxides, Azides
Arsenates, Cyanides, Cyanates	Sulfides, Polysulfides, Sulfoxides, Nitriles
Borates, Chromates, Manganates, Permanganates, Molybdates, Vanadates	Phenols, Cresols

Table 1	
Inorganic	Organic
Acids (except Nitric) (Nitric Acid is isolated and stored by itself.)	Dyes, Stains, Indicators
Sulfur, Phosphorus, Arsenic, Phosphorus Pentoxide	Organic miscellaneous
Inorganic miscellaneous	

6.2 Specific Considerations

6.2.1 Flammable and Combustible Liquids

- Flammable and combustible liquids should be stored only in approved containers. Containers used by the manufacturers of flammable and combustible liquids generally meet these specifications.
- A flammable liquid storage cabinet is an approved cabinet that has been designed and constructed to protect the contents from external fires. Storage cabinets are usually equipped with vents, which are plugged by the cabinet manufacturer. Since venting is not required by any code or the by local municipalities and since venting may actually prevent the cabinet from protecting its contents, vents should remain plugged at all times. Storage cabinets must also be conspicuously labeled ***"FLAMMABLE – KEEP FIRE AWAY"*.**
- Use only those refrigerators that have been designed and manufactured for flammable liquid storage. Standard household refrigerators must not be used for flammable storage because internal parts could spark and ignite. Refrigerators must be prominently labeled as to whether or not they are suitable for flammable liquid storage
- Flammable liquids should be stored separately from strong oxidizers, shielded from direct sunlight, and away from heat sources.

6.2.2 Corrosives

6.2.2.1 Acids

- Mineral acids, including phosphoric, hydrochloric, sulfuric, and perchloric acid can be stored in a cabinet designed for Corrosive Acids. These non-metallic cabinets have no internal metallic parts, acid resistant coating and a cabinet floor constructed to be able to contain spillage.
- Volatile acids, such as oleum or fuming nitric acid, should be stored either in an acid cabinet or in a vented cabinet, such as the fume hood base, particularly after they have been opened.

- Concentrated mineral acids can be very reactive, even with each other. Concentrated acids can even react vigorously with dilute solutions of the same acid, if mixed together rapidly. Different concentrated acids should be stored apart. If stored within the same cabinet, plastic trays, tubs or buckets work well to keep different acids apart within the cabinet.
- Organic Acids (i.e. acetic and formic) should be stored separately from mineral acids
- Nitric Acid should be stored separately.

It should be noted that if there is only one corrosive cabinet available different types of acids by be stored together if they are separated using plastic trays, tubs, buckets or some other form of secondary container to separate them within the cabinet.

6.2.2.2 Bases

- Solid bases (i.e. sodium and potassium hydroxide) can be stored in their containers on a shelf
- Liquid bases (i.e. dilute ammonia, solutions of sodium bicarbonate) that have a ph < 11 may be stored on
- Liquid bases (i.e. concentration ammonium hydroxide) or solutions made from solid bases that have a ph>11 must be stored in a corrosive cabinet.
- Acids and basis should not be stored in the same cabinet.

6.2.3 Compressed Gases

- All cylinders must be secured to a wall, bench or fixed support using a chain or strap placed 2/3 of the way up. Cylinder stands are an alternative to straps.
- Cylinders should be strapped individually.
- Cylinders should not be stored with a regulator attached. Secure the proper gas cap to the threaded portion on the top of the cylinder to protect the valve.*
- Do not store full and empty cylinders together.
- Oxidizers and flammable gases should be stored in areas separated by at least 20 feet or by a noncombustible wall.
- Cylinders should not be stored near radiators or other heat sources. If storage is outdoors, protect cylinders from weather extremes and damp ground to prevent corrosion.
- No part of a cylinder should be subjected to a temperature higher than 125^{o}F. A flame should never be permitted to come in contact with any part of a compressed gas cylinder.
- Do not place cylinders where they may become part of an electric circuit.
- Keep the number of cylinders in a laboratory to a minimum to reduce the fire and toxicity hazards.
- Lecture bottles should always be returned to the distributor or manufacturer promptly when no longer needed or discarded if at atmospheric pressure.
- Ensure that the cylinder is properly and prominently labeled as to its contents.

- NEVER place acetylene cylinders on their side

7.0 CONTROLLING CHEMICAL EXPOSURE

Once the hazards are known, the risk of an accident may be reduced significantly. There are four general methods for controlling one's exposure to hazardous substances:

1. Engineering Controls
2. Administrative Controls
3. Safe Work Practices
4. Personal Protective Equipment (PPE)

In the laboratory, these methods or a combination of them can be used to keep exposure below permissible exposure limits**.**

7.1 Engineering Controls

Equipment installed in the laboratory should considered the primary method of controlling chemical exposure. Examples of Engineering controls are:

- Fume Hoods
- Bench top fume hoods
- Elephant Trunks
- Sharp Containers
- Broken Glass Containers
- Use of wet methods to reduce generation of dusts or other particulates

All laboratory personnel should be familiar enough with the chemicals they are using to know what equipment should be used to prevent chemical exposure. The SDS will have what engineered controls should be used when working with a specific chemical.

7.1.1 Fume Hoods

A fume hood is used to control exposure of the hood user and lab occupants to hazardous or odorous chemicals and prevent their release into the laboratory. A secondary purpose is to limit the effects of a spill by partially enclosing the work area and drawing air into the enclosure by means of an exhaust fan. This inward flow of air creates a dynamic barrier that minimizes the movement of material out of the hood and into the lab.

In a well-designed, properly functioning fume hood, only about 0.0001% to 0.001% of the material released into the air within the hood actually escapes from the hood and enters the laboratory.

The determination that a fume hood is necessary for a particular experiment should be based on a hazard analysis of the planned work. Such an analysis should include:

- A review of the physical characteristics, quantity and toxicity of the materials to be used;
- The experimental procedure;
- The volatility of the materials present during the experiment;
- The probability of their release;
- The number and sophistication of manipulations; and
- The skill and expertise of the individual performing the work.

The level of protection provided by a fume hood is affected by the manner in which the fume hood is used. No fume hood, however well designed, can provide adequate containment unless good laboratory practices are used, as follows:

- Know the toxic properties of the chemicals with which you work.
- Be able to identify signs and symptoms of overexposure.
- Perform all work 6 inches behind the sash and keep all chemicals and equipment behind that line during procedure.
- Keep the sash completely lowered anytime "hands-on" experiments are not in progress or whenever the hood is on and unattended.
- The hood is not a substitute for personal protective equipment. Wear gloves, safety glasses, etc., as appropriate.
- Visually inspect the baffles to be sure the slots are open and unobstructed.
- Do not block baffles. If large equipment is in the hood, put it on blocks to raise it approximately two inches so that air may pass beneath it.
- Do not use the hood as a storage cabinet.
- Keep the sash clean and clear.
- Clean all chemical residues from the hood chamber after each use.
- All electrical devices should be connected outside the hood to avoid sparks which may ignite a flammable or explosive chemical.
- Never raise the sash above the line marked on the side hood or above the plastic stop to ensure the flow stays above 100 cubic feet per minute (cfm).
- If the hood as a flow meter attached to it make sure the flow is above 100 cfm.
- No more than two people may work in a four foot or six foot hood at any one time.
- No more than three people may work in an eight foot hood at any one time.
- Before beginning any work in a fume hood make sure the hood is functioning properly by checking the flow on the attached flow meter.
- If the hood malfunctions while working in a fume hood all work **must** cease immediately and open containers must be covered.

7.1.2 Bench Top Hoods

Laboratories PS011 and PS014 contain bench top hoods for the organic teaching laboratories (CHEM 1125, 2315, and 2325) to be performed in. The following procedures must be followed:

- The lab instructors should ensure that the hoods are turned on and working properly.
- Under no circumstances should the laboratory be performed if the bench top hoods are not working properly
- The sashes are to be opened only long enough to install the equipment needed to perform the laboratory.

7.1.3 Elephant Trunks

An elephant trunk is a flexible duct or hose connected to an exhaust system. It can only capture contaminants that are very close to the inlet of the hose, typically less than a distance equal to one half of the diameter of the duct.

Elephant trunks can be effective for capturing discharges from gas chromatographs, pipe nipples or the end of tubing. However, the effectiveness of the elephant trunk should be carefully evaluated before they are used to control releases of hazardous substances.

7.1.4 Sharp Containers

Sharp containers are to be used for any of the following used in the laboratory:

- Syringes
- Needles
- Scalpels
- Razorblades
- Any glass (broken or unbroken) containing or that has been contaminated with biological or infectious agents.

7.1.5 Broken Glass Containers

Broken glass boxes are to be used for any glass (broken or unbroken) that is being discarded. The box must be puncture proof, lined and labelled: “CAUTION, BROKEN GLASS”. There can be no liquid in the containers (except for the last residual drops).

7.1.6 Use of wet methods to reduce generation of dusts or other particulates

Wet saws should be used as much as possible when cutting rocks.

7.2 Administrative Controls

Administrative controls are changes in the method or process to reduce exposure. These include:

- Substituting a less toxic chemical
- Reducing the amount of the chemical being used
- Reducing the length of the exposure time
- Using plastic equipment instead of glass

All Laboratory personnel are encouraged to look for and suggest changes in procedures to reduce exposure.

7.3 Safe Work Practices

Safe work practices are discussed in the Chemical Handling section of this document.

7.4 Personal Protective Equipment (PPE)

Person protective equipment is discussed in the Personal Protective Equipment section of this document.

8.0 CHEMICAL HANDLING

Each laboratory employee with the training, education and resources provided by supervision, shall develop and implement work habits consistent with this CHP to minimize personal and coworker exposure to the chemicals in the laboratory. Based on the realization that all chemicals inherently present hazards in certain conditions, exposure to all chemicals shall be minimized.

8.1 Before you Begin

All laboratory personnel should observe the following rules:

- Know the potential hazards and appropriate safety precautions before beginning work. Ask and be able to answer the following questions:
- What are the hazards?
- What are the worst things that could happen?
- What do I need to do to be prepared?
- What work practices, facilities or personal protective equipment are needed to minimize the risk?
- Know the location and how to use emergency equipment, including safety showers and eyewash stations.
- Never block safety equipment, electrical panels or doors and keep aisles clear and free from tripping hazards.

- Familiarize yourself with the emergency response procedures, facility alarms and building evacuation routes.
- Know the types of personal protective equipment available and how to use them for each procedure.
- Be alert to unsafe conditions and actions and bring them to the attention of your supervisor or lab manager immediately so that corrections can be made as soon as possible.
- Prevent pollution by following waste disposal procedures. Chemical reactions may require traps or scrubbing devices to prevent the release of toxic substances to the laboratory or to the environment.
- Position and clamp reaction apparatus thoughtfully in order to permit manipulation without the need to move the apparatus until the entire reaction is completed. Combine reagents in the appropriate order and avoid adding solids to hot liquids.

8.2 General Procedures

- Avoid distracting or startling other workers
- Do not allow practical jokes or horseplay
- Use laboratory equipment only for its designated purpose
- Do not allow unauthorized personnel, including children and pets, in laboratories where hazardous substances are stored or are in use or hazardous activities are in progress.
- Do not prepare, store (even temporarily), or consume food or beverages in any chemical laboratory
- Do not smoke in any chemical laboratory. Additionally, be aware that tobacco products in opened packages can absorb chemical vapors.
- Do not apply cosmetics when in the laboratory
- Remove gloves by turning them inside out as they are removed and before touching any door knobs.
- Never wear or bring lab coats or jackets into areas where food is consumed.
- Confine long hair and loose clothing in the laboratory. Wear shoes at all times. Open-toed shoes or sandals are not appropriate.
- Under no circumstances should mouth suction be used to pipette chemicals or to start a siphon. Use a pipette bulb or a mechanical pipetting device to provide a vacuum.
- Wash well before leaving the laboratory. Do not use solvents for washing skin.
- Keep work areas clean and free from obstruction. Clean up spills immediately.
- Do not block access to exits, emergency equipment, controls, electrical panels etc.
- Avoid working alone.

8.3 Transporting Chemicals

Spills and chemical exposure can occur if chemicals are transported incorrectly, even when moving chemicals from one part of the laboratory to another. To avoid these type of incidents, consider the following:

- Use a bottle carrier, cart or other secondary container when transporting chemicals in breakable containers (especially 250 ml or more) through hallways or between buildings. Secondary containers are made of rubber, metal or plastic, with carrying handle(s), and are large enough to hold the entire contents of the chemical containers in the event of breakage. A variety of such containers are available from the Chemistry stockroom or from laboratory supply catalogs.
- Transport of hazardous chemicals in individual containers exceeding four liters between buildings must be done on a cart with a tray sufficient to contain the contents of the container.
- Transportation of hazardous chemicals in personal vehicles is strictly forbidden.
- When moving in the laboratory, anticipate sudden backing up or changes in direction by others. If you should stumble or fall while carrying glassware or chemicals, try to project them away from yourself and others.
- The individual transporting the chemical should be knowledgeable about the hazards of the chemical and should know how to handle a spill of the material.
- When transporting compressed gas cylinders, the cylinder should always be strapped in a cylinder cart and the valve protected with a cover cap. Do not attempt to carry or roll cylinders from one area to another.
- Transport chemicals in freight elevators rather than passenger elevators, if available.
- Keep chemicals in their original packing when transporting, if possible.

8.4 Laboratory Equipment and Glassware

Each employee shall keep the work area clean and uncluttered. At the completion of each work day or operation, the work area shall be thoroughly cleaned and all equipment properly cleaned and stored.

In addition, the following procedures shall apply to the use of laboratory equipment:

- All laboratory equipment shall be used only for its intended purpose.
- All glassware will be handled and stored with care to minimize breakage; all broken glassware will be immediately disposed of in the broken glass container.
- Labels shall be attached to all chemical containers, identifying the contents and related hazards in accordance with the OSHA Hazardous Communication Standard also known as the Right to Know.
- Waste receptacles shall be identified as such and explicitly labeled regarding contents.

- All laboratory equipment shall be inspected on a periodic basis and replaced or repaired as necessary.

8.5 Specific Procedures

8.5.1 Flammable Liquids

The main objective in working safely with flammable liquids is to avoid accumulation of vapors and to control sources of ignition.

Besides the more obvious ignition sources, such as open flames from Bunsen burners, matches and cigarette smoking, less obvious sources, such as electrical equipment, static electricity and gas-fired heating devices should be considered

Some electrical equipment, including switches, stirrers, motors, and relays can produce sparks that can ignite vapors. Although some newer equipment have spark-free induction motors, the on-off switches and speed controls may be able to produce a spark when they are adjusted because they have exposed contacts.

Pouring flammable liquids can generate static electricity. The development of static electricity is related to the humidity levels in the area. Cold, dry atmospheres are more likely to facilitate static electricity. Bonding or using ground straps for metallic or non-metallic containers can prevent static generation.

- Control all ignition sources in areas where flammable liquids are used. Smoking, open flames and spark producing equipment should not be used.
- Whenever possible use plastic or metal containers or safety cans.
- When working with open containers, use a laboratory fume hood to control the accumulation of flammable vapor.
- Use bottle carriers for transporting glass containers.
- Use equipment with spark-free, intrinsically safe induction motors or air motors to avoid producing sparks.
- Avoid using equipment with series-wound motors, since they are likely to produce sparks.
- Do not heat flammable liquids with an open flame. Steam baths, salt and sand baths, oil and wax baths, heating mantles and hot air or nitrogen baths are preferable.
- Minimize the production of vapors and the associated risk of ignition by flashback. Vapors from flammable liquids are denser than air and tend to sink to the floor level where they can spread over a large area.
- Electrically bond metal containers when transferring flammable liquids from one to another. Bonding can be direct, as a wire attached to both containers, or indirect, as through a common ground system.
- When grounding non-metallic containers, contact must be made directly to the liquid, rather than to the container.

- In the rare circumstance that static cannot be avoided, proceed slowly to give the charge time to disperse or conduct the procedure in an inert atmosphere.

8.5.2 Flammable Solids

Flammable solids often encountered in the laboratory include alkali metals, magnesium metal, metallic hydrides, some organometallic compounds, and sulfur. Many flammable solids react with water and cannot be extinguished with conventional dry chemical or carbon dioxide extinguishers.

- Ensure Class D extinguishers, e.g., Met-L-X, are available where flammable solids are used or stored.
- Sand can usually be used to smother a fire involving flammable solids. Keep a container of sand near the work area.
- If a flammable, water-reactive solid is spilled onto skin, brush off as much as possible, then flush with copious amounts of water.
- NEVER use a carbon dioxide fire extinguisher for fires involving lithium aluminum hydride (LAH). LAH reacts explosively with carbon dioxide.

8.5.3 Peroxide Forming Compounds and Reactives

Certain chemicals can form dangerous peroxides on exposure to air and light. Since they are sometimes packaged in an atmosphere of air, peroxides can form even though the containers have not been opened. Peroxides may detonate with extreme violence when concentrated by evaporation or distillation, when combined with other compounds, or when disturbed by unusual heat, shock or friction. Formation of peroxides in ethers is accelerated in opened and partially emptied containers. Refrigeration will not prevent peroxide formation and stabilizers will only retard formation.

Peroxide formation may be detected by visual inspection for crystalline solids or viscous liquids, or by using chemical methods or specialized kits for quantitative or qualitative analysis. If you suspect that peroxides have formed, do not open the container to test since peroxides deposited on the threads of the cap could detonate.

The following recommendations should be followed to control the hazards of peroxides.

- Know the properties and hazards of all chemicals you are using through adequate research and study, including reading the label and SDS.
- Inventory all chemical storage at least twice a year to detect forgotten items, leaking containers, and those that need to be discarded.
- Identify chemicals that form peroxides or otherwise deteriorate or become more hazardous with age or exposure to air. Label containers with the date received, the date first opened and the date for disposal as recommended by the supplier.

- Minimize peroxide formation in ethers by storing in tightly sealed containers placed in a cool place in the absence of light. Do not store ethers at or below the temperature at which the peroxide freezes or the solution precipitates.
- Choose the size container that will ensure use of the entire contents within a short period of time.
- Visually or chemically check for peroxides of any opened containers before use.
- Clean up spills immediately. The safest method is to absorb the material onto vermiculite or a similar loose absorbent.
- When working with peroxidizable compounds, wear impact-resistant safety eyewear and face shields. Visitor specs are intended only for slight and brief exposure, and should not be used when working with peroxidizable compounds.
- Do not use solutions of peroxides in volatile solvents under conditions in which the solvent might be vaporized. This could increase the concentration of peroxide in the solution.
- Do not use metal spatulas or magnetic stirring bars (which may leach out iron) with peroxide forming compounds, since contamination with metals can lead to explosive decomposition. Ceramic, Teflon or wooden spatulas and stirring blades are usually safe to use.
- Do not use glass containers with screw-top lids or glass stoppers. Polyethylene bottles with screw-top lids may be used.

8.5.4 Corrosive Liquids

Corrosive liquids (e.g. mineral acids, alkali solutions and some oxidizers) represent a very significant hazard because skin or eye contact can readily occur from splashes and their effect on human tissue generally takes place very rapidly.

The following should be considered:

- The eyes are particularly vulnerable. It is therefore essential that approved eye and face protection be worn in all laboratories where corrosive chemicals are handled.
- Gloves and other chemically resistant protective clothing should be worn to protect against skin contact.
- To avoid a flash steam explosion due to the large amount of heat evolved, always add acids or bases to water (and not the reverse).
- Acids and bases should be segregated for storage.
- Liquid corrosives should be stored below eye level.
- Adequate quantities of spill control materials should be readily available.

8.5.5 Corrosive Solids

Corrosive solids, such as sodium hydroxide and phenol, can cause burns to the skin and eyes. Dust from corrosive solids can be inhaled and cause irritation or burns to the respiratory tract. Many corrosive solids, such as potassium hydroxide and sodium hydroxide, can produce considerable heat when dissolved in water.

- Wear gloves and eye protection when handling corrosive solids.
- When mixing with water, always slowly add the corrosive solid to water, stirring continuously. Cooling may be necessary.
- If there is a possibility of generating a significant amount of dust, conduct work in a fume hood.

8.5.6 Compressed Gases

Compressed gases can be toxic, flammable, oxidizing, corrosive, inert or a combination of hazards. In addition to the chemical hazards, compressed gases may be under a great deal of pressure. The amount of energy in a compressed gas cylinder makes it a potential rocket. Appropriate care in the handling and storage of compressed gas cylinders is essential.

The following is an overview of the hazards to be avoided when handling compressed gases:

- Avoid dropping, dragging or sliding cylinders. Use a suitable hand truck or cart equipped with a chain or belt for securing the cylinder to the cart, even for short distances.
- Do not permit cylinders to strike each other violently. Cylinders should not be used as rollers for moving material or other equipment.
- Cylinder caps should be left on each cylinder until it has been secured against a wall or bench or placed in a cylinder stand, and is ready for installation of the regulator. Cylinder caps protect the valve on top of the cylinder from damage if knocked.
- Never tamper with pressure relief devices in valves or cylinders.
- Use only wrenches or tools provided by the cylinder supplier to remove a cylinder cap or to open a valve. Never use a screwdriver or pliers.
- Keep the cylinder valve closed except when in use.
- Position cylinders so that the cylinder valve is accessible at all times.
- Use compressed gases only in a well-ventilated area. Toxic, flammable and corrosive gases should be carefully handled in a hood or gas cabinet. Proper containment systems should be used and minimum quantities of these products should be kept on-site.
- When discharging gas into a liquid, a trap or suitable check valve should be used to prevent liquid from getting back into the cylinder or regulator.

- Where more than one type of gas is in use, label gas lines. This is particularly important when the gas supply is not in the same room or area as the operation using the gases.
- Do not use the cylinder valve itself to control flow by adjusting the pressure.

Before using cylinders, read all label information and SDSs associated with the gas being used. The cylinder valve outlet connections are designed to prevent mixing of incompatible gases. The outlet threads vary in diameter; some are internal and some are external; some are right-handed and some are left-handed. Generally, right-handed threads are used for fuel gases.

To set up and use the cylinder, follow these steps:

- Attach the closed regulator to the cylinder. Never open the cylinder valve unless the regulator is completely closed. Regulators are specific to the gas involved. A regulator should be attached to a cylinder without forcing the threads. Ensure the threads of both the regulator and main valve are clean. If the inlet of a regulator does not fit the cylinder outlet, no effort should be made to try to force the fitting. A poor fit may indicate that the regulator is not intended for use on the gas chosen.
- Turn the delivery pressure adjusting screw counter-clockwise until it turns freely. This prevents unintended gas flow into the regulator.
- Open the cylinder slowly until the inlet gauge on the regulator registers the cylinder pressure. If the cylinder pressure reading is lower than expected, the cylinder valve may be leaking.
- With the flow control valve at the regulator outlet closed, turn the delivery pressure adjusting screw clockwise until the required delivery pressure is reached.
- Check for leaks using *Snoop* or soap solution. At or below freezing temperatures, use a glycerin and water solution, such as *Snoop*, rather than soap. Never use an open flame to detect leaks.
- When finished with the gas, close the cylinder valve, release the regulator pressure and replace the gas cap if it will not be used in the near future.

9.0 PERSONAL PROTECTIVE EQUIPMENT (PPE)

Personal protective equipment (PPE) is special gear used to protect the wearer from specific hazards of a hazardous substance. It is a last resort protection system, to be used when substitution or engineering controls are not feasible. PPE does not reduce or eliminate the hazard, protects only the wearer, and does not protect anyone else.

PPE includes eye protection, gloves, respiratory protection, and protective clothing. The need for PPE is dependent upon the type of operations and the nature and quantity of the materials in use, and must be assessed on a case by case basis. Workers who rely on PPE must understand the functioning, proper use, and limitations of the PPE used.

9.1 Eye Protection

9.1.1 Safety Glasses

Safety glasses look very much like normal glasses buy have lenses that are impact resistant and frames that are far stronger than standard street wear glasses. Safety glasses with proper impact and shatter resistance will be marked "Z87" on the frame or lens. Safety glasses must have side shields and should be worn whenever there is the possibility of objects striking the eye, such as particles, glass, or metal shards.

Standard street wear eyeglasses fitted with side shields are not sufficient. Safety glasses come in a variety of styles to provide the best fit and comfort, including some designed to fit over prescription glasses.

Safety glasses do not provide adequate protection from significant chemical splashes. They do not seal to the face, resulting in gaps at the top, bottom and sides, where chemicals may seep through. Safety glasses may be adequate when the potential splash is minimal.

Safety glasses are also not appropriate for dusts and powders, which can get by the glasses in ways similar to those described above. Safety goggles are best used for this type of potential exposure.

9.1.2 Chemical Splash Goggles

Chemical Splash Goggles should be worn when there is potential for splash from a hazardous material. Like safety glasses, goggles are impact resistant. Chemical splash goggles should have indirect ventilation so hazardous substances cannot drain into the eye area. Some may be worn over prescription glasses.

9.1.3 Face Shields

Face shields are in order when working with large volumes of hazardous materials, either for protection from splash to the face or flying particles. Face shields must be used in conjunction with safety glasses or goggles.

9.1.4 Contact Lenses

Contact lenses may be worn in the laboratory, but do not offer any protection from chemical contact. If a contact lens becomes contaminated with a hazardous chemical, rinse the eye(s) using an eyewash and remove the lens immediately. Contact lenses that have been contaminated with a chemical must be discarded. Safety glasses, goggles, and/or shield must still be worn.

9.2 Gloves

Choosing the appropriate hand protection can be a challenge in a laboratory setting. Considering the fact that dermatitis or inflammation of the skin accounts for 40-45% of all work-related diseases, selecting the right glove for the job is important.

Not only can many chemicals cause skin irritation or burns, but also absorption through the skin can be a significant route of exposure to certain chemicals. Dimethyl sulfoxide (DMSO), nitrobenzene, and many solvents are examples of chemicals that can be readily absorbed through the skin into the bloodstream, where the chemical may cause harmful effects.

Protective gloves should be worn when handling hazardous materials, chemicals of unknown toxicity, corrosive materials, rough or sharp-edged objects, and very hot or very cold materials. When handling chemicals in a laboratory, disposable latex, vinyl or nitrile examination gloves are usually appropriate for most circumstances. These gloves will offer protection from incidental splashes or contact.

When working with chemicals with high acute toxicity, working with corrosives in high concentrations, handling chemicals for extended periods of time or immersing all or part of a hand into a chemical, the appropriate glove material should be selected, based on chemical compatibility.

When selecting the appropriate glove, the following characteristics should be considered:

- degradation rating
- breakthrough time
- permeation rate

Degradation is the change in one or more of the physical properties of a glove caused by contact with a chemical. Degradation typically appears as hardening, stiffening, swelling, shrinking, or cracking of the glove. Degradation ratings indicate how well a glove will hold up when exposed to a chemical. When looking at a chemical compatibility chart, degradation is usually reported as E (excellent), G (good), F (fair), P (poor), NR (not recommended) or NT (not tested).

Breakthrough time is the elapsed time between the initial contact of the test chemical on the surface of the glove and the analytical detection of the chemical on the inside of the glove.

Permeation rate is the rate at which the test chemical passes through the glove material once breakthrough has occurred and equilibrium is reached. Permeation involves absorption of the chemical on the surface of the glove, diffusion through the glove, and desorption of the chemical on the inside of the glove. Resistance to permeation rate is usually reported as E (excellent), G (good), F (fair), P (poor) or

NR (not recommended). If chemical breakthrough does not occur, then permeation rate is not measured and is reported ND (none detected).

For mixtures, it is recommended that the glove material be selected based on the shortest breakthrough time.

The flowing table includes major glove types and their general uses. All SDS have a PPE section and it should be looked at:

Glove Material	General Uses
Butyl	Offers the highest resistance to permeation by most gases and water vapor. Especially suitable for use with esters and ketones.
Neoprene	Provides moderate abrasion resistance but good tensile strength and heat resistance. Compatible with many acids, caustics and oils.
Nitrile	Excellent general duty glove. Provides protection from a wide variety of solvents, oils, petroleum products and some corrosives. Excellent resistance to cuts, snags, punctures and abrasions.
PVC	Provides excellent abrasion resistance and protection from most fats, acids, and petroleum hydrocarbons.
PVA	Highly impermeable to gases. Excellent protection from aromatic and chlorinated solvents. Cannot be used in water or water-based solutions.
Viton	Exceptional resistance to chlorinated and aromatic solvents. Good resistance to cuts and abrasions.
Silver Shield	Resists a wide variety of toxic and hazardous chemicals. Provides the highest level of overall chemical resistance.

Natural rubber	Provides flexibility and resistance to a wide variety of acids, caustics, salts, detergents and alcohols.

- All gloves should be inspected for signs of degradation or puncture before use. Test for pinholes by blowing or trapping air inside and rolling them out. Do not fill them with water, as this makes the gloves uncomfortable and may make it more difficult to detect a leak when wearing the glove.
- Disposable gloves should be changed when there is any sign of contamination. Reusable gloves should be washed frequently if used for an extended period of time.
- While wearing gloves, be careful not to handle anything but the materials involved in the procedure. Touching equipment, phones, wastebaskets or other surfaces may cause contamination. Be aware of touching the face, hair, and clothing as well.
- Follow the manufacturer's instructions for washing and caring for reusable gloves.
- Gloves should be removed avoiding skin contact with the exterior of the glove and possible contamination. Disposable gloves should be removed as follows:
    1. Grasp the exterior of one glove with your other gloved hand.
    2. Carefully pull the glove off your hand, turning it inside-out. The contamination is now on the inside.
    3. Ball the glove up and hold in your other gloved hand.
    4. Slide your ungloved finger into the opening of the other glove. Avoid touching the exterior.
    5. Carefully pull the glove off your hand, turning it inside out again. All contamination is contained.
    6. Discard appropriately.
- Door knobs should not be touched when wearing gloves.

9.3 Respiratory Protection

A respirator may only be used when engineering controls, such as general ventilation or a fume hood, are not feasible or do not reduce the exposure of a chemical to acceptable levels. Since the use of a respirator is regulated by the OSHA Respiratory Protection Standard, respirator use at UVU is subject to prior review by the CHC according to university policy.

Any worker who believes that respiratory protection is needed must notify the CHC for evaluation of the hazard and enrollment in the Respiratory Protection Program. This program involves procedures for respirator selection, medical assessment of employee health, employee training, proper fitting, respirator inspection and maintenance, and recordkeeping.

9.4 Protective Clothing

When the possibility of chemical contamination exists, protective clothing that resists physical and chemical hazards should be worn over street clothes. Lab coats are appropriate for minor chemical splashes and solids contamination, while plastic or rubber aprons are best for protection from corrosive or irritating liquids. Disposable outer garments (i.e., Tyvek suits) may be useful when cleaning and decontamination of reusable clothing is difficult.

Loose clothing (such as overlarge lab coats or ties), skimpy clothing (such as shorts), torn clothing and unrestrained hair may pose a hazard in the laboratory.

9.4.1 Footwear

Closed-toed shoes should be worn at all times in buildings where chemicals are stored or used. Perforated shoes, sandals or cloth sneakers should not be worn in laboratories or where mechanical work is conducted. Such shoes offer no barrier between the laboratory worker and chemicals or broken glass.

Chemical resistant overshoes or boots may be used to avoid possible exposure to corrosive chemical or large quantities of solvents or water that might penetrate normal footwear (e.g., during spill cleanup).

10.0 WASTE DISPOSAL

Under no conditions shall volatile or harmful chemicals be disposed of down the laboratory drains. Harmful or volatile chemicals shall be defined as listed on the EPA Priority list. Students, Staff and Faculty will place the waste chemicals in the designated waste containers. The waste will then be disposed of by state contracted waste handlers. Coordination of waste removal will be handled by the CHC.

10.1 Classification of Waste as Hazardous

Waste is considered hazardous if:

- It is on either of two lists (referred to as the P- and U-listed wastes) of specific chemical substances developed by the Federal Environmental Protection Agency (EPA).
- It is on a list of nonspecific sources (referred to as the F-listed wastes) that includes a broad range of spent halogenated and non-halogenated solvents.
- It is on a list of specific sources that includes primarily industrial processes.
- It exhibits any of the following characteristics as defined by the EPA (definitions are abbreviated):
    - Ignitable
        - A liquid with a flash point less than 60 degrees Centigrade

        - not a liquid and capable under normal conditions of causing fire through friction, absorption of moisture or spontaneous chemical changes
        - An ignitable compressed gas
        - An oxidizer
    - Corrosive
        - It is aqueous and has a pH less than or equal to 2 or greater than or equal to 11
        - It is a liquid and corrodes steel at a rate greater than 0.250 inches per year at 55 degrees Centigrade
    - Reactive
        - It is normally unstable
        - It reacts violently with water
        - It forms potentially explosive mixtures with water
        - It generates toxic gases, vapors or fumes when mixed with water
        - Cyanide or sulfide wastes that generate toxic gases, vapors or fumes at pH conditions between 2 and 12.5
        - It is capable of detonation or explosive decomposition if subjected to strong initiation or under standard temperature and pressure
        - It is classified as a Department of Transportation explosive
    - Toxicity Characteristic
        - If an extract of the waste is found to contain certain metals, pesticides or selected organics above specified levels (referred to as the D list)
        - If it is otherwise capable of causing environmental or health damage if improperly disposed (this is a judgment you must make based upon your knowledge of the material from the SDS or the literature).

All SDSs have a disposal section and should be consulted. Consulting the Faculty Supervisor, Lab Manager, and/or CHC is encouraged.

If there are any questions about whether a waste is Hazardous or not, the most conservative approach will be used and therefore it will be assumed it is hazardous.

10.2 Storage of Chemical Hazardous Waste

Containers of hazardous waste may be stored in an area of a laboratory. This area must be controlled by the faculty supervisors, lab manager or workers generating the waste. State and federal regulations stipulate how waste generators store chemical waste and require the following:

- Any container used to store hazardous waste must be labeled with the words "Hazardous Waste" (regardless of its location) as soon as accumulation begins.

- Be sure that the container is compatible with the chemical waste.
  Use containers that are made of or lined with materials which will not react with, and are otherwise compatible with, the hazardous waste to be stored. For example, do not place hydrofluoric acid in glass. Often the original container is suitable.
- Waste containers must be closed at all times, except when being filled. Do not leave funnels in the containers.
- Be sure that containers in the waste storage area do not leak. Consider the use of secondary containment, such as a tray, larger container or basin. If a leaking container is found, immediately clean up any spilled material according to established spill cleanup procedures and transfer the waste into a container that is in good condition.
- No more than one quart of an acutely hazardous waste (P-listed wastes) or 55 gallons of other hazardous wastes may be stored (per waste stream) in the waste storage area. If this threshold quantity is reached, the worker must transfer the waste to a 180-day storage area
- Like any chemical storage in the laboratory or work area, be sure to segregate the containers according to the type of waste (aqueous and organic liquids, biological liquids and solids, and sharps.
- Waste stored near drains (floor, sink, cup sink) should have secondary containment. If you have a sink or drain that is not in use, contact maintenance to explore possibilities for plugging or sealing the drain. Secondary containers must be compatible with the waste.

10.3 180-Day Storage Areas

The 180-day storage areas are located in SB033a and SB033b. Wastes stored in these rooms will shipped to an off-site authorized commercial facility within 180 days from the date the full waste containers are placed in the rooms.

Additional information is available in the Waste Management Plan available in the document section of the Laboratory Safety web page located at: http://www.uvu.edu/csh/lab-safety.html.

11.0 CHEMICAL SPILLS, RELEASES AND ACCIDENTS

11.1 Spill Prevention

Most spills are preventable. The following are some tips that could help to prevent or minimize the magnitude of a spill:

- Pre-planning is essential. Before working with a chemical, the laboratory worker should know how to proceed with spill cleanup and should ensure that there are adequate spill control materials available.
- Place chemical containers being used in a hood or lab bench area that reduces the possibility of accidentally knocking over a container.

- Keep all unused reagents in their appropriate storage area and keep your work area clean of needles equipment and clutter.
- Plan your movements. Look where you are reaching to ensure you will not cause a spill.
- Avoid transporting chemicals from the stockroom during periods of high traffic in the hallways such as between classes.
- Transport chemical containers in a chemical carrier or cart.
- Place absorbent plastic backed liners or lipped trays on bench tops or in fume hoods where spills can be anticipated.

11.2 Spill Response and Clean-up Procedures

In the event of a chemical spill, the individual(s) who caused the spill is responsible for prompt and proper clean-up unless the cleanup will require the use of a respirator. It is also their responsibility to have spill control and personal protective equipment appropriate for the chemicals being handled readily available.

The following are general guidelines to be followed for a chemical spill.

- Immediately alert area occupants and supervisor, and evacuate the area, if necessary.
- If fire or medical attention is needed, dial 911.
- Attend to any people who may be contaminated. Contaminated clothing must be removed immediately and the skin flushed with water for no less than fifteen minutes.
- If a volatile, flammable material is spilled, immediately warn everyone, control sources of ignition and ventilate the area.
- Don personal protective equipment, as appropriate to the hazards. Refer to the SDS or other references for information.
- If respiratory protection will be need, evacuate the room and contact the CHC immediately.
- Using the chart below, determine the extent and type of spill. If the spill is large, if there has been a release to the environment or if there is no one knowledgeable about spill clean-up available, contact the CHC or call 911.

Category	Size	Response	Treatment Materials
Small	up to 300cc	chemical treatment or absorption	neutralization or absorption spill kit
Medium	300 cc – 5 liters	absorption	absorption spill kit
Large	more than 5 liters	Evacuate and call CHC immediately	outside help

- Protect floor drains or other means for environmental release. Spill socks and absorbents may be placed around drains, as needed.
- Contain and clean-up the spill according to the table above.
  Loose spill control materials should be distributed over the entire spill area, working from the outside, circling to the inside. This reduces the chance of splash or spread of the spilled chemical. Many neutralizers for acids or bases have a color change indicator to show when neutralization is complete.
- When spilled materials have been absorbed, use brush and scoop to place materials in an appropriate container. Polyethylene bags may be used for small spills. Five gallon pails or 20 gallon drums with polyethylene liners may be appropriate for larger quantities.
- Complete a hazardous waste sticker, identifying the material as Spill Debris involving XYZ Chemical, and affix onto the container. Spill control materials will probably need to be disposed of as hazardous waste.
- Decontaminate the surface where the spill occurred using a mild detergent and water, when appropriate.
- Report all spills to your Laboratory Manager/Faculty Supervisor and the CHC.

11.3 Spills resulting in release to the Orem City wastewater stream

If a chemical goes down the drain contact the CHC or the UVU Police immediately who will immediately contact the Orem City Water Reclamation Facility. The neutralization tanks will be immediately capped preventing flow into the Orem City wastewater stream. Emergency numbers are listed below

UVU and Orem City Water Reclamation Facility and Emergency Contact Numbers			
Contact	**Title**	**Office #**	**Cell #**
Utah Valley Univeristy			
Craig Moore	Chemical Hygiene Coordinator	801-863-5252	801-870-9934
UVU Police & Fire Emergency		911 or 801-863-5555	
Orem Police and Fire Dispatch		801-229-7070	

UVU and Orem City Water Reclamation Facility and Emergency Contact Numbers			
Contact	**Title**	**Office #**	**Cell #**
Orem Water Reclamation Facility			
Giles Demke	Water Reclamation Section Manager	801-229-7475	801-541-7182
Ned Miner	Water Reclamation Field Supervisor	801-229-7472	801-361-2357
Loren Willes	Pretreatment Coordinator	801-229-7491	801-649-7305
Randy Sandoval	Process Supervisor	801-229-7473	801-400-5990

11.4 Spill Reports

Any time any components of the spill kit is used to cleanup a spill the CHC must be notified so the components can be replaced to ensure that the spill kit is always complete. If the spill is larger than one liter a Chemical Spill Report form (Attachment 1) will need to be fill out.

12.0 SAFETY AND EMERGENCY EQUIPMENT

- Telephone numbers of emergency personnel, supervisors and other workers as deemed appropriate have been posted.
- All laboratory personnel should become familiar where the safety equipment is in the lab. This includes:
    - Fire Extinguishers
    - Fire Blankets
    - Safety Showers
    - Drench Hoses
    - Eye Wash Stations
    - Spill Clean-up Kits
    - First Aid Kits

Location signs for safety and emergency equipment will be posted for safety and emergency equipment that is not immediately visible (within 5 seconds) upon entering the laboratory.

It should be noted that

- Due to change in fire code not all laboratories have fire blankets.
- Fire extinguishers are placed only in laboratories where flammable chemicals are present.

13.0 EVACUATION/EMERGENCY PROCEDURES

13.1 Chemical Exposure

When exposure to a chemical seconds count the following guidelines should be used.

- If First Responders are going to be need dial 911

13.1.1 Chemicals on Skin or Clothing

- Flush the area with water for 15 minutes.
- If spill above the elbow on the trunk or legs the safety shower should be used.
- While rinsing, quickly remove any contaminated clothing (**This is not a time to be modest**)
- Use cautions when removing pullover shirts or sweaters to prevent to contamination of the eyes.
- Check the Safety Data Sheet to determine if any delayed effects should be expected.
- Discard contaminated clothing or launder them separately from other clothing. Leather garments or accessories cannot be decontaminated and should be discarded.
- For flammable solids on skin, first brush off as much of the solid as possible, then proceed as described above.
- Drench hoses can be used only if the spill in on the forearm (below the elbow or just on just the face.

13.1.2 Chemicals in Eyes

- Immediately flush eye(s) with water for at least fifteen minutes. The eyes must be forcibly held open to wash, and the eyeballs must be rotated so all surface area is rinsed. The use of an eye wash fountain is desirable so hands are free to hold the eyes open. If an eyewash is not available, pour water on the eye, rinsing from the nose outward to avoid contamination of the unaffected eye.
- Remove contact lenses while rinsing. Do not lose time removing contact lenses before rinsing. Do not attempt to rinse and reinsert contact lenses.
- Seek medical attention regardless of the severity or apparent lack of severity. Explain carefully what chemicals were involved. If easily accessible, bring an SDS.

13.1.3 Chemical Inhalation

- Close containers, open windows or otherwise increase ventilation, and move to fresh air.
- If symptoms, such as headaches, nose or throat irritation, dizziness, or drowsiness persist, seek medical attention. Explain carefully what chemicals were involved.
- Review the SDS to determine what health effects are expected, including delayed effects.

13.1.4 Chemical Ingestion

- Immediately contact the Poison Control Center at 800-222-1222 for instructions.
- Do not induce vomiting unless directed to do so.
- Seek medical attentions

13.1.5 Chemical Injection

- Wash the area with soap and water
- Seek medical attention, if necessary.

13.2 Evacuation

It is each individual's responsibly to make him/herself aware of the primary and secondary evacuation route. Depending on the reason for evacuation the following guidelines should be used.

13.2.1 Fire

In the event of a fire, depending on the size of the fire take the following actions:

- **If the fire is large or spreading.**
  - Activate the fire alarm to alert building occupants.
  - If possible, shut down any equipment which may add fuel to the fire.
  - Do not turn off any hoods in the immediate area, as they will tend to keep the area free from smoke and fumes.
  - Close the door behind you to prevent the fire's spread.
  - Evacuate the building.
  - Be prepared to inform First Responders the exact location, details of the fire, and the chemicals stored and used in the area.
- **If your clothing catches on fire.** Drop to the floor and roll to smother the fire. If a co-worker's clothing catches fire, get the person to the floor and roll him or her to smother the flames. Use the safety shower if you are near it.
- **Small Fire.** If the fire is not bigger than a wastepaper basket and you know how to use fire extinguisher and feel comfortable do so, fight the fire from a

position where you can escape, only if you are confident that you will be successful.
- **Fire contained in a small vessel.** If you feel comfortable in doing so, suffocate the fire by covering the vessel with a lid of some sort.

In all cases notify the Chemical Hygiene Coordinator so an incident report can be fill out.

13.2.2 Electrical Outage

In the event of a power outage take the following actions:

- Turn off power switches to any electrical equipment being used (except the hoods).
- Remove any container off hot/stir plates.
- Cover any open containers containing chemicals.
- If a container cannot be covered put the container in the hood and close the sash completely.
- Evacuate the room.
- Inform UVU Facilities of the outage if it seem localized to the immediate area

These same procedure should be used for whatever other reason the laboratory may need to be evacuated.

13.2.3 Large Spills or Spills Requiring a Respirator for Cleanup

As previously mentioned if a spill is larger than five liters or is a chemical that will require a respirator for cleanup, evacuate the laboratory and contact the CHC immediately.

14.0 LABORATORY AND CHEMICAL SECURITY

In order to prevent accident exposure, theft and/or the vandalism of hazardous chemicals and laboratory equipment the following procedures will be followed:

- No UVU employee or research student should have unsupervised access to any laboratory until they have received the Laboratory Safety Training given by the CHC.
- Once trained the employee or research student will have their UVU identification (ID) card activated for only the laboratories they need access to in order to perform their job requirements or research.
- Once a student employee is no longer working for UVU or once a research student is done doing research their UVUID should be turned off.

- For laboratories that do not have electronic proximity locks extreme caution should be used when issuing out keys to student employees and research students.
- If a key is issued to a student employee or research student it is the responsibly of the faculty member/lab manager to get the back from them when they are no longer working for UVU or doing research.
- If more than ten keys need to be issued for a particular laboratory, it is strongly recommended that the lock be replaced with an electronic proximity lock.
- Chemical store rooms should be locked or attended at all times.
- Multiple containers of the same chemical should not be stored in preparation laboratories.
- Students should not have unsupervised access to the preparation laboratories attached to the education laboratories.
- The hallway doors to research laboratories should never be unlocked or propped open (unless working in the laboratory alone).
- The side doors should only be unlatched when moving large pieces of equipment into or out of the laboratory.
- Hallway doors to education laboratories may be propped open (never with a chair or garbage can) while the laboratory is in session, if the professor/lab instructor is in the laboratory.
- No one should let anyone else into a research laboratory unless they personally know that individual is allowed access to that specific laboratory. If not let them use their UVUID card as proof they have access to the laboratory.
- No one should ever borrow there UVUID card or keys to any other individual.
- If anyone is the last one to leave a laboratory they should ensure that the hall way door is closed tight and locked.
- Student employees that work in multiple laboratories will be issued an UVU ID badge so faculty and lab managers who they are.
- Pure ethanol will be stored in the main chemical stockroom and distributed as needed in order maintain “accurate records of all receipts, shipments, usage, destructions and claims pertaining to the withdrawal and use of tax-free alcohol” in accordance with The Bureau of Alcohol, Tobacco, and Firearms (ATF) regulation covering the Distribution and Use of Tax-Free Alcohol (27CFR Part 22).

15.0 INFORMATION AND TRAINING

All CSH personnel working with, teaching, mentoring, or supervising anyone working with hazardous chemicals are required to read CHP. In addition they must also receive laboratory safety training when they are first assigned to a work area where hazardous chemicals are present and before assignments involving new exposure situations. General laboratory safety training is provided by the CHC. More specific training for particular materials or operations in a particular work area is provided by the CHC, laboratory managers and/or research faculty supervisors.

15.1 Laboratory Safety Training

Laboratory safety training will be mandatory for all faculty, lab managers, staff, student employees, and research students that work with, teach, mentor, or supervise anyone working with hazardous chemicals in the all the CSH Departments with the exception of the Math, Exercise Science and Outdoor Recreation, and Community and Public Health departments . Initial training will take place within one month of hire. These sessions will be provide regularly to accommodate everyone. Research students will also be required to attend the training. Training sessions will be conducted the first or second week of each semester to accommodate as many research students as possible. Other accommodations will be made on an individual basis as needed. Research students will not have access to the laboratories until they have completed the training. All personnel will also be required perform an annual refresher training session on line.

The Safety Training Sessions will cover the following topics:

- An overview of the OSHA Laboratory Standard
- The location and availability of the CHP
- Controlling Chemical Exposure
- Understanding symbols of labels
- Location and availability of Safety Data Sheets
- An explanation of permissible exposure limits
- Storage and transportation of chemicals
- The use, function, and selection of person protective equipment
- Emergency procedures for chemical exposure
- Spill response and clean-up procedures
- Hazardous waste Disposal Procedures

15.2 Training Records

The CHC will maintain training records for all personnel. The *Laboratory Safety Training Roster* (Attachment 2) will be used to verify attendance to Laboratory. Reading of the CHP will be verified by personnel signing the *Statement of Understanding* forms (Attachment 3a and 3b) stating that they have read, understand, and will follow the policies and procedures outlined in the CHP. Attachment 3a is for the Dean, Department Heads, Faculty, Lab Managers and Staff to sign. Attachment 3b is for student employees and research students to sign.

16.0 PRIOR APPROVAL OF LABORATORY ACTIVITIES

Depending upon the activity, certain laboratory activities will require approval before they be performed. These activities include the following:

16.1 Chemical Procurement

The decision to procure a chemical shall be a commitment to handle and use the chemical properly from initial receipt to ultimate disposal.

Requests for procurement of new chemicals shall be submitted to the Central Stock Room Manager or CHC for approval. The form entitled *New Chemical Purchasing Request* (Attachment 4), shall be used for this purpose. Information on proper handling, storage and disposal shall be known to all involved personnel prior to the procurement of the chemical. Chemicals utilized in the laboratory shall be those which are appropriate for the ventilation system.

If the chemical is considered particularly hazardous the *Particularly Hazardous Substance Approval* Form (Attachment 4) will be used. For more information regarding Particularly Hazardous Substance see the Particularly Hazardous Substance section of this document

All chemicals shall be received in the Central Chemical Stockroom. Personnel who receive chemical shipments shall be knowledgeable of the proper procedures for receipt. Chemical containers shall not be accepted without accompanying labels, SDSs, and packaging in accordance with all appropriate regulations. All chemical shipments should be dated when received, opened, and put out of service.

16.2 Working in the Laboratory Unsupervised

Research students will not have access to their particular laboratory until they have received the Laboratory Training. They will also be required to read the CHP within one month of the training. Research students should discuss in depth with their faculty mentor what procedures they are allowed to do unsupervised.

16.3 Working Alone in the Laboratory

Working alone in a laboratory should generally be avoided. If you are in a laboratory alone make sure your supervisor, faculty mentor, or Lab Manager know you are there and they should periodically check in with you. In addition the door to the laboratory should be propped open (never a chair or the garbage can).

16.4 Unattended Operations

When laboratory operations are performed which will be unattended by laboratory personnel (continuous operations, overnight reactions, etc.), the following procedures will be employed:

- The faculty mentor or lab manager will review work procedures to ensure for the safe completion of the operation.
- An appropriate sign will be posted at all entrances to the laboratory (Attachment 6).
- The overhead lights in the laboratory will be left on.
- Precautions shall be made for the interruption of utility service during the unattended operation (loss of water pressure, electricity, etc.).
- The person responsible for the operation will return to the laboratory at the conclusion of the operation to assist in the dismantling of the apparatus.

16.5 Critical Operations

In the event that a laboratory or a building has to be evacuated, it is possible that there may be a procedure/operation occurring that if just abandoned could result in a catastrophic results (i.e. fire, explosion). All Laboratory Managers, faculty and staff should identify any procedures that they would deem as critical (based on the definition above) and fill out the *Critical Operations* form (Attachment 7) to be approved by the CHC and Department Head. The following should be supplied on the form

- The individual filling out the form.
- The laboratory where the critical operation/procedure may be being done.
- The critical operation/procedure
- Why it should be considered critical.
- Those specific individuals that will need to stay to help perform the operation/procedure. (Only those listed on the form may stay!)
- What additional safety procedure will be taken (i.e. additional PPE).
- What extra training will need to be provided to those who need to stay.
- Special training will be given to any individuals who may be performing what has been deemed necessary and will be documented on the Special Training for Critical Operation form (Attachment 8).

Only those operations/procedures that have been pre-approved as “Critical” by the CHC and the Department Head may be performed when evacuation is required. It should be noted that

- NO one will be required to stay if they don’t want to
- No one’s personal safety should be jeopardize in order to perform the critical operation
- To prevent the catastrophic result the procedure will take less than a minute
- If it is not safe to stay (even for a minute) evacuate!

17.0 CHEMICAL EXPOSURE DETERMINATION

OSHA establishes exposure limits for several hundred substances. Laboratory workers must not be exposed to substances in excess of the permissible exposure limits (PEL) specified in OSHA Subpart Z, *Toxic and Hazardous Substances*. PELs refer to airborne concentrations of substances averaged over an eight-hour day. Some substances also have "action levels" below the PEL requiring certain actions such as medical surveillance or routine air sampling.

The SDS for a particular substance indicates whether any of the chemicals are regulated through OSHA and, if so, the permissible exposure limit(s) for the regulated chemical(s). This information is also available in the OSHA Table Z list of regulated chemicals.

17.1 Incident Reporting

In the event of any incident that results in a possible overexposure to a chemical, regardless of whether any signs or symptoms of exposure are noted or whether the laboratory worker seeks medical attention, the laboratory worker should complete a *Possible Chemical Overexposure Incident* Form (Attachment 9). The form must be submitted to the CHC and copies forwarded UVU's Emergency Risk Management Director. Completed forms are retained by the CHC.

17.2 Exposure Monitoring

Exposure monitoring must be conducted if there is reason to believe that exposure levels for a particular substance may routinely exceed either the action level or the PEL. The CHC, the Faculty Mentor, and Laboratory Mangers may use professional judgment, based on the information available about the hazards of the substance and the available control measures, to determine whether exposure monitoring must be conducted.

When necessary, exposure monitoring is conducted by CHC according to established industrial hygiene practices. Results of the monitoring are made available to the individual monitored and his or her Faculty Mentor/Lab Manager within 15 working days of the receipt of analytical results.

Based on the monitoring results, periodic air sampling may be scheduled at the discretion of CHC, in accordance with applicable federal, state and local regulations.

The CHC maintains records of all exposure monitoring results.

18.0 MEDICAL CONSULTATIONS AND EXAMINATIONS

Laboratory workers should seek medical attention from under the following conditions:

1) If the individual experiences signs or symptoms associated with a hazardous chemical to which he or she may have been exposed in the laboratory
2) Where exposure monitoring reveals an exposure level routinely above the OSHA action level or permissible exposure limit
3) Whenever a spill, leak, explosion or other occurrence results in the likelihood of a hazardous exposure to a laboratory worker

18.1 Medical Consultation Procedure

18.1.1 Emergency Situations

Call 911! Be able to provide as much information as possible to the dispatcher

- The nature of the exposure
- The Chemical exposed to

18.1.2 Non-Emergency Situations

For University employees (faculty, staff, part-time student employees) non-emergency situations will be handle through the University Worker's Compensation Fund Insurance. Utah Valley University has a work place injury agreement with the following facility:

Work Med
830 North 980 West
Orem, Utah 84057
801-724-4000

Provide the physician with the identity of the hazardous chemicals encountered and the conditions by which the worker was exposed. If available, the SDS should be provided to the physician. All medical exams will be provided at no cost to the worker, without loss of pay.

Cameron Evans of Human Resources will need to be contacted at 801-863-8389

For research students non-emergency injuries are handled through the Emergency Risk Management Director.

19.0 PARTICULARLY HAZARDOUS SUBSTANCES

Particularly hazardous substances are defined to include select carcinogens, reproductive toxins and substances that have a high degree of acute toxicity (such as cyanides and dimethyl mercury).

19.1 Select Carcinogens

Any substance which meets one of the following criteria:

- It is regulated by OSHA as a carcinogen
- It is listed under the category, "known to be carcinogens," in the Annual Report on Carcinogens published by the National Toxicology Program (NTP) (latest edition)
- It is listed under Group 1 ("carcinogenic to humans") by the International Agency for Research on Cancer Monographs (IARC) (latest editions)
- It is listed in either Group 2A or 2B by IARC or under the category, "reasonably anticipated to be carcinogens" by NTP, and causes statistically significant tumor incidence in experimental animals in accordance with any of the following criteria:
    - After inhalation exposure of 6–7 hours per day, 5 days per week, for a significant portion of a lifetime to dosages of less than 10 mg/m^3;
    - After repeated skin application of less than 300 (mg/kg of body weight) per week

- After oral dosages of less than 50 mg/kg of body weight per day.

19.2 Reproductive Toxin

Chemicals that affect the reproductive capabilities including adverse effects on sexual function and fertility in adult males and females, as well as adverse effects on the development of the offspring. Chemicals classified as reproductive toxins in accordance with the Hazard Communication Standard (§1910.1200)

19.3 High acute toxicity

Any chemical that falls within any of the following categories:

- A chemical with a median lethal dose (LD_{50}) of 50 mg or less per kg of body weight when administered orally to certain test populations
- A chemical with an LD_{50} of 200 mg or less per kg of body weight when administered by continuous contact for 24 hours (or less if death occurs within 24 hours) to certain test populations
- A chemical with a median lethal concentration (LC_{50}) in air of 200 parts per million (ppm) by volume or less of gas or vapor, or 2 mg per liter or less of mist, fume, or dust, when administered to certain test populations by continuous inhalation for one hour, provided such concentration and/or condition are likely to be encountered by humans when the chemical is used in any reasonably foreseeable manner.

A link to a list of the more commonly used particularly hazardous substances is posted on the Lab Safety Page on the College of Science Web Page. However, this list is not exhaustive. Consult the product SDS or the CHC to determining whether a substance is classified as particularly hazardous

Before using a particularly hazardous substance, an individual must:

1. Complete a *Particularly Hazardous Substance Approval Form* (Attachment 5). This form is available on the Lab Safety Page on the College of Science Web Page.
2. Submit the completed form to their supervisor or Faculty Mentor for approval.
3. Submit the approved form to the CHC for approval.
4. Post the area where the substance will be used with a *Designated Area* sign (Attachment 10), available from the CHC or can be downloaded on the Laboratory Safety Page of the College of Science Web Page.
5. Follow the procedures outlined in the **Working Safely with Particularly Hazardous Substances** section of this Document.
6. All personnel that will be using the chemical must sign the *Particularly Hazardous Substance Training Form* (Attachment 11)

The *Particularly Hazardous Substance Use Approval Form* provides documentation of the specific standard operating procedure for use of the substance. These procedures

include the use of containment devices and personal protective equipment, decontamination procedures and procedures for safe removal of contaminated waste.

19.4 Working Safely with Particularly Hazardous Substances

The increased hazard risk associated with Particularly Hazardous Substances calls for more strict operating procedures in the laboratory:

19.4.1 Work Habits

- There should be no eating, drinking, smoking, chewing of gum or tobacco, application of cosmetics or storage of utensils, food or food containers in laboratory areas where Particularly Hazardous Substance are used or stored.
- All personnel should wash their hands and arms immediately after the completion of any procedure in which a Particularly Hazardous Substance has been used and when they leave the laboratory.
- Each procedure should be conducted with the minimum amount of the substance, consistent with the requirements of the work.
- The laboratory worker should keep records of the amounts of each highly hazardous material used, the dates of use and the names of the users.
- Work surfaces, including fume hoods, should be fitted with a removable liner of absorbent plastic-backed paper to help contain spilled materials and to simplify subsequent cleanup and disposal.

19.4.2 Personal Protective Equipment

- Particularly Hazardous Substance may require more stringent use of personal protective equipment. Check the SDS for information on proper gloves, lab clothing and respiratory protection.
- Proper personal protective equipment must be worn at all times when handling Particularly Hazardous Substance.
- Lab clothing that protects street clothing, such as a fully fastened lab coat or a disposable jumpsuit, should be worn when Particularly Hazardous Substance are being used. Laboratory clothing used while manipulating Particularly Hazardous Substance should not be worn outside the laboratory area.
- When methods for decontaminating clothing are unknown or not applicable, disposable protective clothing should be worn. Disposable gloves should be discarded after each use and immediately after overt contact with a Particularly Hazardous Substance.

19.4.3 Ventilation/Isolation

- Most Particularly Hazardous Substance work should be performed in a fume hood, glove box, or other form of ventilation. If the chemical may produce vapors, mists or fumes, or if the procedure may cause generation of aerosols, use of a fume hood is required.

- A fume hood used for Particularly Hazardous Substance must have an average face velocity of between 95 and 125 feet per minute. This measurement is noted on flow meter incorporated in the hood.
- A glove box should be used if protection from atmospheric moisture or oxygen is needed or when a fume hood may not provide adequate protection from exposure to the substance; e.g., a protection factor of 10,000 or more is needed.
- Highly toxic gases must be used and stored in a vented gas cabinet connected to a laboratory exhaust system. Gas feed lines operating above atmospheric pressure must use coaxial tubing.

19.4.4 Storage and Transportation

- Stock quantities of Particularly Hazardous Substance should be stored in a designated storage area or cabinet with limited access. Additional storage precautions (i.e., a refrigerator, a hood, a flammable liquid storage cabinet) may be required for certain compounds based upon other properties.
- Containers must be clearly labeled.
- Double containment should also be considered. Double containment means that the container will be placed inside another container that is capable of holding the contents in the event of a leak and provides a protective outer covering in the event of contamination of the primary container.
- Containers should be stored on trays or pans made of polyethylene or other chemically resistant material.
- Persons transporting Particularly Hazardous Substance from one location to another should use double containment to protect against spills and breakage.

19.4.5 Vacuum Lines and Services

- Each vacuum service, including water aspirators, should be protected with an absorbent or liquid trap to prevent entry of any Particularly Hazardous Substance into the system.
- When using volatile Particularly Hazardous Substance, a separate vacuum pump should be used. The procedure should be performed inside a fume hood.

19.4.6 Decontamination and Disposal

- Contaminated materials should either be decontaminated by procedures that decompose the Particularly Hazardous Substance to produce a safe product or be removed for subsequent disposal.
- All work surfaces must be decontaminated at the end of the procedure or work day, whichever is sooner.

- Prior to the start of any laboratory activity involving a Particularly Hazardous Substance, plans for the handling and ultimate disposal of contaminated wastes and surplus amounts of the Particularly Hazardous Substance should be completed.

20.0 INSPECTIONS AND AUDITS

Maintenance and regular inspection of laboratory equipment are essential parts of the Laboratory safety program. The CHC will conduct an audit of all phases of the CHP each year. Results will be provided to the department chairs, faculty, and the laboratory managers. Lab managers and faculty mentors are responsible for taking corrective action.

The Laboratory Audit check list (Attachment 12) will be used to document the audit.

Safety showers, eyewash fountains, and drench hoses will be tested monthly and will be documented on tags attached to the showers, eyewash fountains, and drench hoses.

Fume hoods that do not have a flow meter incorporated in the hood will be tested and documented annually.

OSHA requires that all fire extinguishers be inspected visually monthly. The following should be checked:

- Extinguisher is still charged
- Safety pin is still in place
- If extinguisher has a hose, it is not cracked and still attached to the extinguisher
- The annual certified inspection tag is attached and not expired

In addition all fire extinguishers must be inspected annually by a certified inspector. An inspection tag is attached with the date and month the inspection was performed.

21.0 RECORDKEEPING

The follow records will be established and maintained by the CHC:

- Attendance to the laboratory training safety meeting
- New chemical requests
- Particular hazardous substance requests
- Annual laboratory audit checklists
- All chemical exposure incidents
- All Spill reports
- All accident investigations

- Medical records for employees exposed to hazardous chemicals and harmful physical agents will be maintained for the duration of employment plus 30 years per 29 CFR 1910.1020.
- Inventory and usage records for high risk substances (amounts of substances on-hand, amounts used and names of workers involved) shall be maintained for 5 years.

22.0 REFERENCES AND RECOMMENDED READING

National Research Council, Prudent Practices for Handling Hazardous Chemicals in Laboratories, National Academy Press, Washington, D.C. 1981.

National Research Council, Prudent Practices for Disposal of Chemicals from Laboratories,

National Academy Press, Washington, D.C., 1983.

Freeman, N.T., Introduction to Safety in the Chemical Laboratory, Academy Press, 1982.

Manufacturing Chemists' Association, Inc., Guide For Safety In The Chemical Laboratory, D.Van Nostrand Company, Inc., 1954.

Green, Michael E., *Safety In Working With Chemicals*, MacMillan Publishing Co., Inc. 1978.

Pipitone, David A., *Safe Storage of Laboratory Chemicals*, Wiley & Sons, Inc. 1984.

Code of Federal Regulations, 29 CFR part 1910 subpart Z section 1910.1450, *Occupational Exposure to Hazardous Chemicals in Laboratories*, 1990.
Occupational Exposures to Hazardous Chemicals in the Laboratory

Guidance for hazard determination for compliance with the OSHA hazard communication standard
(29 CFR 1910.1200) https://www.osha.gov/dsg/hazcom/ghd053107.html#process

OSHA Hazard Communication Standard
https://www.osha.gov/dsg/hazcom/index.html

ATF Distribution and Use of Tax Free Alcohol 27 CFR Part 22
https://www.law.cornell.edu/cfr/text/27/part-22

Global Harmonized System of Classification and Labeling of Chemicals
http://www.uvu.edu/chemistry/docs/lab-safety/ghs.pdf

Attachments

Attachment 1
Chemical Spill Report Form

Department Name:	Reporting Person: Phone #:
Date & time spill occurred or was discovered:	
Location (building)	Location (room)
Material spilled:	Amount spilled:
Approximate area covered by spill:	
Any personnel contamination? Describe and include any first aid provided:	
Any Chemical Release to the drain? Describe:	
Describe how the spill occurred to the best of your knowledge. Include any relevant circumstances in as much detail as possible.	
What containment measures were taken to control the spill?	
What corrective actions were taken to control and clean up the spill?	
What Personal Protective Equipment was worn during clean up?	
List any existing or potential hazards that either caused or resulted from the incident.	
What was done with the cleanup materials?	

Attachment 2
Laboratory Safety Training Roster

Laboratory Safety Training Attendance					
Date	Department	Name (Printed)	UVU ID Signature	Position	Mentor/Manager

Statement of Understanding

I, Enter your Name acknowledge that:

- I have read and understand the College of Science's Chemical Hygiene plan (CHP) located at: http://www.uvu.edu/chemistry/docs/lab-safety
- Understand my role as Choose Role in implementing the CHP
- Will observe to the best of my ability the policy and procedures outlined in the CHP. Failure to do so may result in lack of access to Scholarly Activities Committee (SAC) money and ability to order and use chemicals.

Signed:Enter Your Name UVUIDEnter Your UVUID.

Date:Click here to enter a date.

Statement of Understanding

I, Enter your Name acknowledge that:

- I have read and understand the College of Science's Chemical Hygiene plan (CHP) located at: http://www.uvu.edu/chemistry/docs/lab-safety
- Understand my role as Choose Role in implementing the CHP
- Will observe to the best of my ability the policy and procedures outlined in the CHP. Failure to do so may result in termination to access to the laboratories.

Signed:Enter Your Name UVUIDEnter Your UVUID.

Date:Click here to enter a date.

Attachment 4
NEW CHEMICAL PURCHASING REQUEST FORM

Date_____ Requestor_____

Dept_____ Proposed Location_____

Chemical Name_____

MSDS Attached □ Yes □ No

NOTE: MATERIAL SAFETY DATA SHEET REQUIRED FOR APPROVAL

Proposed Use:

_____
_____
_____
_____

Engineering	Controls Storage Requirements	Personal Protective Equipment
□ Fume Hood	□ Flammable Cabinet	□ Chemical Goggles
□ Canopy Hood	□ Corrosive Cabinet	□ Face Shield
□ Laminar Flow	□ Acid Cabinet	□ Overalls/Apron
□ Other	□ Other	□ Gloves
_____	_____	Type_____
		□ Other_____

Will Medical Surveillance be required? □ Yes □ No

If yes, indicate type_____

Is chemical classified as a Particularly Hazardous Substance □ Yes □ No
(If yes the Particularly Hazardous Substance Approval form must be filled out)

Comments:_____
_____
_____

Approved by:

_____ Date: _____
(Faculty Mentor)

_____Date:_____
(Chemical Hygiene Coordinator/Chemical Stockroom Manager)

Attachment 5
Particularly Hazardous Substance Approval Form

Before using any particularly hazardous substance, please complete this form and have it approved by your Faculty Mentor and Chemical Hygiene Coordinator. See page 3 of this form for more complete definitions of a particularly hazardous substances and instructions for completing this form.

Name Enter Name
Faculty Mentor Enter Supervising Professor Department Enter Department

1. Substance Information

A. Chemical name Enter Name of Chemical

B. ☐ Carcinogen ☐ Reproductive Toxin ☐ High Acute Toxicity

C. Estimated Rate of Use (e.g., grams/month) Enter Rate of Use

D. SDS reviewed and readily available ☐ Yes ☐ No

2. Hazards

Physical Hazards

A. Flammable ☐ Yes ☐ No B. Corrosive ☐ Yes ☐ No

C. Reactive ☐ Yes ☐ No D. Temperature sensitive ☐ Yes ☐ No

E. Stability (e.g., decomposes, forms peroxides, polymerizes, shelf-life concerns) ❍ Stable ❍ Unstable

F. Known incompatibilities Enter incompatibilities

Health Hazards

G. Significant Route(s) of Exposure
Inhalation Hazard ☐ Yes ☐ No
Skin Absorption ☐ Yes ☐ No

H. Sensitizer ☐ Yes ☐ No I. Medical Consultation Needed ☐ Yes ☐ No

3. Procedure

A. Briefly describe how the material will be used
Enter How Material will be used
Vacuum system used ☐ Yes ☐ No
B. If yes, describe method for trapping effluents Enter How effluents will be trapped

4. Exposure Controls

Ventilation/Isolation

A. Hood required ☐ Yes ☐ No
If yes, hood currently operates at 95 - 125 feet per minute face velocity ☐ Yes ☐ No
B. Glove box required ☐ Yes ☐ No C. Vented gas cabinet required ☐ Yes ☐ No

D. Personal Protective Equipment (PPE) (Check all that apply)

☐ Safety glasses ☐ Chemical splash goggles ☐ Face shield

☐ Gloves (type Enter type) ☐ Lab coat ☐ Apron

☒ Respirator ☐ SCBA *(Respirators and SCBA require EHS approval)*

☐ Other, please describe Enter additional

Attachment 5
Particularly Hazardous Substance Approval Form

5. Location/Designated Area/Personnel

A. Building Enter Building B. Lab Enter Laboratory

C. List all individuals who will be using the Chemical

D. Location where substances will be stored Enter Location

E. Storage Method/Precautions

☐ refrigerator/freezer ☐ hood
☐ double containment ☐ vented cabinet
☐ flammable liquid storage cabinet ☐ other, describe _____

6. Spills and Decontamination

A. Spill control materials readily available ☐ Yes ☐ No

B. Special personal protective equipment needed (e.g., SCBA) ☐ Yes ☐ No Describe Describe

C. Decontamination method Enter Decontamination method

7. Waste Disposal

A. In-lab neutralization ☐ Yes ☐ No B. Deactivation ☐ Yes ☐ No

C. Dispose as hazardous waste ☐ Yes ☐ No

8. Authorization

This individual has demonstrated an understanding of the hazards of the listed substance and plans to handle the substance in a manner that minimizes risk to health and property. He/she is authorized to use the substance in the manner described.

_____ _____

(Faculty Mentor) Chemical Hygiene Coordinator

Attachment 5
Particularly Hazardous Substance Approval Form

USING THIS FORM

For purposes of this form, a particularly hazardous substance (PHS) includes known or suspected human carcinogens, reproductive toxins, and substances with acute toxicity above certain thresholds. A more complete definition is included in your departmental Chemical Hygiene Plan.

Each individual planning to use a PHS must complete this form and have it approved by their Principal Investigator or supervisor and the departmental Chemical Hygiene Officer prior to their initial use.

Responsibility for determining whether a chemical is a PHS and completing this form rests jointly with the supervisor and the individual seeking use approval.

1. SUBSTANCE INFORMATION

A. Enter name and CAS (Chemical Abstract Service) number of the PHS.

B. *Carcinogen*: if on IARC, OSHA or NTP list *Reproductive toxin*: mutagens, teratogens, embryotoxins
High Acute Toxicity: oral $LD_{50} \leq 50$ mg/kg, skin $LD_{50} \leq 200$ mg, air $LC_{50} \leq 200$ ppm or ≤ 2 mg/l.
See Chemical Hygiene Plan for more information.

C. Self-explanatory

D. MSDS may be available in hard copy or via the internet.

2. HAZARDS

Refer to *Physical Properties* section of SDS

A. Flammable liquid: flashpoint $\leq 100°$ F Flammable solid: liable to cause fire through friction, absorption of moisture, spontaneous chemical change, or which can be ignited readily and when ignited burns vigorously.

B. Corrosive: Causes visible destruction of, or irreversible alterations in, living tissue by chemical action at the site of contact.

C. Reactive: May become unstable or contact with water produces flammable or toxic gas.

D. Temperature Sensitive: Must be kept within a certain temperature range to ensure stability.

E. Unstable: substance will vigorously polymerize, decompose, condense, or will become self-reactive under conditions of shock, or high or elevated pressure or temperature. Also includes time-sensitive materials, particularly those that produce peroxides over time.

F. List chemicals or materials that might cause instability or adverse conditions if mixed with the particularly hazardous substance(s).

G. Inhalation: inhalation of the substance may cause adverse health effects.

H. Skin exposure: substance is readily absorbed through the skin or can cause significant damage to skin upon contact.

I. Certain chemicals are known to effect the immune system, causing a person to experience allergic reactions, up to and including anaphylactic shock, upon exposure to the chemical, after the initial sensitization.

J. Some chemicals can accumulate in body tissues and may require initial or periodic medical surveillance.

3. PROCEDURE

A. Briefly describe the part of the experimental procedure that involves the substance, with particular attention to how the chemical will be manipulated.

B. Vacuum systems include central vacuum systems and vacuum pumps within the lab.

C. Describe what will be done to ensure that the substance is not accidentally drawn into the vacuum system. Cold traps or filters are some examples of such measures.

4. EXPOSURE CONTROLS

A. A fume hood should be used for chemicals that may produce vapors, mists, or fumes, or if the procedure may cause generation of aerosols.
B. A glove box should be used if protection from atmospheric moisture or oxygen is needed or when a fume hood may not provide adequate protection from exposure to the substance; e.g., a protection factor of 10,000 or more is needed.
C. Highly toxic gases must be used and stored in a vented gas cabinet connected to a laboratory exhaust system. Gas feed lines operating above atmospheric pressure must use coaxial tubing.
D. Safety glasses protect from flying particles and minor chemical splashes, for instance, from opening a centrifuge tube.
E. Chemical splash goggles should be worn when there is a possibility of a significant chemical splash. Most chemical manipulations, particularly where pressure is involved, warrant chemical splash goggles.
F. Face shield, worn with splash goggles, provides full face protection when working with large volumes of chemicals. Gloves should be worn when working with any particularly hazardous substance. Since not all gloves offer significant protection from every chemical, it is important to choose the glove that offers the best resistance. See the MSDS, or glove manufacturer compatibility charts for more information. Lab coats should be worn when working with hazardous substances. The coat should not be worn outside the laboratory and should be laundered separately from other clothing.
G. Aprons offer chemical resistance and protection from splashes and can be used in conjunction with a lab coat.
H. Respirators offer protection from inhalation of substances when engineering controls are not sufficient. Use of respirators must be approved by the Chemical Hygiene Coordinator.
I. Self-Contained Breathing Apparatus (SCBA). Contact the Chimical Hygiene Coordinator if you feel an SCBA is necessary

LOCATION/DESIGNATED AREA

A. Building where the substance will be used
B. Room number where the substance will be used.
C. List all individuals that will be using the chemical.
D. This room or area must be posted with a Designated Area sticker available through the Chemical Hygiene Coordinator or on the Lab Safety Page of the College of Science Web Page
E. Describe where the substance will be stored. Be specific, e.g, on a shelf, in a refrigerator, in a hood, etc.
F. Self-explanatory. Double containment means that the container will be placed inside another container that is capable of holding the contents in the event of a leak and provides a protective outer covering in the event of contamination of the primary container.

6. SPILLS AND DECONTAMINATION

A. Self-explanatory
B. Self-explanatory.
C. Describe how the work area will be decontaminated after use, in the event of a spill, or upon completion of the work and before removal of the designated area signage.

7. WASTE DISPOSAL

A. Some corrosive chemicals may be neutralized before disposal via the drain or the hazardous waste program.
B. Some materials, such as ethidium bromide, can be chemically deactivated before disposal via the drain or the hazardous waste program.
C. Particularly hazardous substances must not be poured down the drain without consulting the Chemical Hygiene Coordinator.

Attachment 6
Unattended Operations Sign

Experimental Procedure Currently in Progress

Please leave the lights and pay attention to your surroundings

Attachment 7
Critical Operation Approval

NOTE: A “Critical Operation” is a procedure/operation occurring that if just abandoned could result in a catastrophic results (i.e. fire, explosion). It is not a procedure that if abandoned results in lost data.

Name_____Date_____

Building_____Laboratory_____

Describe the Procedure/Operation _____
_____
_____
_____

Describe what may happen if the Procedure/Operation is just abandoned _____
_____
_____

Describe what needs to be done to prevent what may happen and how long it will take
_____
_____
_____

List the individuals that will be involved _____
_____
_____

List what additional safety procedures that will be need (i.e. respirators, SCBAs, additional PPE) _____
_____
_____

What extra training will be needed _____
_____
_____

Approval _____ _____
(Department Head) (Chemical Hygiene Coordinator)

Attachment 8
Special Training for a Critical Operation

By signing below I am attesting that I have been trained on the Critical Operation listed on the attached Critical Operation Approval form; and the I understand what will need to be done to reduce the hazard, what additional safety procedures need to be followed, and what additional PPE will need to be used. I also understand that I am under no obligation to stay and perform the procedure(s) listed in the attached form.

Name (printed)	Position	Signature	Date

Attachment 9
Possible Chemical Overexposure Incident

Date of incident _____ Time of Incident _____

Name _____ Phone _____ E-Mail _____

Department _____ Supervisor/Faculty Mentor_____

Substances in use _____

_____

_____

MSDS attached to this report ❑ yes ❑ no ❑ not available

Duration of exposure _____

Estimated amount of chemical involved _____

Control measures used at time of incident: ❑ Fume Hood ❑ Protective Clothing _____

❑ Eye Protection _____ ❑ Face Shield ❑ Gloves _____ ❑ Respirator _____

Location and Description of incident _____

_____

_____

_____

Witnesses _____

Location of injuries or sites of contact, e.g., skin, eyes:_____

_____

Signs and symptoms developed, if any _____

_____

First aid administered _____

Elapsed time for signs and symptoms to develop _____

Medical consultation sought? ❑ yes ❑ no

_____	_____	_____
Name of Supervisor	Signature	Date
_____	_____	_____
Chemical Hygiene Officer	Signature	Date

AUTHORIZED PERSONNEL ONLY

The following Chemical(s) are being used inside this Laboratory:

_____

_____

_____Which has/have been designated as a (circle appropriate):

Carcinogen

Reproductive Hazard

High Acute Toxicity

Do not enter unless you are familiar with the appropriate PPE, handling, storage, transportation, decontamination, and disposal procedures.

Attachment 11
Particularly Hazardous Substance Training

By signing below I am attesting that I have been trained on the Particularly Hazardous Substance (s) listed in the attached form, and I have read the Safety Data Sheet(s)

I understand:

- The particular hazard(s) associated with the attached chemical(s)
- The extra exposure controls will be used
- The appropriate PPE associated with the associated chemical(s)
- How to clean up any spills and decontaminate any contaminated equipment
- How to disposal of the associated chemicals properly

Name (printed)	Position	Signature	Date

Attachment 12
Laboratory Audit Check List

Date_____
Building_____Laboratory_____Department_____

	Item	Criteria	Item	Comment
Chemical Storage				
	1	**Chemicals segregated by hazard class**		
	a	Flammables are away from oxidizers and stored in flammable cabinet		
	b	Acids and flammables are separated		
	c	Acids and bases are separated		
	d	Acids stored in acid cabinet or secondary containment		
	e	Organic Acids separated from mineral acids		
	f	Nitric acid is separated from other acids, e.g. in its own plastic tub, in a separate cabinet, or in a separate part of the acids cabinet		
	2	Chemical containers in good condition		
	3	**Chemical containers properly labeled**		
	a	Primary original containers need to have a label on and the label must be readable		
	b	Secondary containers that are used for storage (e.g., squeeze bottles) need to be labeled with the chemical contents		
	4	Chemical containers closed		
	5	Glass chemical containers are not stored on the floor		
	6	Hazardous chemicals not stored above eye level		
	7	Lab safe refrigerator used for cold flammable storage		
	8	Peroxide forming chemicals not expired		
	9	Gas cylinders properly secured		
	10	Fume hood not used as permanent storage		

Attachment 12
Laboratory Audit Check List

Date_____

Building_____Laboratory_____Department_____

	Item	Criteria	Item	Comment
Ignition Sources				
	11	Vacuum pumps and other ignition sources are segregated from flammables/ combustibles		
	12	**Electrical cords**		
	a	Electrical cords are in good condition		
	b	Extension cords are not used as permanent wiring		
	c	Power strips are not connected in series (daisy-chained)		
Chemical/Sharps/Glass Waste				
	13	Less than 55 gallons of chemical waste in area		
	14	**Chemical waste containers**		
	a	Properly labeled to indicate that the material is waste and ALL the contents have to be indicated. A list on a clipboard can be used for indicating the contents as long as it is near the waste container and it's very clear which list goes with which container (the container itself still needs to be labeled as "waste")		
	b	Original contents label MUST be defaced or removed		
	c	Containers always kept closed if not being added to		
	d	Funnels only allowed if they are actively pouring waste in or funnel has a closed lid and is firmly secured to the waste container		
	e	Chemical waste stored at point of generation		
	f	Chemical waste stored on floor is in secondary containment		
	15	**Glass waste disposal box properly used**		
	a	Box should not be more than ¾ full		

Attachment 12
Laboratory Audit Check List

Date_____

Building_____Laboratory_____Department_____

	Item	Criteria	Item	Comment
	b	Box should not contain hazardous materials (e.g. unclean chemical bottles or untreated biological material)		
Chemical/Sharps/Glass Waste (continued)				
	14	**Chemical waste containers**		
	c	Box should not have liquids (e.g. signs of water damage to the cardboard or containers containing liquid)		
	d	Box should have structural integrity (e.g. bottom is rotting)		
	16	**Sharp containers**		
	a	Containers should not be more than ¾ full		
	b	Containers should not have bottles, beakers, etc. in them unless that glassware is INFECTIOUS		
	c	Sharps cannot be discarded anywhere other than sharps containers		
	e	Containers properly used/properly disposed when full		
Chemical Hygiene				
	17	Excess clutter was not present in the lab (cluttered lab benches, fume hoods, and floors that goes beyond daily use [>24 hours])		
	18	Items were not stored within 18 inches of a fire sprinkler head		
	19	**Food/drinks**		
	a	Food/drinks not in the lab		
	b	Food/drink not stored in lab refrigerators		
	20	Electrical panels/disconnects clear of obstruction/ panel doors closed		
	21	Safety Data Sheets (SDSs) available for all chemicals in laboratory (if no computer is available in laboratory, hard copies must be available)		

Attachment 12
Laboratory Audit Check List

Date_____
Building_____Laboratory_____Department_____

	Item	Criteria	Item	Comment
	22	**Personal Protective equipment (PPE)**		
	a	Safety glass are being worn		
	b	Proper gloves are being used		
Chemical Hygiene (continued)				
	22	**Personal Protective equipment (PPE)**		
	c	No open toe shoes		
	d	No Shorts		
	23	**Fume Hoods**		
	a	Fume Hood has been tested within the past year		
	b	Fume hood sash not blocked by items or objects — cannot close all the way		
	c	Fume hood sash closed when unattended/at or below 18 inches when attended		
	d	Baffles are not blocked. Large equipment is put on blocks to raise it approximately two inches so that air may pass beneath it.		
	24	Refrigerators that have not been retrofitted for flammable chemicals have a sign posted saying, "Do not store flammable solvents in this refrigerator"		
	25	**Unattended operations (if applicable)**		
	a	Unattended operation sign posted at all entrances		
	b	Lights are left on		
	26	**Particularly Hazardous Substances (if applicable)**		
	a	Particularly Hazardous Substances sign is posted at all entrances		
	b	Usage log is up to date		

Attachment 12
Laboratory Audit Check List

Date_____
Building_____Laboratory_____Department_____

	Item	Criteria	Item	Comment
	c	Appropriate extra PPE is being worn		

Emergency Equipment and Exits				
	27	Exits and aisles clear of obstruction		
	28	Emergency Contacts list posted at each exit		
	29	Evacuation Routes posted at each exit		
	30	**Emergency equipment**		
	a	**Showers, Eyewash Stations, Drench Hoses**		
	i	Signs posted		
	ii	Free of obstructions		
	iii	Tested within last six months		
	b	**Fire Blankets**		
	i	Prominently hanging on wall		
	ii	Free of obstructions		
	c	**Fire Extinguishers**		
	i	Signs posted		
	ii	Prominently mounted on wall		
	iii	Inspection tag current		
	d	**First-aid Kits**		
	i	Available and prominent		
	ii	Free of obstructions		
	31	Spill supplies available		