Safety information for all CAL employees

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After reading through this document and completing required online safety modules, fill out the Acknowledgement of Safety Instructions and Emergency Preparation Training sheet.

SAFETY PROTOCOLS SPECIFIC TO THE OSU CENTRAL ANALYTICAL LABORATORY

All CAL users must have completed the online EH&S Comprehensive Laboratory Safety training modules.

In case of emergency call: **911**
For Oregon State Police/Department of Public Safety call: **541-737-7000**
For OSU emergency information call: **541-737-8000**
For poison control call: **1-800-222-1222**

Personal Protective Equipment
Appropriate personal protective equipment (PPE) required in the OSU CAL will always include; closed toe shoes, long pants, a laboratory jacket, safety glasses, and gloves. Several procedures will require respirators or heat resistant gloves. PPE, first aid kits, fire blankets, acid chemical spill kit, and base chemical spill kits are available for use and are located on top of the desk next to the front door. Lab jackets will be laundered periodically. Disposable gloves are for single use only. Once gloves have been removed, they are not to be put back on. Do not touch your face or personal items while wearing gloves. Do not wear gloves outside of the lab.

Evacuation
There are two exits in the lab. If you hear an alarm, evacuate. The front/main door leads to the "soils café" room and the main body of the Agricultural Life Science Building (ALS). The secondary exit is through the "Elementar" room (3079H) and may be a good option for evacuation because it is right next to the sky bridge that leads to Nash Hall. If there is information or reason to believe that the cause for evacuation is in ALS, please use the secondary exit, proceed directly downstairs, move away from the building, and follow the instructions of the safety coordinator for the area. Never re-enter the building after evacuating unless cleared by emergency personnel.

Fire
There is a fire extinguisher on the wall in the hallway outside of the "soils café" room and one in the Elementar room. Fire extinguishers should be used by trained personnel only. Training can be done on the EH&S website. If you are not trained, activate a fire alarm (outside the back door by the Elementar), evacuate the area, and call 911. As you evacuate, notify other occupants, close doors behind you, check the heat of door handles before you grab it, and do not use elevators.

Attention
It is the responsibility of everybody in the lab to pay attention to their surroundings. Even when doing repetitive lab work, do not do anything that distracts you to the point of making mistakes or not hearing important safety information. If earbuds or headphones are worn, they must be

at a volume low enough to hear a voice over them. Ideally, only one ear would have a bud in at a time. Do not have phone conversations or watch videos while performing lab work.

Chemical Contact

The primary eye wash and shower station are located the end of the wall that divides the two main compartments of the laboratory, directly across from room 3079G. If anything comes in contact with your face you should immediately proceed to the eye wash station and thoroughly rinse your face and eyes by placing your face close to the rinse and pushing the orange paddle away from you. Keep your face in the wash station for a minimum of 60 seconds. Follow up steps will differ depending on the situation but you will always need to report the incident to your supervisor and with an EH&S incident/accident report and may seek appropriate medical attention. The shower rinse should be used if chemicals are splashed on other parts of your body. Clothing (particularly if made of plastic derived fabrics) may need to be stripped to eliminate the risk of melting to your skin. Again, any time the shower is used, this must be reported to your supervisor and on an EH&S incident/accident report which can be found on the OSU EH&S website http://oregonstate.edu/ehs/forms.

Chemical safety

Store chemicals in their original containers when possible. If a solution is made, the container it is stored in must be labelled with the solution contents, date it was made, and name of who created it. Acids, bases, organics, and oxidizers have certain storage requirements and should be stored separately in the appropriate cabinets. All unattended reactions (including open beakers containing any solution) needs to be labelled with what it is, whether it's hazardous, and who is responsible for it. Even if it is only DI water, and you know it's not dangerous, custodial staff need to know if they are working around hazardous chemicals.

Power Outage

In the case of a power outage, please remain calm and remain where you are unless directed to evacuate. Secure your experiments, close chemical containers and fume hood sashes prior to leaving. Turn off equipment when appropriate, assist people with disabilities, use the emergency information number for updates (541-737-8000) and notify others in your department. There is no equipment currently in CAL that requires any immediate action when the power goes out, so keep everyone safe by not running to check on equipment.

Injury or Illness

In the case of severe injury or sudden severe illness, call 911, keep patient still and comfortable, deliver first aid if trained, and send someone to the loading zone outside of ALS to meet the ambulance to help them find the patient. Report the incident/accident to your supervisor and to EH&S. Any incident that requires use of a first aid kit needs to be reported.

Hazardous Waste
Hazardous waste created through standard CAL procedures can be collected in the large drum in the back of the lab by the Lachat FIA. Neither this drum nor any other temporary hazardous waste collection container should ever be left open or unlabeled. If hazardous waste is produced in a nonstandard way (for example, if a student is using CAL facilities to perform a procedure that CAL does not normally perform, and would therefore not be included in the CAL waste determination forms), do not put that waste in the large drum. Put the waste in a bottle with a secure screw-top, label it using a hazardous waste label, and let Gloria know.

Hazardous Substance Release
If there is a health risk, move away or evacuate the area and call public safety. If handling the spill is within your training, contain spill with appropriate absorptive/neutralizing materials that are found on the top of the desk near the front door. Notify all others in your area of the incident and the action taken. If wider scale evacuation is warranted, please pull the alarm, immediately contact public safety and EH&S, and follow evacuation protocol. For routine service related to a more minor incident contact Facility Services for work coordination: 541-737-2969.

Broken Glass
If you break any lab glass, carefully put all large pieces in the broken glass bin at the back of the lab near the Lachat FIA. Use the hand broom and dustpan to sweep up all small shards, and empty the dustpan into the broken glass bin. If the top flap of the broken glass bin cannot freely move, the bin is full. Tie the plastic bag at the top and use packing tape to secure the top of the box to the bottom. Make sure that the outside of the box is clearly labeled “Broken Glass”, and take it down to the Dumpster. Broken glass is not recyclable. Tell Gloria or Adam what item was broken.

Crime, Suspicious Persons/Objects, Bombs
Do not attempt to apprehend, interfere, confront, or move anything, and leave the area using your best judgement. Contact the police and public safety at 541-737-7000 immediately or 911 if an emergency. If possible, observe/note details of the situation that may be relevant to any potential investigation.

Fume hood
Fume hoods must be used when handling acids and certain organic materials. If you are unsure of whether a procedure must be performed in a fume hood, ask Gloria or Adam. When using the fume hood, make sure that the sash is no higher than the sticker on the side of the hood. All

chemicals being stored in the hood must have secondary containment (e.g., a plastic cafeteria tray) to prevent damage caused by leaks.

Gas cylinders

Gas cylinders must be chained to a wall or other secure surface. Only move gas cylinders or attach/detach regulators if you have been trained to do so. Do not ever open a cylinder if there is no regulator attached. Make sure that the correct grade of regulator is being used for each cylinder (it should be impossible to attach the wrong kind, but it is always good to check).

Drying ovens

The drying ovens in our lab are for either plant or soil drying. The ovens for soil drying are set to 105C, and no paper or plant material should be in those ovens. Use tongs or heat-resistant gloves when removing objects from the 105C oven. Make sure that the door is closed completely when not in use. If the temperature on the oven needs to be adjusted, do so gradually, and check the temperature frequently.

Muffle furnaces

The heavy furnaces at the back of the lab are used to incinerate organic material. They get extremely hot. Allow the ovens to cool off slowly, so the lab isn't exposed to the full heat of the oven. If the oven is opened too soon, it can be a fire risk.

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Acid Washing

An acid bath is a suitable container that holds up to several liters of concentrated acid that is used for cleaning glassware, plastic, and ceramic objects. Metal objects such as tweezers, spatulas, and stirring bars should never be placed in the acid bath as they will corrode. Rubber items should also be excluded since they disintegrate after extended periods in acid.

Potential Hazards

Acids are corrosive substances which cause destruction of living tissue by chemical action at the site of contact causing severe burns. Corrosive effects can occur not only on the skin and eyes, but also in the respiratory tract and may be harmful if inhaled, causing destruction to the tissue of the mucous membranes and upper respiratory tract. For this reason, skin/eye contact with acid and direct inhalation of the noxious fumes should be avoided.

Personal Protective Equipment

Because of the severe hazards associated with strong acids, laboratory users need to wear appropriate personal protective equipment (PPE) at all times. This includes a lab coat, safety goggles, appropriate gloves, closed toe shoes and full leg coverage (i.e. no shorts or skirts). Best practice dictates that when working with stronger acids or during the preparation/disposal of an acid bath chemical resistant gloves and aprons (such as neoprene or PVC) should be worn.

Special Handling and Storage Requirements

- It is essential that all strong corrosives be stored separately from all chemicals with which they may react. Ensure secondary containment (such as a nalgene/polypropylene tray or tub) and segregation of incompatible chemicals. See the “Chemical Storage Safety Instruction” for more information on chemical storage requirements.
- Acid baths should always be done inside a fume hood in order to protect employees from potential inhalation health effects. It also helps prevent erosion in the space.
- Due to the risk of inhaling noxious fumes acid baths should be kept in or near fume hoods or in well ventilated areas.
- When diluting acids **always** add acid to water (**NEVER** water to acid). Transfer from container to the receptacle by using an appropriate funnel to avoid spillage.
- Label the acid bath in plain English (no abbreviations) with its chemical content and percentage. See “Safety Instruction on Chemical Labeling” for more information.
- Make sure all containers/baths have tight fitting lids that are kept closed when not in use. Acid should **NEVER** be left in a container that is open and venting.
- Keep the acid containers/baths out of high traffic areas and ensure it is done near certified eye wash/safety shower in case of emergencies.

Procedure

1. Use the formula (M1)(V1)=(M2)(V2) where M is the molarity and V is the volume to determine amount of concentrated acid needed. The amount of water is determined by the amount of acid plus whatever is needed to bring the solution up to the final desired volume.
2. Wearing full PPE carefully add the desired amount of **acid** to **water** (**NEVER** water to acid), preparing enough solution to completely submerge the items.
3. Before placing the items into the bath make they are thoroughly rinsed with distilled water to remove the bulk of contents. Check for any residue, using a scrub brush if necessary.
4. To wash, slowly submerge items into the acid bath to prevent any acid splashing back. Allow to sit a couple of hours, preferably overnight, with the acid bath lid securely fastened. Make sure all surfaces are in contact with the acid and that there are no air pockets.
5. When done, carefully remove items from the acid bath to avoid spillage or splash back. Thoroughly rinse the solution from items, first with tap water then distilled water. Allow to dry.

Spill and Incident Procedures

Assess the extent of danger, help contaminated or injured persons, evacuate the spill area, and avoid breathing vapors. If possible, confine the spill to a small area using a spill kit or absorbent material. Keep others from entering contaminated area (i.e. use caution tape, barriers, etc.).

- *Small* (less than1 gallon) – If the lab worker has been properly trained and does not perceive the risk to be greater than normal laboratory operations, they should use appropriate personal protective equipment and clean-up materials for the chemical spilled. Cover the spill with sodium carbonate or bicarbonate (be careful of possible strong reaction). When reaction stops, pickup with damp sponge or paper towels or sweep up. Place waste in container, label, and arrange for chemical waste pick-up, or if appropriate dispose of in regular waste.
- *Large* (more than 1 gallon) – Call EH&S at 541-737-7000 via public safety for assistance. Notify others in area of spill. Turn off ignition sources in area. Evacuate the area and post doors as a spill area. Remain on the scene, but at a safe distance to receive and direct safety personnel when they arrive.

Chemical spill on the body or clothes – Remove all contaminated clothing and rinse the affected area with running water or use the emergency shower for at least 15 minutes. Seek medical attention if necessary. Notify supervisor immediately.

Chemical splashes into eyes – Immediately rinse the eyeball and inner surface of eyelid (by forcibly holding the eye open) with water from the emergency eyewash station for at least 15 minutes. Seek medical attention if necessary. Notify supervisor immediately.

Waste Disposal

Best practice is to place a Hazardous Waste request with EH&S when disposing of any acid. However, certain acids may be neutralized and poured into the sanitary sewer, but only when the neutralized mixture is nontoxic and meets the city of Corvallis discharge limits (pH of 6-9.5). During the neutralization of an acid the lab worker should don full PPE and work in a fume hood if possible.

The following is a list of acids and bases that may **not** be neutralized and disposed of by sanitary sewer:

- Perchloric acid at any concentration
- Nitric acid, at concentrations above 70% or red fuming nitric acid.
- Sulfuric acid, fuming (Oleum or disulfuric acid)
- Hydrofluoric acid at any concentration.
- Acids with heavy metals in solution.
- Aqua Regia
- Acids that contain dyes or surfactants
- Any organic acids that are still toxic after neutralization (most organic acids - one exception is acetic acid with a concentration of less than 80%(i.e. do not neutralize glacial acetic acid.)

If a laboratory has any questions or concerns about the proper disposal of an acid they should contact EH&S at 541-737-2273 for assistance, or place a Hazardous Waste request at http://oregonstate.edu/ehs/waste.

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Safety Instruction

Waste: Glass/Lab-ware Disposal

General

- Clean, unbroken waste glass at OSU is recycled through OSU Campus Recycling (7-2925).
- The glass recycling program is not an avenue to dispose of chemical wastes or chemically contaminated glass.
- View Campus Recycling's Glass page for more information.

Normal Glass (non-chemical/lab)

- Glass does not need to be separated by color.
- Remove lids from containers and rinse container.
- Place in appropriate campus recycling bins.
- Do not place broken glass in the recycling bins.

Chemically Contaminated Glass/Lab-ware

- Does NOT get recycled.
- Most chemically contaminated glass/lab-ware should be boxed up, labeled 'glass', and disposed of directly in the dumpster.
- Containers/Lab-ware contaminated with high hazard chemicals known as P-List materials must be handled by EH&S as hazardous waste. P-list materials can be found here.
- Chemically contaminated containers must be empty prior to being boxed up and disposed of but do not need to be rinsed.
- Allow any residual VOC's from empty solvent containers to dissipate in a fume hood before disposing.
- Obliterate all chemical/warning labels from chemical containers before disposing.

Broken Glass/Lab-ware (chemically contaminated or not)

- Deposit broken glass/lab-ware in puncture-resistant, sealed packaging (cardboard box), tape shut, label as glass, and place in building dumpsters.
- Broken glass/lab-ware disposal box kits are available from Chemical Stores in Gilbert Hall or from commercial vendors.
- Broken glass/lab-ware boxes are NOT hazardous waste and EH&S does NOT handle them.
- Broken glass/lab-ware contaminated with high hazard chemicals known as P-List materials must be handled by EH&S as hazardous waste, not as described above. P-list materials can be found here.

Broken glass disposal kit

Non-Recyclable Glass and Lab-ware

- Heat Resistant Glass
  - Borosilicate glass, also called hard glass or lab glass (trade names: Corning, Pyrex, Kimax, Kimble), pasteur or volumetric pipets, glass tubing & rods, microscope slides and cover glasses.
- Plate Glass (window glass) and Automotive Glass.
- Non-recyclable glass and lab-ware should be boxed up, labeled as glass, and placed in the dumpster.

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OSU ENVIRONMENTAL HEALTH & SAFETY

Safety Instruction

Chemical Container Labeling

All containers that contain a "Hazardous Chemical" must be labeled for the health and safety of employees, students, visitors, and emergency responders. By OSHA definition, a "Hazardous Chemical" means any chemical which is classified as a physical or health hazard, a simple asphyxiant, combustible gas, pyrophoric gas, or hazard not otherwise classified.

What type of label is needed on a hazardous chemical container?

- Hazardous chemical containers used within a Laboratory Area must follow the OSHA Laboratory Standard.
- Hazardous chemical containers used within a Non-Laboratory Area must follow the OSHA Hazardous Communication Standard.

Summary of OSHA standards and labeling requirements for Hazardous Chemical Containers

	Laboratory Areas & Use		Non-Laboratory Areas & Use (machine shop, paint shop, etc.)	
Required Label Information [1]	**Manufacturer's container [2]**	**Secondary container [3]**	**Manufacturer's container**	**Secondary container**
Chemical Identity [4]	Required [5]	Required	Required	Required
Hazard Warning	Recommended [6]	Recommended	Required	Required
Owner Name	Recommended	Recommended	Recommended	Recommended
Date Opened or Transferred [7]	Required for peroxide formers, reactive substances; etc.		Required for peroxide formers, reactive substances; etc.	

[1] This information may be added to the secondary container with an indelible pen, commercially available label, or by printing a label via the **EH&S Assistant** database.

[2] The container produced by the chemical manufacturer that is delivered to the user.

[3] All containers other than the manufacturer's container (i.e. squeeze or glass bottles, flasks, Eppendorf tubes, etc.).

[4] Label information must be legible and in plain English.

[5] Chemical identity and hazard warning should already be printed on the manufacturer's container.

[6] Recommended for best practices, though not required per regulation.

[7] Required for chemicals that degrade over time, peroxide formers, and air and water reactives.

Chemical Labeling Abbreviations

- Abbreviations for simple solutions (e.g. KCl) can be used if supplemented by the written name (e.g. Potassium chloride).
- Abbreviations for complex solutions (e.g. TAE buffer or Bouin's solution) can be used if there is a cross reference prominently posted in either the work area **or** within the **Lab-Specific Chemical Hygiene Plan (LCHP)**.

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Other Labeling Situations

- Many small containers of similar materials stored together:
    - Label the outside of the container with approximate contents if feasible **or** list where more information can be found such as in a laboratory notebook.
    - Add hazard label for highest hazard material if feasible.
- Temporary container being mixed or reacted:
    - Add a small card to the immediate area listing the appropriate information.
    - If unattended, use an **Overnight / Unattended Lab Reaction Form**.
- Laboratory notebook nomenclature can be used to identify and label intermediary chemicals that are part of an ongoing experiment or process, provided the nomenclature code and the location of the codes (in a lab notebook) are provided within the Chemical Hygiene Plan or posted within the laboratory.

Hazard Warning Information

- Chemicals in the original manufacturer's container that have been recently purchased from a supplier will most likely contain hazard information in the form of warnings and pictograms.
- Older manufacturer's chemical containers may have alternative labeling schemes that provide essentially the same information as the new labels.
- OSU uses the Hazardous Materials Information System (HMIS) for consistency; however containers with the National Fire Protection Association (NFPA) labeling system can also be used. The HMIS and NFPA hazard codes are published in the Safety Data Sheets (SDS) available through the **OSU EH&S SDS webpage**.
- For chemicals with no published hazard information, a descriptive entry in a laboratory notebook will suffice.

What About Labeling of Non-Hazardous Chemical Containers?

Although OSHA regulations require labeling only those containers with hazardous chemicals, EH&S recommends all non-hazardous chemical containers be labeled with the product identity in order to minimize confusion. In the event there is a chemical with no OSHA hazard, then a label will make that fact obvious.

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Safety Instruction

Chemical Storage Guidelines

General Storage Requirements

- Always review a chemical's MSDS/SDS for proper storage procedures.
- Do not store glass chemical containers on the floor (without secondary containment) or window ledges.
- Chemical storage areas should be well lit, appropriately ventilated and kept away from aisles, exits, and heat.
- Minimize storage on the lab bench, in fume hoods, and other work areas.
- Use first-in, first-out system (oldest chemicals first); to avoid degradation of older chemicals and their containers.
- Inspect stored chemicals often for expiration, deterioration and chemical integrity.

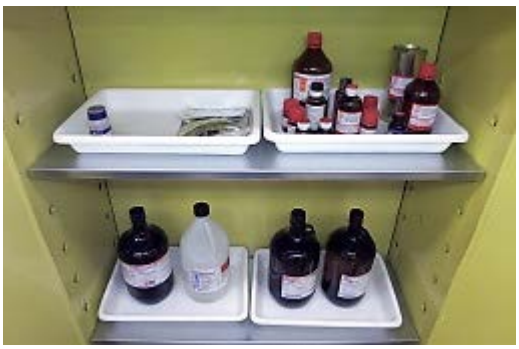
Storage Shelves/Cabinets

- Ensure chemical storage shelves are securely fastened to the wall and have lips or other suitable methods to prevent bottles from falling in the event of an earthquake.
- Avoid storing all chemicals above shoulder height. Large containers (1 gal or larger), liquids, and corrosive materials should be stored no higher than eye level.
- Do not overcrowd shelves.
- Flammables (in excess of 10 gal) must be stored in a flammable storage cabinet.
- Label chemical storage cabinets according to the type of chemical family or hazard classification found there (Acid Storage, Solvent Storage, etc.).

Storage in Refrigerators and Freezers

- Never store chemicals in office, domestic, or personal refrigerators; food and chemicals should never be stored together.
- When storing flammables in refrigerator, use an approved explosion proof or flammable storage refrigerator only.
- Label all refrigerator/freezers as to intended use.
- Frequently inventory materials stored in refrigerator/freezers and defrost occasionally to prevent chemicals from becoming trapped in ice formations.

Secondary Containment



- Use secondary containment, such as polyethylene or stainless steel trays, to separate incompatible chemicals stored in the same area and to provide spill containment.
- Provide secondary containers for storage of solvents and concentrated acids and bases.
- Use secondary containers during storage of all hazardous chemicals on the floor.

Storage of Hazardous Waste

- Minimize storage of hazardous waste.
- Store hazardous waste using the same guidelines as you would for storing chemical containers; use secondary containment, ensure the container is closed when not in use, and ensure proper labeling of the waste.

- If you no longer need a chemical, rather than keeping it stored, dispose of it properly (e.g. as hazardous waste) or follow the chemical reuse guidelines.
- Maximum storage times:
  - When storing untreated chemicals that degrade to unstable forms (e.g. peroxide formers such as ethyl ether), limit maximum storage time to one year from purchase or six months from first use. Note date received/date opened on such materials.
  - For other hazardous chemicals, use manufacturer's recommended storage time (if there is one) or other indications of degradation (e.g. discoloring of liquids).
- Expired chemicals should not be stored or used in laboratories and should be relinquished to EH&S for disposal.

Segregating Hazardous Chemicals

Store chemicals by hazard classification; avoid storing chemicals alphabetically unless they are compatible or already separated into appropriate hazard classes - this ensures that incompatible chemicals are segregated.

Accidental contact between incompatible chemicals can result in a fire, an explosion, the formation of highly toxic and/or flammable substances, or other potentially harmful reactions. If incompatible chemicals must be stored in the same cabinet, be sure to provide physical segregation (secondary containment).

Class of Chemicals	Recommended Storage Method	Examples	Incompatibles
Corrosives - Inorganic (Mineral) Acids	Store in a corrosive storage cabinet or in secondary containment	Hydrochloric acid, sulfuric acid, hydrofluoric acid, phosphoric acid	Bases and cyanides
Corrosives – Organic Acids	Store in a corrosive storage cabinet or in secondary containment	Acetic acid, trichloroacetic acid, lactic acid	Bases and cyanides
Corrosives - Bases	Store in a corrosive storage cabinet or in secondary containment	Ammonium hydroxide, sodium hydroxide	Acids
Explosives	Store in secure location away from all other chemicals	Acetone Peroxide, Trinitrobenzene	Flammable liquids, oxidizers, acids and bases
Flammable	Store in flammable storage cabinet (in excess of 10 gal) within secondary containment	Acetone, benzene, ethanol	Oxidizers
Oxidizers	Store in secondary containment, separate from flammable and combustible materials	Sodium hypochlorite, potassium chlorate, peroxides, nitrates	Separate from reducing agents, flammables, and combustibles
Water-Reactive	Store in dry, cool location, protect from water fire sprinkler	Sodium metal, potassium metal, lithium metal	Separate from all aqueous solution, and oxidizers
Compressed Gas - Flammable	Store in cool, dry area, away from oxidizing gases. Securely strap or chain cylinders to a wall or bench top	Methane, acetylene, propane	Oxidizing and toxic compressed gases, oxidizing solids
Compressed Gas - Oxidizing	Store in cool, dry area, away from flammable gases and liquids. Securely strap or chain cylinders to a wall or bench top	Oxygen, chlorine, bromine	Flammable gases

***Note*: Certain chemicals require special segregation precautions to be taken. Concentrated nitric and perchloric acids should be stored in their own secondary containment within a corrosive storage cabinet due to oxidizing characteristics. Amines are often flammable in addition to being corrosive and should be stored in their own secondary containment within a chemical storage cabinet.**

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Drying Ovens

Improper use of a drying oven can potentially lead to a fire. Some basic steps to take to avoid this situation:

Prior to Use:

- **Refer** to the **manufacturer's instruction manual** to determine operating limitations of the oven.
- **Post** written instructions on how to use the drying oven.
- Ensure the **equipment** is **properly maintained, the thermostat is calibrated,** and report any faults to your supervisor immediately so they can be corrected.
- Know your sample's combustible/flammable temperature limit and **do not exceed this temperature**.
- **Check** the **thermostat** regularly to ensure it has an accurate calibration

Loading the Oven:

- **Start** the drying oven **early in the day** to ensure it has reached temperature and can be checked for stability before you leave work for the day.
- Do not overfill the oven. Do not "solid-pile" your sample; **Spread out your sample and leave space for airflow.**
- If the oven has **elements in the bottom** of the oven drying area, ensure there is no way for the items being dried to fall through the shelf directly onto the elements below.
- Use **heat-resistant gloves** when working with a hot oven.
- If the samples need to be dried over a number of days, **start early in the week** so it is not left running over the weekend leaving it unattended for extended periods of time.

In Case of a Sample Overheating

- If the sample contents within the oven start to smolder, **Do Not Open The Oven Door!**
- **If it is safe to do so**, **turn off** the oven, **unplug** the power cord, and **monitor** for flare-up.
- **Call 911 if a fire develops.**

Oven Use

- When using the drying oven **DO NOT** exceed a maximum temperature of _____C°/ F° (circle one) and/or a maximum usage time of _____minutes/hours (circle one).

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Safety Instruction

Eye & Face Protection

Policy

- OSU policy requires that appropriate eye protection be provided to and worn by employees that are exposed to eye hazards.
- The minimum acceptable form of eye protection is safety glasses that meet the requirements specified in the most recent ANSI Z87.1-2010 standard.
- It is the responsibility of supervisors and teaching lab coordinators to ensure employees and students wear appropriate eyewear when necessary.

Contact Lenses/Prescription Glasses

- EH&S does not recommend that contact lenses be worn in the laboratory without proper eye protection for the following reasons:
  - They can create a visual problem if suddenly displaced.
  - Contact lenses are difficult to remove should chemicals get into the eyes and they tend to prevent the removal of contaminants by natural eye fluids.
  - Soft contact lenses present special hazards. They discolor when they come into contact with many laboratory chemicals and can absorb chemicals and chemical vapors, causing extensive corneal damage before the wearer is aware of the problem.
- Normal prescription glasses do not provide adequate protection from injury to the eyes and do not meet ANSI standards.
- View the Safety Glasses Prescription Program Safety Instruction for instructions on how to participate in the program.

Types of Eye & Face Protection

- *Safety Glasses* – Protective eyeglasses with impact-resistant lenses and safety frames constructed of metal or plastic.
- *Goggles* – tight-fitting eye protection that completely covers the eyes, eye sockets, and the facial area immediately surrounding the eyes. Provides protection from impact, dust, and splashes.
- *Face Shields* – Headgear providing a transparent sheet of plastic covering the entire face. They protect against nuisance dusts and potential splashes of sprays of hazardous liquids but will not provide adequate protection against impact hazards.
- *Welding Shields* – Constructed of vulcanized fiber or fiberglass and fitted with a filtered lens, welding shields protect eyes from burns caused by infrared, ultraviolet, or intense radiant light; they also protect both the eyes and face from flying sparks, metal spatter and slag chips produced during welding, brazing, soldering and cutting operations.
- *Laser Safety Goggles* – Provides protection from laser radiation.

Hazards to Consider

- Impact – flying fragments, objects, chips, particles, sand, dirt, etc
- Heat – hot sparks, splash from molten metals, and high temperature exposure
- Chemicals – splashes and irritating mists
- Dust – woodworking, buffing, general dusty conditions
- Light and/or Radiation (i.e. welding) – optical radiation, poor vision

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Selection of Eye and Face PPE

- Safety eyewear should be selected according to:
  - The identified eye injury hazard(s)
  - Performance of the eyewear versus applicable ANSI standards
  - Availability
  - Employee preference among available choices

The following chart suggests recommended Eye/Face Personal Protective Equipment (PPE) based on common workplace activities and hazards:

Activity	Eye/Face Hazards	Eye/Face Protection
Chemical handling, laboratory operations	Chemical splash or spill, acid burns, fumes, glass breakage	Chemical goggles or safety glasses with side protection. Use a face shield plus chemical goggles for severe exposure.[(1)(2)]
Hot work	Sparks, optical radiation, flash burns	Safety glasses with shaded lenses or welding shield. Use the face shield or welding helmet in addition to safety glasses for severe exposure.[(1)(3)]
Grinding, sawing	Flying particles, dust	Impact goggles or safety glasses with side shields. Use a face shield plus impact goggles or safety glasses for severe exposure.[(1)(2)]
Laser operations	Reflected or direct laser beam impact	See Laser Safety Eyewear Selection Chart [(4)]
Machining	Flying particles, mists, vapors	Safety glasses with side shields or goggles.[(2)]
Pesticide/fertilizer applications with hand sprayer	Chemical splash or spill, airborne chemicals	Chemical goggles. Or safety glasses. Use face shield plus safety glasses/goggles for severe exposure.[(1)]

(1) Faceshields and welding shields must be worn in combination with safety glasses or goggles.

(2) Safety glasses that provide side protection must be worn when working if there is a potential for objects to fly in workers' eyes and face or when working with biological, chemical, or radioactive materials.

(3) Welding goggles, shields, or helmets should be equipped with a shade that provides the appropriate level of protection as referenced in the OSHA Filter Lenses for Protection Against Radiant Energy Table.

(4) Lasers: Due to the variety of wavelengths emitted by lasers, no set of eyewear can offer the user complete protection unless it is opaque. It is the responsibility of each laser user to be informed via SOPs and supervisors of the relevant laser wavelengths in use and the corresponding protection offered by the eyewear. Consult the Laser Safety – Manual for more information.

Comfort and Fit

- Protective eyewear should fit well; safe ty glasses and goggles should fit with the bridge properly supported on your nose and the center of the lens in front of your eye with the frame being as close to the face as possible.
- Ensure goggles and glasses do not interfere with the seal of a tight-fitting respirator.

Maintenance/Storage

- Before each use, eye and face protection equipment should be inspected for damage (i.e. cracks, severe scratches, distortion). If deficiencies are noted, the equipment should be cleaned, repaired or replaced before use.
- Eye and face protection devices that have been subject to an impact should not be used and are required to be discarded.
- When one protector is being used by more than one person, it is recommended that it be cleaned and disinfected prior to use by another person.
- Disinfect eyewear if it was contaminated by a hazardous chemical.
- Store clean eyewear in a closed container protected from dust, moisture or damage.

Additional Resources

- OSHA 29 CFR 1910 Subpart I Appendix B
- OSHA 29 CFR 1910.133
- ANSI Z87.1-2010 – Practice for Occupational and Educational Eye and Face Protection

Fact Sheet

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HEALTH & SAFETY

Safety Instruction

Eyewash & Safety Shower

Introduction

This Safety Instruction outlines the requirements for the maintenance and use of Emergency Eyewash and Safety Shower units.

- **Emergency Eyewash units** are required in all areas where employees handle substances that are potentially injurious when in contact with the eyes, including areas where corrosive materials are used.
- **Safety Showers** are needed wherever there is a possibility that either highly corrosive or highly toxic chemicals may splash over **substantial areas of the body**.
- Additional information can be found in the **OR-OSHA Fact Sheets**: **Eyewash & Safety Showers**.

How to Use an Eyewash Station

Go Immediately!! Don't waste a moment. Time is of the essence.

- Activate the hands free lever
  - Should activate with a single motion
  - Dust covers will pop off
- Get your eyes directly into the stream of water

- If you have contacts, gently remove them while flushing
- Hold your eyes open with your fingers
- Gently roll your eyes to ensure complete flushing
- Flush for up to 15 minutes as necessary

Responsibilities

- Environmental Health and Safety (EH&S) will perform *annual* inspections on Eyewashes and Safety Showers.
- Safety Showers will be tested by EH&S due to the need for special equipment to contain the discharge water.
- Departments shall conduct and document ***weekly*** inspections of Eyewashes within the workspaces they manage. This includes *ensuring*:
  - Inspections are documented and include the date and inspector's name or initials.
  - The inspection document is maintained near the Eyewash (EH&S has inspection cards available upon request).
  - Maintenance of a container under the drainpipe to collect discharge water when not plumbed to the sewer.
  - Unobstructed access.
  - The bowl and spouts are clean and free of trash.
  - Protective eyewash covers are properly positioned, clean, and intact.
  - Protective eyewash covers come off when activated.
  - Water flows from both eyepieces and that the streams of water meet.
  - Water flow continues until the paddle is moved to its resting position.
  - Water drains from the bowl.
  - Maintenance problems are promptly reported to **Facilities Services**.

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Eyewash Activation / Testing

It is necessary to regularly activate eyewash units to clear any potential debris or bacteria from the plumbing. Activating a unit until the water runs clear ensures that water quality and other safety features are maintained.

Regulatory Standards

Oregon-OSHA and ANSI minimum standards for Eyewash & Safety Showers:

- Must be located within a 10-second, unobstructed walking distance of the affected worker.
  - Trash cans, pallet jacks, boxes, raw materials, and other stored items are considered obstructions.
  - A door is considered an obstruction *unless* the hazard is non-corrosive. Then, 1 door can be present as long as it opens in the same direction of travel as the person requiring the use of the safety equipment.
- Water quantity must be sufficient to sustain a flow for at least 15 minutes.
- Installation shall be according to the manufacturer's instructions, in a well-lit area, and identified with a highly visible sign.
- Must have a stay-open valve to allow for hands-free operation.
- Testing, water pressure, and flow rate to follow manufacturer's criteria.
- Clean, sanitary and operating correctly.
- Eyewash and safety showers must be protected from freezing during cold weather.
- For self-contained eye-wash systems: **do not use solutions** past their expiration date.

Training

Supervisors (i.e. PIs, Lab and Shop Managers) are responsible for initial and annual refresher training of all their workers in the location and proper use of Eyewashes & Safety Showers. This training must be documented as part of their Lab-Specific Chemical Hygiene Plan. This Safety Instruction may be used for training purposes in addition to the manufacturer's instructions.

A Few OSU Examples

Emergency Eyewash/Drench Hose Inspection Checklist

Building: ________________________________ Room #:_________________

How to Test:

- Visually inspect the area around the eyewash/drench hose to ensure the area is clear of obstructions and all protective covers are in good condition;
- Activate and flush eyewash/drench hose for 3 minutes or until water is clear;
- Ensure all jets are working properly with good flow;
- Ensure the eyewash/drench hose water is clear before turning off;
- If there is an issue with your eyewash you can contact facilities or EH&S for assistance; and
- Refer to the Eyewash & Safety Shower Safety Instruction for more information: http://oregonstate.edu/ehs/sites/default/files/pdf/si/eyewash_and_safety_shower_si.pdf

Date	Initials	Date	Initials	Date	Initials

Fact Sheet

OSU
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HEALTH & SAFETY

Safety Instruction

Food & Drink in Laboratories

Introduction

Eating, drinking, gum chewing, or similar activities within laboratories where teaching or research involving toxic substances take place, can result in the accidental ingestion of hazardous materials (chemical, biological, and/or radiological). Good laboratory practices, which is supported by the Occupational Safety and Health Administration (OSHA), the Centers for Disease Control and Prevention (CDC), Prudent Practices in the Laboratory (PPL), and the Nuclear Regulatory Commission (NRC), seeks to eliminate this potential route of exposure and these agencies have guidelines which prohibit these activities in areas where hazardous materials are present.

Policy

Eating, drinking, smoking, gum chewing, the application of cosmetics or contact lenses, the storage of food and beverages or similar activities are not permitted in laboratories or other facilities where hazardous materials (as listed below) are used, handled or stored.

Under no circumstance shall food or drink be stored or consumed in a laboratory, space or room containing:

- **Moderate, High or Extreme Hazard Carcinogenic materials** (http://ehs.oregonstate.edu/carcinogen-safety-manual)
- **Radioactive materials**
- **Unbound engineered nanomaterials**
- **Highly toxic chemicals** (a substance with an oral LD50 of less than 50 mg/kg or skin toxicity of less than 200 mg/kg)
- **Research animals, or**
- **Microorganisms designated as Biosafety Level (BSL) 1 or higher**
  NOTE: Other harmful substances not included above may also apply and should be taken into consideration when determining food/drink prohibition. Contact EH&S for a consultation if further assistance is needed.

Exceptions

Where consistent with building, departmental, or other local rules, Principal Investigators may allow food or beverages in certain rooms in the following situations:

a) A room in which the above conditions do not apply. These rooms must have clearly designated “Clean Areas” separated from the work space and only on the condition that no hazardous materials are allowed within the designated clean area at any time. OR

b) A connecting room that is separated from the lab with floor to ceiling walls and a closing door. If the designated clean area can only be accessed by going through the laboratory, then all food and beverage items must be covered while being carried through the laboratory.

Each clean area should be clearly demarcated and have at least one sign that reads as follows:

Copies of the sign above can be found on the EH&S website at:
http://ehs.dev.acquia.cws.oregonstate.edu/sites/ehs.oregonstate.edu/files/pdf/forms/fooddrinkcleanareanotice.pdf

If a person has questions or concerns regarding whether the laboratory may be permitted a “Clean Area” they should contact EH&S at 541-737-2273 for further consultation.

Regulations

OSHA Bloodborne Pathogens Standard;

I. 29 CFR 1910.1030 (d)(2)(ix) - Eating, drinking, smoking, applying cosmetics or lip balm, and handling contact lenses are prohibited in work areas where there is a reasonable likelihood of occupational exposure.

II. 29 CFR 1910.1030(d)(2)(x)) - Food and drink shall not be kept in refrigerators, freezers, shelves, cabinets or on countertops or benchtops where blood or other potentially infectious materials are present.

OSHA Sanitation Standard;

I. 29 CFR 1910.141 (g)(2) - No employee shall be allowed to consume food or beverages in a toilet room nor in any area exposed to a toxic material.

OSHA Laboratory Standard;

I. 29 C.F.R. 1910.1450 Appendix A (d) - Avoid eating, drinking, smoking, gum chewing, or application of cosmetics in areas where laboratory chemicals are present (22, 24, 32, 40); wash hands before conducting these activities (23, 24). Avoid storage, handling, or consumption of food or beverages in storage areas, refrigerators, glassware or utensils which are also used for laboratory operations (23, 24, 226).

OSU Chemical Hygiene Plan;

5.3 Personal Habits in the Laboratory

1. Eating, drinking, and cosmetic application are not permitted in laboratories.
2. Food may not be stored in a refrigerator that has been used or is being used to store chemicals.
3. Ice produced by ice machines for laboratory use shall not be used for beverages, food, or food storage.

OSU Radiation Safety Manual

6. Regulations Concerning Radioisotopes

6.6.6. Eating, drinking, smoking, or applying cosmetics is not permitted in any area where unsealed radioactive materials are stored or used.

Guidelines

Prudent Practices in the Laboratory (published by National Academic Press, 2011);

I. 5.C.2.2 Avoiding Ingestion of Hazardous Chemicals - Eating, drinking, smoking, gum chewing, applying cosmetics, and taking medicine in laboratories where hazardous chemicals are used should be strictly prohibited. Food, beverages, cups, and other drinking and eating utensils should not be stored in areas where hazardous chemicals are handled or stored. Glassware used for laboratory operations should never be used to prepare or consume food or beverages. Laboratory refrigerators, ice chests, cold rooms, ovens, and so forth should not be used for food storage or preparation. Laboratory water sources and deionized laboratory water should not be used for drinking water.

II. 5E-1 Biohazardous Materials - Never eat, drink, smoke, handle contact lenses, apply cosmetics, or take or apply medicine in the laboratory.

III. 5E-2 Radioactive Materials - Never eat, drink, smoke, handle contact lenses, apply cosmetics, or take or apply medicine in the laboratory, and keep food, drinks, cosmetics, and tobacco products out of the laboratory entirely so that they cannot become contaminated.

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Fact Sheet

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Safety Instruction

Lab Fume Hood Safety

Please refer to section **303: Local Exhaust Systems** of the **OSU Safety (SAF) Policy & Procedures Manual**.

See also the **OSU Chemical Hygiene Plan**

General

- Laboratory fume hoods are important safety devices.
- Hoods function as local exhaust ventilation that protect personnel from exposure to chemicals being handled
- Training of personnel, proper design of experiments and careful operation of equipment are equally important for lab safety
- Fume hoods cannot overcome poor work practices by users

Good Fume Hood Practices

Operation

- Before using a hood check that the **air is exhausting properly**
- If the hood is not working, notify EH&S, 7-2273
- Keep **sash openings** to a **minimum**
- Hoods are annually checked by EH&S – more frequently on request
- Hood sash should not be positioned higher than the line on the "Approved Use" sticker.
- If there is a need for **safety/blast shields** within the hood, they should be obtained separately; the sash alone should not be used as safety/blast shield.
- Sources of emission should be kept at least **5 inches inside the plane of the sash**
- Users should keep their **faces outside** the plane of the hood sash
- Keep **front air foil** clear – don't block with lab bench liner
- Don't block hood exhaust openings or room air supply vents; they are essential for the proper operation and capture efficiency of the hood
- Keep **hood sashes closed** when not in use
- Design experiments **NOT to exceed the hood's exhaust capacity** with anticipated experimental emissions

Storage

- Keep **storage of chemicals** in a hood to a **minimum**
    - Stored chemicals may add to the seriousness of an incident such as a fire
    - Stored chemicals block exhaust openings
- **Only necessary equipment** should be placed in the hood
- **Large equipment impedes air flow** and causes air turbulence and poor capture efficiency
- Place **large equipment on spacers** to allow for air to pass underneath

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Safety Instruction

Gas Cylinder Safety

General

- Review MSDSs/SDSs and read all labels before handling, storing, or using compressed gases. If you do not know what is in the cylinder, do not use it.
- Always use compatible hookups, tubing, regulators, valves, and protective caps.
- Compressed air should not be used for cleaning purposes without appropriate reduction of valves (30 psi maximum).
- All employees using a compressed gas cylinder must be properly trained in the safe use, handling, and storage of the cylinder.
- Never discard any of the safety plugs or caps.
- Lecture sized bottles contain specific storage requirements and hazards. More information can be located in the Lecture Bottle Safety Instruction.

Potential Hazards/Precautions

- Chemical Hazards: Gases can be toxic, flammable, oxidizing, corrosive or inert.
  - Gases such as nitrogen or helium can displace air creating an oxygen-deficient atmosphere.
  - Toxic gases (e.g. carbon monoxide, ammonia) can create poisonous atmospheres.
  - Flammable, oxidizing or reactive gases (e.g. acetylene) can result in a fire and exploding cylinders.
- Physical Hazards: Physical hazards are in response to high pressures inside gas cylinders.
  - Damage from falling, heat, electrical circuits, motion, vibration or anything that can cause a weakness or crack in the cylinder wall or shell can cause a cylinder to rupture, explode, or act as an uncontrolled rocket.
  - Cryogenic liquids pose specific physical hazards such as frostbite and other extreme cold temperature hazards, more information can be found in the Cryogenic Liquid Safety Instruction.

Labeling Requirements

- Prior to use, ensure all cylinders are clearly labeled to identify their contents or lack thereof (e.g. empty).
- If the labeling on the gas cylinder becomes unclear or defaced so that the contents cannot be identified, the cylinder should be marked “contents unknown” and the manufacturer must be contacted regarding appropriate procedures for removal.
- Any gas lines leading form a compressed gas supply must be clearly labeled.
- Do not rely on color-coding as a means of identification; cylinder colors vary from supplier to supplier.
- Labels on caps have no value because caps could be are interchangeable.

Safe Handling & Use

- Use compressed gases only in areas with adequate ventilation.
- Never intentionally drop or strike compressed gas cylinders against one another.
- Do not use a compressed gas in a confined space.
- Never use a leaking, corroded or damaged cylinder. Remove the cylinder from service and contact the supplier for return.
- Keep cylinder valves closed except when the cylinder is being used. When opening a cylinder valve, stand so that the valve outlet is pointed away from yourself and all other employees. Open valves slowly.
- Use only regulators, pressure relief devices, valves, hoses and other auxiliary equipment that is designed for the specific container and compressed gas to be used.
- A minimum of 20 feet must be maintained between oxidizers and flammable gases and other combustible materials, such as oil or grease. A firewall (partition) 5 feet high with a half-hour rating can be substituted.

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Personal Protective Equipment (PPE)

- Eye protection must always be worn when handling and working with compressed gases. In some cases additional protection may be needed in the form of a face shield.
- Use foot protection when moving or transporting cylinders
- Use gloves and protective clothing to protect against frostbite (for cryogenic liquids), corrosives, and pinch points.
- If respirators are required for use with compressed gases (i.e. Atmosphere-supplying respirator for asphyxiant gases), follow the Respiratory Protection Program to be eligible to wear a respirator.

Inspecting a Cylinder

- Visually inspect compressed gas cylinders upon delivery and on a routine bases; inspect for exterior corrosion, denting, bulging, gouges or digs. Leaking cylinders, cylinder valves, or other equipment should be moved to a safe, isolated area and taken out of service.
- All damaged or questionable cylinders or equipment should be returned to the supplier for correction or replacement.
- Shut a leaking valve and tighten the valve glad or nut. If it still leaks, close it, remove the cylinder to a well-ventilated area, and post a warning of the hazard rendering it unserviceable.

Transportation

- Do not move cylinders if you cannot do so with ease; do not roll, drop or let cylinders bump violently against one another.
- Compressed gas cylinders must be transported with protective/safety caps in place
- Avoid dragging or sliding cylinders. Do not lift cylinders by the caps. Firmly secure the cylinder and move with a suitable hand truck, lift truck, or crane with a cradle or platform. Do not use lifting magnets; slings, ropes, or chains are acceptable if the cylinder is equipped by the manufacturer with lifting attachments.

Cylinder Storage

- All compressed gas cylinders (whether empty or full and regardless of size) need to be individually secured upright to racks, walls, work benches or hand trucks by a strong chain or strap, or secured by any other approved method capable of preventing the cylinder from falling or being knocked over due to accidental contact, vibration, or earthquakes.
  - The chain or strap should be near the top 1/3 of the cylinder but below the cylinder's shoulder.
  - As a best practice, OSU EH&S recommends using a second chain on the bottom 1/3 of the cylinder to prevent the cylinder from sliding out of the upper chain.
- When a cylinder is in storage, ensure the steel valve protection caps are on.
- Do not expose cylinders to corrosive or combustible materials.
- Group and store compressed gases based on their hazard class.
- Compressed gas cylinder storage areas must be located away from emergency exits and must be kept in a well-ventilated room protected from weather.
- Prevent indoor or outdoor temperatures from exceeding 125°F (52°C) for all cylinder storage areas.
- Store flammable cylinders in a well-ventilated area away from oxidizers, open flames, sparks, and other sources of heat or ignition.
- Store full and empty cylinders separately.

Empty Cylinders

- When empty, close and return cylinders. Empty cylinders must be marked as "EMPTY".
- Replace protective caps and close all valves before returning empty cylinders to the supplier.
- Empty cylinders have residual pressure and should always be handled as full.
- Handle empty cylinders with the same case as full cylinders.

Hydrostatic Testing

- All cylinders require periodic hydrostatic testing as required by the Department of Transportation (DOT). During hydrostatic testing, the cylinder is examined to ensure it can safely hold its rated pressure. **Cylinder owners must set up this testing prior to refilling the cylinder**, whereas rented cylinders will be tested by their owner prior to refill.
- The frequency of the testing depends upon the cylinder material:
  - Aluminum –every 5 years
  - Steel –every 5 years

Fact Sheet

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HEALTH & SAFETY

Safety Instruction

Laboratory Safety

Include the OSU laboratory safety training videos as part of the safety orientation for your lab.

Lab Safety Rules

These concepts may apply in any areas where hazardous chemicals are used or stored.

General

1. Safety takes precedence over all other considerations.
2. When performing dangerous chemical procedures, be sure there is someone in the immediate vicinity you can reach in case of emergency.
3. Know the location of eyewash fountains and emergency showers. Find out how to use them properly.
4. Before beginning a procedure, take a minute to investigate hazards involved; take all necessary safety precautions.
5. Store food products in separate non-lab refrigerators specifically reserved for that use.
6. Eating, drinking, and smoking is not permitted in laboratory areas. Break rooms should be available for that use.
7. Remove unsafe equipment from service. Report unsafe facilities or behavior to your supervisor.
8. Because unattended equipment and reactions are major causes of fire, floods, and explosions, double check utility connections. Anticipate hazards that would result from failure of electrical, water, or gas supply.
9. Use hose keepers on water condenser lines.

Personal Protection, Clothing, and Hair

1. Properly label all containers.
2. Wear approved eye and face protection suitable for the work at hand. Safety glasses or goggles should be worn at all times while working with chemicals at the counter or laboratory hood. A face shield should be worn when working with potentially eruptive substances.
3. Remind all visitors and non-lab staff to observe lab safety rules, including eye protection, while in the laboratory.
4. Wear protective gloves and clothing whenever handling corrosive, toxic, or other hazardous chemicals. Wear closed-toe shoes at all times in the lab.
5. Check that guards are provided on moving parts of mechanical apparatus to prevent hazardous contact.
6. Maintain lab areas reasonably neat and uncluttered.
7. Use the fume hood for all operations involving harmful gases or fumes and for flammable or explosive materials. Check the hood to see that it is operating adequately and has been inspected within the last year.
8. Use a safety shield or barrier to protect against explosion, implosion, and flash fires when performing reactions with large volume of flammable liquids or unstable material.
9. Inspect glassware for cracks, sharp edges, and contamination before using. Broken or chipped glassware should be repaired and polished or discarded.
10. Always use a lubricant (e.g., water, glycerol) when inserting glass tubing into rubber stoppers or grommets. Protect hands in case tubing breaks.
11. Broken glass should be put in impervious containers that are large enough to completely contain the glass. These containers are to be placed into the building trash dumpsters by laboratory personnel.
12. Do not handle radioactive isotopes without oversight from the Radiation Safety Office.

Chemical Handling

1. Transport dangerous or flammable liquids in a safety pail or other adequate secondary containment. Prevent containers from tipping when transporting on a cart.
2. Take extra precautions when working with large quantities of reactants.
3. Use caution when adding anything to a strong acid, caustic, or oxidant. Add slowly.
4. When adding solids (boiling chips, charcoal, etc.) to a liquid, check that it isn't hot.
5. Use a pipet filler - not mouth suction - for all pipet work
6. Keep the mouth of any vessel being heated pointed away from any person (including yourself).

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7. When working with biohazardous material, guard against infection by skin contact, inhalation of aerosols, and contamination of food and beverages.
8. Known carcinogens, mutagens, and teratogens should not be used or stored in normal laboratory situations. Such substances require extreme precaution, tight security, limited access, secondary containers, and other safety procedures; see the OSU Carcinogen Safety program.
9. Flammable liquids should only be heated with steam, hot water or a grounded heating mantle. Check the area for possible flames or electrical sparks.
10. All experiments involving volatile flammable liquids (e.g., diethyl ether) should be considered fire or explosive hazards.
11. When not in use, laboratory natural gas lines should be shut off at the line valve rather than at the equipment.
12. Whenever possible, position energized electrical equipment, or other devices that may emit sparks or flame, at least six inches above the floor.
13. Properly ground electrical equipment.
14. Laboratory electrical equipment should have a three-conductor cord that connects to a grounded electrical outlet, unless the equipment is dual-insulated..
15. Electrical wiring for experiments, processes, etc. should be done neatly, and must conform to electrical code requirements.
16. Store strong oxidants (e.g., nitrates, chlorates, perchlorates, peroxides) in a dry area apart from organic materials.
17. Use a specially designed wash-down laboratory hood for open heated perchloric acid digestions.

Chemical Storage

1. Include the word "flammable" on all flammable liquid containers.
2. Whenever possible, store flammable solvents in NFPA-approved flammable liquid storage cabinets or approved solvent storage rooms.
3. If storing more than 10 gallons of flammable liquids in a laboratory, a flammable liquid cabinet MUST be used.
4. Pay careful attention to peroxide-forming compounds. Organic peroxides may detonate by shock, friction, or heat. Compounds with dangerous tendencies to form peroxides by reaction with oxygen (e.g., many ethers and other chemical clases) have a limited shelf life. They should be dated on opening, and should in no case be stored for longer than one year.
5. Keep caustics stored below eye level.
6. Keep glass containers of chemicals off the floor - unless they are inside protective containers or pans that are kick-proof.
7. Inventory chemicals periodically and discard old, no-longer-needed substances through the campus hazardous waste disposal program.
8. Report chemical inventory annually to EH&S for OR-OSHA and State inventory reporting purposes.
9. See *Safety Bulletin #30* for more information on chemical storage.

Pressure and Vacuum Systems

1. Plan and provide for the possibility of explosion prior to conducting experiments that develop high pressure or vacuum.
2. Heat reactants only in a system with an approved pressure release.
3. Wait for pressure to be released before opening a pressurized vessel (autoclave, etc.).
4. Secure compressed gas cylinders in an upright position at all times to prevent from falling. Keep protective caps in place when moving or storing gas cylinders.
5. Regulators designed for specific cylinders are not interchangable.
6. Keep flammable gas cylinders away from exits and oxygen cylinders.
7. When moving cylinders with a lift truck or hand truck, make sure there is an approved rack or securing device.
8. Oxygen is not a substitute for compressed air.
9. Gauges or regulators for oxidizing gases must not use oil as a lubricant. Oxygen under pressure reacts violently with oil or grease.
10. Suitable pressure regulator are required for compressed gas use.
11. FULLY RELEASE pressure adjusting screws on regulators BEFORE attaching the regulator to a cylinder.
12. Always open the valves on cylinders slowly, anddo not stand in front of pressure regulator gauge faces when opening cylinder valves.
13. Do not strike valves with tools, or use excessive force in making connections.
14. Avoid mixtures of acetylene with oxygen or air prior to use - except at a standard torch.
15. Cylinders not provided with fixed hand wheel valves shall have keys or handles provided on valve stems at all times when cylinders are in use.
16. Compressed gas cylinders are high-pressure vessels and should be handled accordingly - they should not be dropped, bumped violently, skidded or rolled horizontally.
17. Keep stored cylinders out of direct sun and areas with increased temperature, such as boiler or rooms.

Container Handling

1. Properly label all containers. If unsure, check rule # 10 (above).
2. Before re-using any food container, first remove the original label completely.
3. Chemical transport containers are not to be used for non-compatible chemicals or for food products at any time.
4. All containers should have a lid at all times except during an active experiment.

5. Refrigeration of flammable materials must be done in spark-proof or explosion-proof refrigerators.

Chemical Spills and Waste Disposal

1. Devise a plan to deal with small spills before one occurs. POST the plan in the lab and get appropriate equipment. Quickly and thoroughly clean up any liquid or solid chemical spill in the laboratory or area of operations. If any uncertainty exists, call Environmental Health & Safety (EH&S).
2. For large spills, contact EH&S to activate OSU's chemical spill response team.
3. Dispose of chemical wastes by approved methods only. Unwanted or no-longer-useful chemicals are chemical wastes. Contact EH&S for waste disposal guidelines.
4. Reagent bottles should be thoroughly cleaned of any hazardous material prior to disposal. Clean glass reagent bottles can usually be recycled.
5. Four simple steps to help comply with hazardous waste rules:
    a. Perform a waste determination on all wastes (EH&S responsibility)
    b. Label all waste containers with "waste" or "used", plus a chemical description, **BEFORE** adding waste.
    c. Keep all waste containers closed except when adding waste.
    d. Keep the waste in the room where it was generated.

Laboratory Glove Use

No glove may be used as protection from all chemicals. A glove may protect against a specific chemical, but it may not protect the wearer from another. If a glove protects the wearer, it will not protect the wearer forever, as the glove material will deteriorate. Therefore, the following must be considered when choosing which gloves to be worn to protect against chemical exposures.

Factors to consider when choosing gloves:

- Chemical to be used: Consult the compatibility charts to ensure that the gloves will protect you.
- Dexterity needed: The thicker the glove, typically the better the chemical protection, as the glove will be more resistant to physical damage, like tears and cracks, but it will harder be to handle and feel the work.
- Extent of the protection required: Determine if a wrist length glove provides adequate protection, or will a glove that extends further up the arm be required.
- Type of work to be done: gloves are specific to the task. Ensure the correct glove is chosen to avoid injuries. Examples: A nylon cryogenic glove will be damaged if a hot item is handled, where as a “hot mitt” will not protect the wearer when liquid nitrogen is used, as it may be too porous.

Rules for glove use in the labs:

- Wear the correct gloves
- Wear gloves no longer than 2 hours.
- Wash hands once gloves have been removed.
- Disposable gloves must be discarded once removed. Do not save for future use.
- Dispose of gloves into the proper container - gloves contaminated with biologicals go into a red bag; chemical-contaminated gloves are collected as contaminated debris
- Reusable gloves must be washed and dried and inspected for tears and holes prior to reuse.
- Remove gloves before touching personal items (e.g. phones, computers, pens, skin).
- **Do not wear gloves out of the lab.**
- If gloves are needed to transport anything, wear one glove to handle the transported item. The free hand is then used to touch door knobs, elevator buttons, etc. If you are wearing gloves to “protect your sample from you” and are in the hall, no one else understands this and will be concerned about the items you have contaminated with those gloves.
- If for any reason a glove fails, and chemicals come into contact with skin, consider it an exposure and seek medical attention.

Glove Compatibility Charts

The following are links to various companies providing gloves that may be used at the University of Florida. Available on each site are the glove compatibility or chemical resistance charts for those gloves supplied by those companies. Please use these charts to ensure the gloves being used to handle chemicals are providing adequate protection to the wearer. It is important to note that all chemicals will not be listed on these charts. It is also essential to note that two similar gloves supplied by two separate manufacturers may not provide the same level of protection to a specific chemical. Therefore, it will necessary to consult the manufacturer's specific compatibility chart for the brand of gloves being used.

Understanding terms used in glove compatibility charts:

- Breakthrough time: Time it takes for the chemical to travel through the glove material. This is only recorded at the detectable level on the inside surface of the glove.
- Permeation Rate: Time it takes for the chemical to pass through the glove once breakthrough has occurred. This involves the absorption of the chemical into the glove material, migration of the chemical through the material, and then deabsorption once it is inside the glove.
- Degradation rating: This is the physical change that will happen to the glove material as it is affected by the chemical. This includes, but is not limited to swelling, shrinking, hardening, cracking, etc. of the glove material.

Compatibility charts rating systems will vary by the manufacturer's design of their chart. Many use a color code, where red = bad, yellow = not recommended, green = good, or some variation this scheme. A letter code may be used, such as E + excellent, G = Good, P = poor, NR = Not Recommended. Any combination of these schemes may be used, so please understand the chart before making a decision on the glove to be used.

Fact Sheet

OSU
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HEALTH & SAFETY

Safety Instruction

Hazardous Waste Container Labeling

Overview

- Hazardous waste generated at Oregon State University must be disposed of through Environmental Health & Safety (EH&S). The Hazardous Waste Pickup Request form is the avenue for a disposal request.
- Any material that is flammable, corrosive, reactive, or toxic, or is listed by the EPA, is considered a hazardous waste.
- Additionally materials such as sharps, universal waste (batteries, light bulbs, ballasts), and pressurized gas cylinders, as well as non-hazardous chemical waste, are disposed of by EH&S.
- Material that is only radioactive or bio-hazardous is not hazardous waste and has a different disposal procedure.
- EH&S covers the cost of hazardous waste disposal for OSU entities. There is no direct charge to departments/PI's for waste disposal.
- Departments are encouraged to employ waste reduction procedures to limit university costs and environmental impact.
- If there are questions or unusual circumstances, please contact EH&S at 7-2273 for assistance.

Waste Determination

- Prior to disposal of any chemical waste the generator (lab personnel) must perform a hazardous waste determination. The PI or responsible person in a lab disposing of waste must determine if the waste is hazardous and mark the appropriate hazard category on the EH&S waste label. EH&S will also dispose of non-hazardous chemical waste. No chemical waste should be thrown directly in the trash by lab personnel.
- A short list of non-hazardous chemicals and waste reduction techniques can be found on the Hazardous Waste Reduction Safety Instruction; all others should be considered hazardous until the determination has been made.
- Hazardous waste is incinerated, at off-site locations, whenever possible. Departments are encouraged to employ waste reduction procedures to limit costs. Use these guidelines to prepare and request disposal of hazardous chemical waste.

Containers

- Collect each waste in a NON-LEAKING container in good condition; match container size to amount of waste. Reuse original chemical containers for hazardous waste collection when possible. Containers that do not seal, have been damaged, etc. will not be picked up. Former food/beverage containers are not appropriate.
- Liquid containers must not be larger than 5 gallons and approximately 45 pounds in weight. Special arrangements will be made for pickup of drums and large containers. Please note when submitting a waste request that a large container is present.
- Reusable solvent waste containers are available from EH&S and should be the first choice for collecting halogenated and non-halogenated solvent waste.
- All containers must have non-leaking, tight fitting lids that are not cracked, broken, or chemically damaged.
- Paper or cardboard containers should be put into sealed plastic bags.
- Containers should be labeled as soon as waste is put into them, and must be capped at all times when not actively adding waste.

Labels

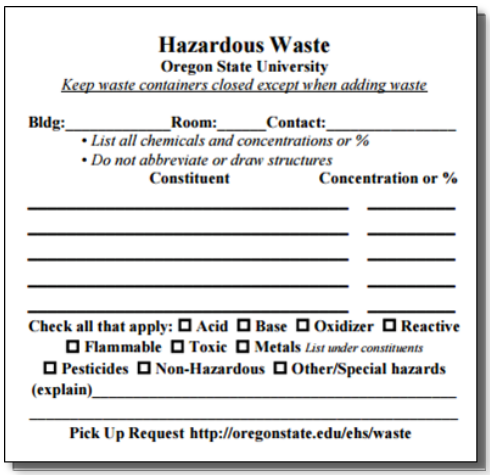
- Chemicals in original non-leaking containers with manufacturer's label must still have an EH&S waste label attached with at a minimum the contact info and hazard category filled out.
- All other wastes require an EH&S waste label which is fully completed and attached to each waste container. Contact info, constituents with percentages, and hazard classification must be marked.
- Containers too small to affix a waste label to may be boxed up or otherwise segregated and a single label applied to the whole group/container of small containers.
- Do not cover existing labels or markings unless those labels/markings no longer apply.
- Fill out the waste label with:
    - Your name, building, and room number.
    - Identification of contents, including total weight or volume and percent ranges for all constituents.
    - The hazard class of the material.

Packing

- Do NOT pre-package and seal materials into boxes. This makes it difficult for EH&S personnel to examine and sort chemicals.
- Waste containers will be examined, and EH&S will then pack and transport waste according to compatibility.

Pickup

- To request waste pickup, use the Hazardous Waste Pickup Request..
- YOU are responsible for ensuring that waste is properly labeled and in closed containers that are suitable for transport.
- All containers must be less than 45 pounds. Special arrangements will be made for heavier containers. Notify EH&S of a larger/heavier containers presence when requesting pickup.



Hazardous Waste
Oregon State University
Keep waste containers closed except when adding waste

Bldg:_____**Room:**_____**Contact:**_____
• *List all chemicals and concentrations or %*
• *Do not abbreviate or draw structures*

Constituent	Concentration or %

Check all that apply: ☐ **Acid** ☐ **Base** ☐ **Oxidizer** ☐ **Reactive**
☐ **Flammable** ☐ **Toxic** ☐ **Metals** *List under constituents*
☐ **Pesticides** ☐ **Non-Hazardous** ☐ **Other/Special hazards**
(explain)_____

Pick Up Request http://oregonstate.edu/ehs/waste

Note: Please make sure waste for pickup is clearly identified and easy to locate! A sheet of paper or post-it note reading 'Waste, EH&S Pickup, Please Dispose' or something similar attached to waste or to a cabinet containing waste for pickup is acceptable. EH&S personnel should not be required to search the lab hoping to locate waste for pickup.

Contact EHS:
ehs@oregonstate.edu
ehs.oregonstate.edu/
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Safety Instruction

Physical Labor Safety

- Facial hair will not be worn by those whose work requires the use of respiratory equipment if it will affect the positive seal of such safety devices.
- Do not use unapproved containers (drinking cups, bottled or canned food containers, glass jars, etc.) to hold oil, industrial chemicals or solvents. All chemical containers shall be labeled, closed when not in use and stored according to the manufacturer's instructions.
- Wearing hand protection, eye protection, foot protection, protective clothing, hoods, head protection, respirators, or other safety equipment is mandatory in those areas and operations specified by your supervisor.
- Wear clothing and footwear appropriate for the work you are hired to perform. Jewelry, rings, loose sleeves, ties, lapels, cuffs, tags, or other loose objects which can be entangled in rotating machinery shall not be worn. Ordinary shoes made of leather or other approved materials shall be worn as a minimum in locations where mechanical or manual work is done or where chemicals or other materials are handled. Slippers, canvas shoes, sandals, and shoes with open toes shall not be worn in such locations.
- When assisting or observing work which is hazardous, wear safety equipment which affords the same protection as that required for the person performing the work.
- Do not disconnect alarms, warning devices, emergency equipment or similar systems without specific permission from your supervisor and the person responsible for the work area.
- Do not ride in or on equipment not designed for transporting people.
- Do not use makeshift devices to ascend or descend between different levels.
- Do not work or stand under a suspended load. Stand clear of all objects being lifted by a hoist or other lifting equipment.
- Do not attempt to operate industrial vehicles, cranes, or hoists unless you are authorized and trained to do so.
- Do not load equipment beyond the prescribed capacity for its use.
- Operate machines only when guards are in place and operational. Do not remove or alter any guard device.
- Do not use machines that are danger-tagged. Switches which are danger-tagged frequently operate machines on which employees are working, and their lives may be endangered should the machine be started.
- Stop power-driven machines or tools when performing inspection of work, changing blades or accessories, discussing the work with others, or leaving the machine or tool unattended.
- Never leave a piece of equipment or part in such a condition that the next employee could get hurt when he/she takes over where you left off.
- Do not carry sharp objects in pockets or clothing.
- Keep tools in good condition. Do not use chisels with mushroomed heads, dull saws, hammers with cracked handles, broken electric plugs, etc. Use the right tool for the job.
- Do not use defective equipment or return a broken or defective tool to storage. The next employee who uses the tool may be seriously injured. Have the tool repaired.
- Inspect wrenches often for worn or sprung jaws or other defects. Defective wrenches should be taken out of service.
- Do not remove or disengage guards provided by the manufacturer for any power tool.
- All tools furnished to a worker or owned by workers are subject to inspections and approval by supervisors for safe design and construction for the work to be performed.
- Do not use compressed air or gas for any other purpose than that for which it is provided. Compressed air or gas should not be used for cleaning clothing or any part of the body. Do not use oxygen or any other gas from pressurized cylinders as a substitute for compressed air.
- Do not use explosive activated tools unless you are certified to do so.
- Workers are not permitted to work in trenches five feet or more in depth without proper protection (see 18: Excavation Operations Safety Rules).
- Check ladders before use. Do not use weak or defective ladders or ladders with missing steps, broken steps, cracked side rails, or broken hardware (see 17: Elevated Work Surface Safety Rules).
- Scaffolds shall be used according to the following rules:
    - Platform planks shall be approved for such use and placed no more than one inch apart.
    - Planks shall be placed so that tipping or sliding is not possible. Cleats must be used.
    - Employees shall not work on the top level of scaffolds unless guard rails are in use.
    - Employees shall not ride rolling type scaffolds (wheels must be locked when used).

Contact EHS:
safety@oregonstate.edu
oregonstate.edu/ehs/
541 • 737 • **2273**

Fact Sheet

OSU
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Safety Instruction

Spill Response – Chemicals

General

- **Note:** Chemical spill kits are available for purchase from Chemistry Stores in Gilbert Hall. http://chemistry.oregonstate.edu/chemistrystores
- Whenever employees work with a chemical substance, they should be aware of its characteristics and should have plans detailing what to do in case of a spill.
- Chemical knowledge is critical when performing risk assessment and is available from safety data sheets and EH&S.
- Specifically, employees should know:
  - what steps to take
  - who to call for assistance
  - what personal protective equipment (PPE) is necessary
  - what absorbent material should be used to contain and minimize the danger of a spill
  - where to find such equipment and material
- Everyone working in a laboratory at OSU should be trained on the location, contents, and use of chemical spill kits by their laboratory supervisor/principal investigator (LS/PI) before the need to use a spill kit arises.

Spill Kit Contents

- A hard copy of this Safety Instruction
- A hard copy of the Pink Pig Absorbent Pad Chemical Compatibility Chart http://www.newpig.com/wcsstore/NewPigUSCatalogAssetStore/Attachment/documents/ccg/HAZMAT.pdf
- Bucket with screw-on lid
- 6 Pink Pig Absorbent Pads (Item number MAT301 at www.newpig.com)
- Heavy duty black plastic garbage bags
- Zip ties (to seal garbage bags)
- Hazardous Waste Labels (available at **http://oregonstate.edu/ehs/waste**)
- Cardboard rectangles/squares for handling used Pig Pads, if necessary
- Appropriate lab-specific PPE, such as lab coats, goggles, gloves, etc., should be available in each laboratory.

Note: Pig Pads are only used for *liquid spills*. *Solid chemical spills* should be carefully cleaned up with pieces of cardboard or a small brush and dust pan, then disposed of as hazardous waste.

Spill Response

If there is a fire or serious injury associated with a spill, call 911 immediately for assistance.

All chemical spills of more than 1 gallon of liquid or 1 pound of solid must be reported to EH&S immediately via Campus Safety (541-737-7000).

Preparation

- The first steps to addressing any chemical spill:
  - assess the magnitude
  - assess the hazards
  - assess the risk to responders and other
- Before attempting to clean up a spill, make sure employees have proper and adequate
  - personal protective equipment
  - spill treatment materials

Contact EHS:
www.ehs.oregonstate.edu
ehs@oregonstate.edu
541 • 737 • 2273

Revised 10/2014

SMALL or **low-hazard spills** (less than 1 gallon of liquid or 1 pound of solid chemical):

1. Assess the magnitude of the spill and the associated hazards (broken glass, toxic fumes, risk of fire, etc.).
2. If the hazards can be safely mitigated with available personal protective equipment (PPE), do so. This includes informing co-workers of the spill, removing ignition sources, and moving equipment that may be damaged by the spilled chemicals. (Note: If the spill is more than 1 gallon of liquid or 1 pound of solid, contact Public Safety at 541-737-7000 and ask them to notify EH&S.)
3. Once all hazards have been assessed, put on appropriate PPE (respiratory protection, goggles, body protection, gloves, impervious shoes/boots, etc.).
4. Apply the Pig Pads to the spill and give the pads time to absorb the chemical.
5. Use gloves and cardboard to move the used Pig Pads to a garbage bag.
6. Seal the garbage bag with a zip tie and label the bag with a Hazardous Waste Label.
7. Place the garbage bag in secondary containment (a cardboard box or plastic tote/bin) labeled "Hazardous Waste." Place the box in a location in the laboratory where EH&S personnel will easily find it.
8. Request a Hazardous Waste Pickup (**http://oregonstate.edu/ehs/waste**).
9. Replenish you spill kit's contents immediately.

LARGE or **high-hazard spills** (more than 1 gallon of liquid or 1 pound of solid chemical):

1. In general, if a chemical spill is greater than 1 gallon in volume or is a particularly hazardous material (strong acid or base, carcinogen, highly reactive chemical, etc.), call Public Safety (541-737-7000), and tell them to contact the on-call EH&S personnel to respond to the spill.
2. Provide the following information:
   - Your name and contact phone number
   - Location of the spill (Building and room number)
   - Approximate volume of spilled liquid
   - Name of chemical
3. Do not attempt to clean up large and/or hazardous chemical spills.
4. Notify all other workers who could be affected by the spill and vacate the laboratory/floor/building, particularly if the chemical produces hazardous fumes or poses other potential health hazards.
5. Wait at the building entrance for EH&S personnel.
6. Serve as a point of contact and provide information about the spill, as requested by EH&S personnel.

Fact Sheet

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HEALTH & SAFETY

Safety Instruction

Walk-in Coolers and Freezers

Coolers and freezers pose potential entrapment hazards. Latches, hinges, handles and knobs can freeze, warp or malfunction. Not all walk-in freezers have alarms inside to signal for help. Even when equipped with an alarm, the following procedures should be followed to prevent possible entrapment:

1. All employees who will potentially enter a freezer or cold room must be trained in these procedures:

    a. Take a co-worker with you when you enter the freezer/cooler, and test the door from the inside to ensure that it opens correctly. Test the safety release latch.

    b. Tell your co-worker how long you intend to be in the freezer/cooler, and have them check on you if you're not out at the designated time.

    c. If entering a freezer/cooler for only a short period, prop the door open to prevent it from closing behind you. (Note that props can become dislodged, so you should notify a co-worker prior to entry as shown in #2 above.)

    d. If you plan to be in the freezer/cooler for an extended period, wear proper attire to protect from the cold.

    e. If there is an emergency alarm, know how it works (if there is an audible alarm, flashing light, whether it calls Facilities or Public Safety, etc.).

2. Post emergency procedures inside the freezer/cooler.

3. Test latches on a regular basis and repair as necessary.

4. If possible, install alarms in walk-in coolers and freezers, and test them regularly.

Contact EHS:
ehs.oregonstate.edu
ehs@oregonstate.edu
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Revised 12/2017