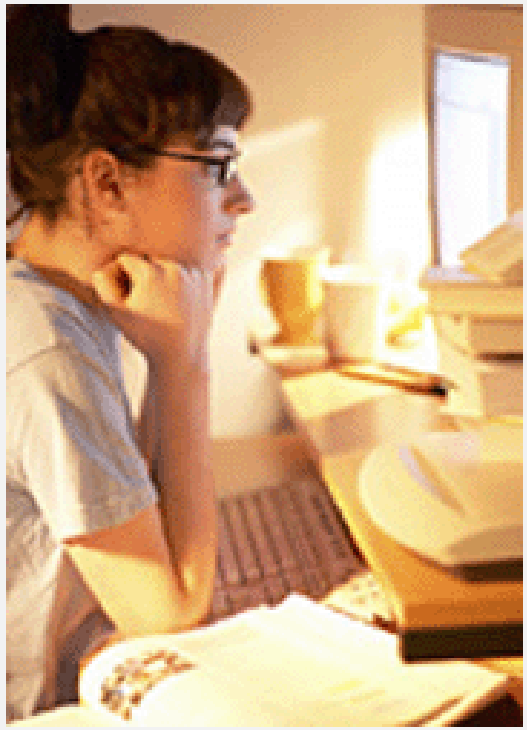
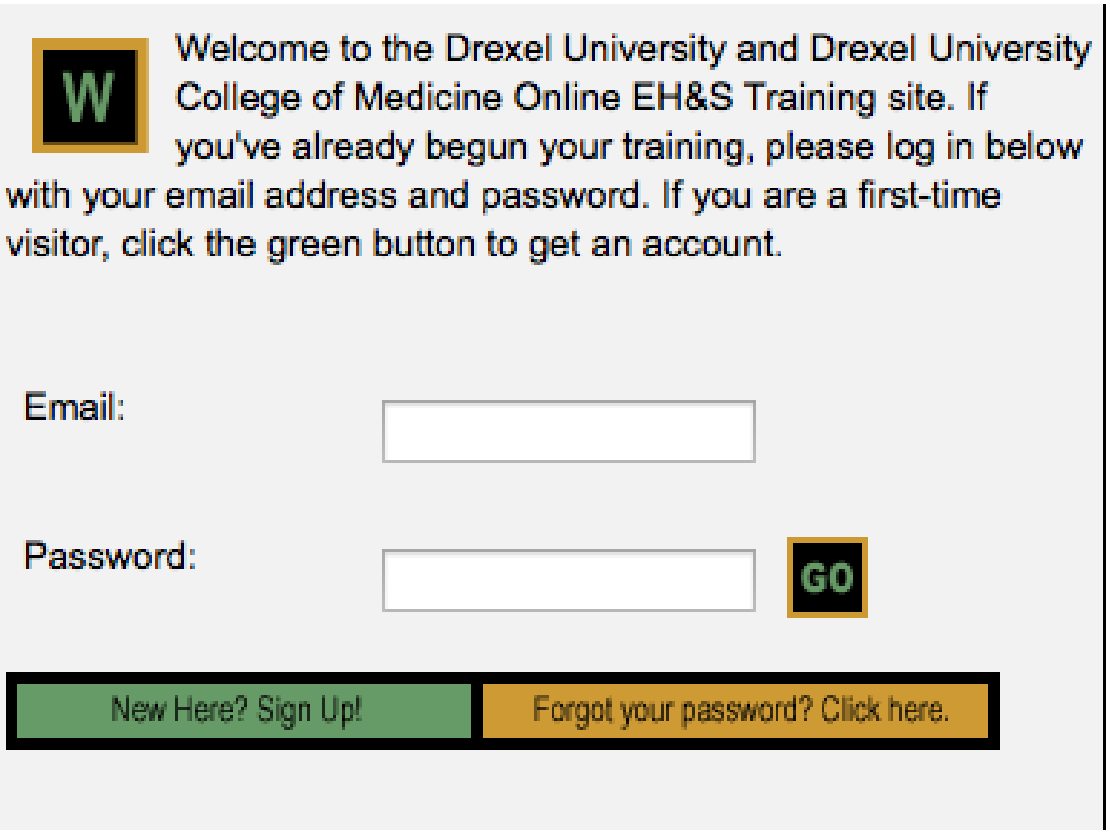
Laboratory Safety Refresher

DREXEL UNIVERSITY
A.J Drexel Nanomaterials Institute
Materials Science and Engineering

Agenda

- Training
- Hazard Communication
- Chemical Hygiene
- Personal Protection Equipment (PPE)
- Respiratory Protection
- Compressed Gas Safety
- Chemical Fume Hood Safety
- Hydrofluoric Acid Safety
- Hazardous Waste Management
- Emergency Response
- Reference Materials





Proper safety training courses must be done on BioRAFT before starting experiments in the lab

Link: https://drexel.bioraft.com

HAZARD COMMUNICATION

Health Hazard Pictogram

Identifies chemicals with one or more of the following characteristics:

- Carcinogen
- Mutagenicity
- Reproductive Toxicity
- Respiratory Sensitizer
- Target Organ Toxicity
- Aspiration Toxicity

Flame Pictogram

Identifies chemicals with one or more of the following characteristics:

- Flammable
- Pyrophoric
- Self-Heating
- Emits Flammable Gas
- Self-Reactive
- Organic Peroxides

Exclamation Mark Pictogram

Identifies chemicals with one or more of the following characteristics:

- Irritant (skin and eye)
- Skin Sensitizer
- Acute Toxicity
- Narcotic Effects
- Respiratory Tract Irritant

Gas Cylinder Pictogram

Identifies chemicals with the following characteristic:

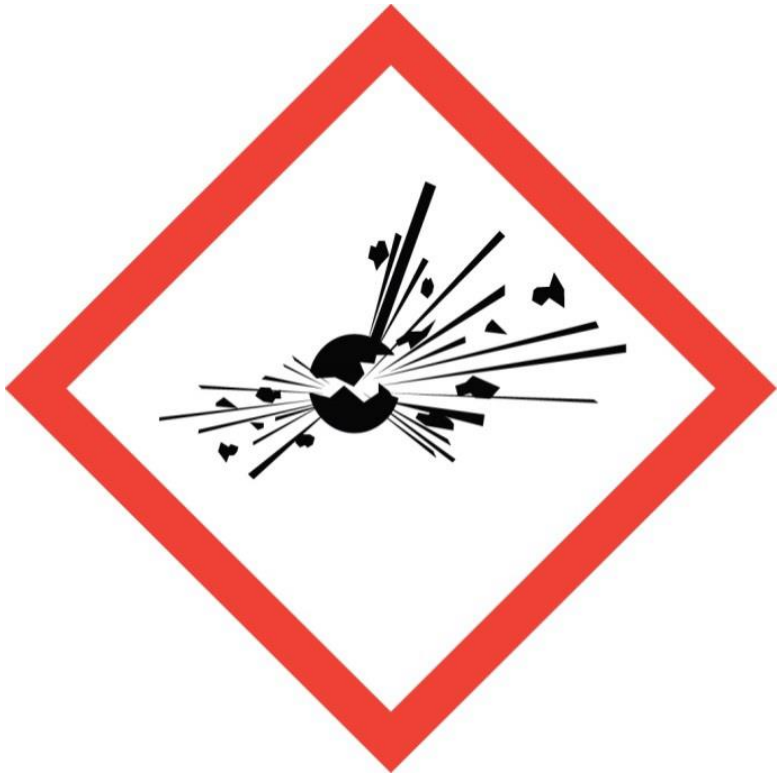
- Gases under Pressure

Corrosion Pictogram

Identifies chemicals with one or more of the following characteristics:

- Skin Corrosion/Burns
- Eye Damage
- Corrosive to Metals

Exploding Bomb Pictogram



Identifies chemicals with one or more of the following characteristics:

- Explosives
- Self-Reactives
- Organic Peroxides

Flame Over Circle Pictogram

Identifies chemicals with the following characteristics:

- Oxidizers (Reactive)

– Oxidizers are very reactive with other materials.

– Oxidizers cause or enhance the combustion of other materials.

Environment Pictogram

Identifies chemicals with the following characteristic:

- Aquatic Toxicity

Skull & Crossbones Pictogram

Identifies chemicals with the following characteristic:

- Acute Toxicity (fatal or toxic)

Chemical Storage Areas and Equipment Labeling

Hazard communication labels must be present wherever hazardous materials are used or storage.

- Cabinets
- Shelves
- Refrigerators
- Freezers

Labels must be present on equipment used to manipulate hazardous materials.

- Incubators
- Biological safety cabinets
- Centrifuges

Manufacturer Chemical Container Labeling

1. **Product Identifier** - Should match the product identifier on the Safety Data Sheet.
2. **Signal Word** - Either use "Danger" (severe) or "Warning" (less severe)
3. **Hazard Statements** - A phrase assigned to a hazard class that describes the nature of the product's hazards
4. **Precautionary Statements** - Describes recommended measures to minimize or prevent adverse effects resulting from exposure.
5. **Supplier Identification** - The name, address and telephone number of the manufacturer or supplier.
6. **Pictograms** - Graphical symbols intended to convey specific hazard information visually.

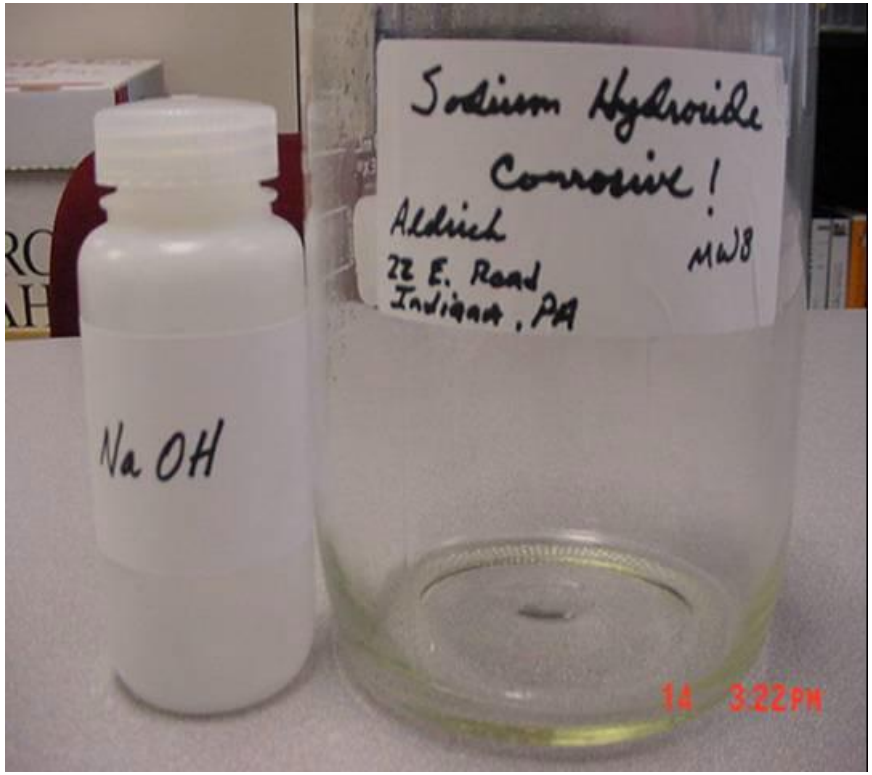
Secondary chemical containers are:

- Beakers
- Volumetric flasks
- Bottles
- Erlenmeyer flasks
- Distillation containers
- Spray and squeeze bottles
- Centrifuge tubes

Secondary Container Labeling

All secondary chemical containers must be labeled with:

- Full chemical name
  - Chemical abbreviations are ***not*** acceptable
- Signal word
- Hazard Statement
- Responsible party
- Label must be in English



Secondary Container Labeling

Materials Science & Engineering

Chemical Safety Label

- Full Chemical Name [in words]:
- Date:
- Contact Name:
- In case of Emergency Call:
- Notes/Comments:

Drexel UNIVERSITY

Plan Ahead

- Determine the potential hazards associated with an experiment prior to initiating work.
- Establish general procedures for behavior in the laboratory.
- Establish specific procedures for use, storage and disposal of potentially hazardous chemicals in the laboratory.
- Ensure all personnel have reviewed the general and specific procedures.

Minimize Exposure!

- Minimize Exposure to Potentially Hazardous Chemicals!
- Do not allow potentially hazardous chemicals to come in contact with your skin or eyes.
- Avoid ingesting, injecting or inhaling potentially hazardous chemicals.
- Use chemical fume hoods and/or other local exhaust devices to prevent exposure to potentially hazardous chemicals.

Do Not Under Estimate the Risks!

- Assume that any mixture of hazardous chemicals will be more toxic than its most toxic component.
- Treat all new compounds and substances of unknown toxicity as toxic substances.

Be Prepared for Accidents!

- Prior to beginning an experiment, know the specific actions to take in the event of accidental release of any potentially hazardous chemicals.
- Know the locations of all safety equipment and the nearest fire alarm pull station and telephone.
- Know what emergency phone numbers to call and whom to notify in the event of an emergency.
- Keep the other laboratory personnel informed of your activities so that they can respond appropriately.

IDENTIFYING HAZARDOUS CHEMICALS – HAZARD DETERMINATION

Principal Investigators/Supervisors should conduct hazard assessment **prior** to initiating any experiments involving potentially hazardous chemicals.

Facility-specific policies and procedures for the higher-risk chemicals and procedures should be developed.

Risk assessment steps:

- Identify the chemicals to be used.
- Amounts required.
- Circumstances of use in the experiment.
- Consider any special employee or laboratory conditions that could create or increase a hazard.

Evaluate the Hazards

Evaluate the hazards posed by the chemicals and the experimental conditions.

- Toxic
- Physical
- Reactive
- Flammable
- Explosive
- Radiation
- Biological hazards
- Any other potentially hazards posed by the chemicals.

Consult literature references, Laboratory Chemical Safety Summaries (LCSSs), Safety Data Sheets (SDSs), or other reference materials.

Minimize Risk

Select appropriate controls to minimize risk, including use of:

– Engineering controls (e.g. chemical fume hoods, local exhaust devices, etc.);

– Administrative controls (e.g. operating procedures, scale limits, etc.);

– Personal protective equipment (e.g. gloves, laboratory coats, safety glasses, splash goggles, etc.)

The controls must ensure that the OSHA's Permissible Exposure Limits (PELs) are not exceeded.

Ask and answer the following questions as a simple approach to the hazard assessment:

1. What are the hazards associated with the process and/or the chemicals?
2. What is the worst thing that could happen?
3. What can be done to prevent this from happening?
4. What can be done to protect from these hazards?
5. What should be done if something goes wrong?

You will need to perform more complex risk assessments for higher risk processes and chemicals.

Contact EH&S for assistance in performing these assessments.

IDENTIFYING HAZARDOUS CHEMICALS - SAFETY DATA SHEETS (SDS)

Safety Data Sheets

The University maintains a central repository online for all personnel to access the SDSs at any time. The online repository can be accessed on the EHS website.

The information can be accessed at the EHS Website. EHS strongly recommends maintaining a copy in the laboratory.

The **Principal Investigator and/or Supervisors** are responsible for:

- Keeping the SDSs binder current.
- Making them available to all personnel entering the laboratory.
- Ensuring all personnel review the SDSs prior to initiating any experiments involving potentially hazardous chemicals.

Reviewing the SDS and recording which materials are carcinogenic, mutagenic or teratogenic.

The information must be conveyed to all personnel working and/or visiting the laboratory.

Storage

Each chemical in the laboratory must be stored in a specific location and returned there after each use.

Acceptable chemical storage locations may include **corrosive cabinets, flammable cabinets, laboratory shelves and cabinets, or appropriate refrigerators or freezers.**

Chemical fume hoods must not be used as general storage areas for chemicals, as this will seriously impair the ventilating capacity of the hood.

Chemicals must not be routinely stored on bench tops. Avoid storing on the benchtop except for those chemicals in use.

Do not store chemicals on the floor. Keep exits, passageways, areas under tables, and emergency equipment areas free of stored chemicals.

Storage Requirements

Segregation of incompatible chemicals is extremely important. It prevents inadvertent reactions during normal and emergency situations.

EH&S recommends storing chemicals in the following hazard classes:

- Reactives
- Flammables
- Corrosives
- Toxic
- Irritants and Non-hazardous chemicals

The Principal Investigator and/or laboratory supervisor must pay particular attention to specific subgroups in each hazard class and whether a chemical has multiple hazard classes.

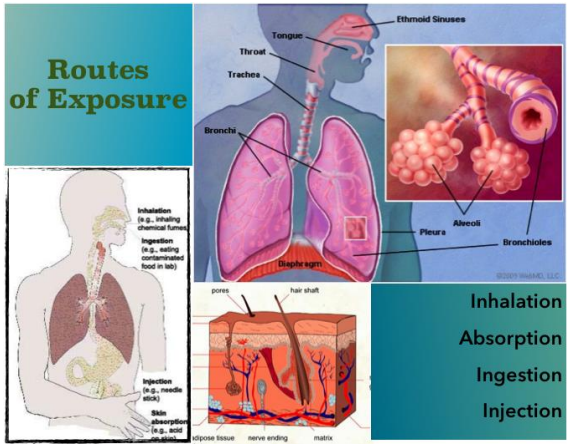
Additional segregation may be required in each sub group.

Refer to the University's CHP for specific storage requirements.

CONTROLLING CHEMICAL EXPOSURES

Routes of Exposure

Working with chemicals require a carefully considered, multi-tiered approach to ensure safety. There are four primary routes of exposure:



1. Inhalation - the most likely route of exposure
2. Absorption - through the skin or eyes
3. Ingestion
4. Injection - skin being punctured by a contaminated sharp object or uptake through an existing open wound

Many hazardous chemicals may affect people through more than one of these exposure routes, so it is critical that protective measures are in place for each of these uptake mechanisms.

Control Hierarchy

The hierarchy of controls prioritizes intervention strategies based on the premise that the best way to control a hazard is to systematically remove it from the workplace, rather than relying on employees and students to reduce their exposure.

1. **Engineering Controls** - general laboratory exhaust systems; local exhaust systems (e.g. chemical fume hood, glove boxes, snorkels, etc.). – Most Effective

2. **Administrative Controls** - chemical substitution; standard operating procedures; work practices.

3. **Personal Protective Equipment** (PPE) Controls - gloves; laboratory coat; safety glasses; splash goggles; respirator; clothes. – Least Effective

Elements of these three controls should be used in a layered approach to create a safe working environment.

HIGHLY TOXIC MATERIAL PRECAUTIONS

Acutely Toxic Materials

Acute toxicity is the ability of a chemical to cause a harmful effect after a single exposure.

Acutely toxic agents can cause local toxic effects, systemic toxic effect, or both.

You can find a list of acutely toxic materials in the University's CHP and Table Z on the OSHA website.

Laboratory personnel working with highly toxic materials must be thoroughly trained on the specific hazards associated with the materials.

Practice good personal hygiene - wash hands, face, neck and any other exposed skin!

Never work alone when handling highly toxic materials!

Preparations for handling highly toxic materials must include:

- Sound and thorough planning, understanding the intrinsic hazards of the materials and the risk of exposure inherent in the planned process.
- Selecting additional precautions that may be necessary to minimize or eliminate these risks.
- Reviewing all emergency procedures to ensure appropriate response to unexpected spills or accidents.

- Specific areas in the laboratory must be designated for working with highly toxic chemicals.
- These areas must be clearly identified and separated from all other operations.
- All equipment in contact with these materials must be identified.
- Procedures that can generate dusts, vapors or aerosols must be conducted in a chemical fume hood, glove box or other suitable and approved containment device.

REACTIVE/EXPLOSIVE MATERIAL PRECAUTIONS

An explosion results when a materialundergoes rapid reaction that results in a violent release of energy.

Such reactions can occur spontaneously or be initiated and can produce pressure, gases, and fumes that are hazardous.

Highly reactive and explosive materials used in the laboratory require appropriate procedures and training.

Light, mechanical shock, heat and certain catalysts can be initiators of explosive reactions.

Many highly reactive chemicals can polymerize vigorously, decompose, condense, and/or become self-reactive.

The improper handling of these materials may result in a runaway reaction that could become violent.

Risk assessment is a necessary step and must be performed prior to working these materials.

Standard operating procedures (SOPs) must be developed to ensure safe handling of the reactive materials.

CORROSIVE MATERIAL PRECAUTIONS

Accidents with corrosive materials in which the material may splash on the body are very common in the laboratory.

Exposure to corrosive chemicals will result in an immediate, acute erosive effect on tissue.

The eyes are particularly vulnerable to injury, and injuries to the respiratory system may range from moderate irritation to severe injury. Skin contact will cause severe burns which are very slow to heal.

Ingestion can cause immediate injury to the mouth, throat, and stomach, and in severe cases can lead to death.

PROTECTIVE APPAREL AND PERSONAL PROTECTIVE EQUIPMENT

Personal Protection Equipment

The minimum PPE and personal apparel required when entering a University laboratory is long pants, safety glasses with side shields, closed toe/top shoes and a laboratory coat. In some cases, additional, or more protective, equipment may be required.

For example, a heavy duty apron, heavy duty gloves, splash goggles, and a face shield would be required if a project involves a chemical splash hazard.

Another example, a fire-resistant laboratory coat would be required for work involving highly flammable materials like Diethyl Ether, t-Butyl Lithium, or alcohol.

Personal Protection Equipment

Safety glasses, laboratory coat and proper attire are required for all employees entering University laboratories.

Your supervisor must perform a hazard assessment to identify the correct PPE for every task involving hazardous materials.

You will be asked to leave the laboratory if you are not wearing proper attire and personal protection equipment.

PERSONAL PROTECTION EQUIPMENT IS THE LAST LINE OF DEFENSE AGAINST HAZARDOUS MATERIAL EXPOSURES!

You must wear pants, shirt, closed toe and top shoes and a laboratory coat when entering University laboratories.

Your Principal Investigator (Advisor) is responsible for providing a laboratory coat.

Clothing that exposes large portions of the skin must not be worn. Shorts, skirts and dresses are prohibited.

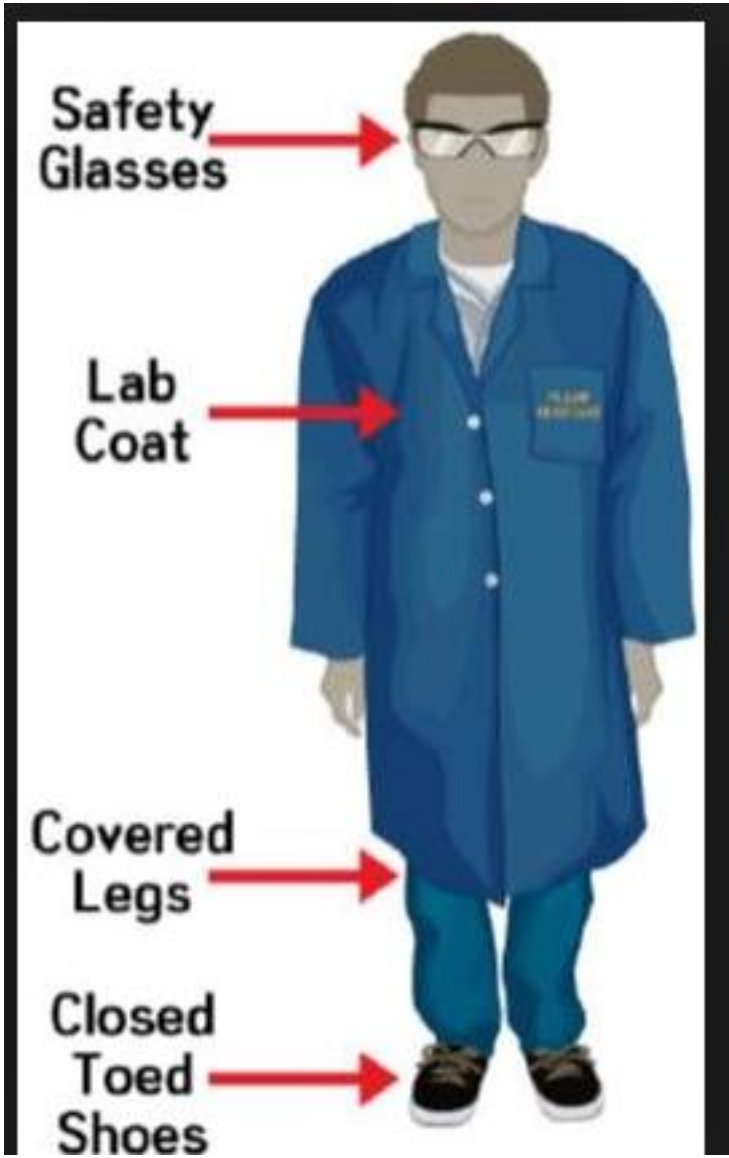
The laboratory coat protects you and your clothes from hazardous material spills and burns.

Damaged or severely contaminated laboratory coats should be disposed of and replaced.

Appropriate shoes that provide proper protection must be worn in laboratories where hazardous materials are in use.

Shoes must cover the entire foot.

Open-toed/top shoes, flip flops, perforated shoes, sandals, and cloth shoes do not provide protection against spilled hazardous materials and are prohibited from being worn in the laboratory.




Open toed
Sandals
Open Top and Perforated
All of these shoes are prohibited in the laboratory!
Perforated
Open Top and Perforated
Flip flops

Eye protection consists of safety glasses with side shields, goggles or a face shield.

Appropriate eye protection must be worn by you when entering laboratories and areas where hazardous materials are used or stored.

Eye protection is required whether or not one is actually performing experimental operations.

Prescription glasses are not approved safety glasses.

Safety glasses, splash goggles or a face shield must be worn over the top of prescription glasses.

Splash goggles or a face shield must be worn for operations that have the potential for splashes or sprays.

You must wear appropriate gloves when you have the potential for direct contact with blood, hazardous chemicals, infectious agents, sharp-edged objects, very hot or very cold materials, or any other hazardous materials.

Gloves protect differently for each chemical.

Wearing the wrong type of glove can be more hazardous than wearing no gloves at all.

If the hazard material seeps through, the glove can hold it in prolonged contact with your skin. Inspect gloves for small holes or tears prior to use.

Use disposable gloves when dexterity is needed and the contamination warrants one-time use.

Use heavy duty gloves when the hazard requires it, such as handling concentrated acids and bases.

Use puncture-resistant gloves when handling sharp objects.

Use insulated gloves when handling cryogenic or hot materials.

Use glove selection guides to ensure the glove used is appropriate for the task. The EHS website has a link to a glove selection guide. Wash hands prior to wearing gloves.

The use of double gloves can provide multiple lines of defense when working with highly toxic or multiple hazard materials.

Change gloves frequently to avoid exposure.

Wash hands with soap and water immediately after removing gloves.

Select gloves appropriate for the task and hazard!

PPE Selection

Hazard	PPE Selection
Solids, low risk	• Safety glasses • Disposable gloves • Laboratory coat
Toxic Solids or Liquids	• Safety glasses or goggles • Disposable gloves • Laboratory coat or disposable coverall or apron • Respiratory protection, as necessary
Flammable Liquids	• Safety glasses or splash goggles or face shield • Disposable gloves • Fire resistant laboratory coat

PPE Selection

Hazard	PPE Selection
Pyrophoric Liquids	• Safety glasses and face shield • Fire resistant gloves • Disposable gloves • Fire resistant laboratory coat
Cryogenic Liquids	• Safety glasses and face shield • Insulated cryogenic gloves • Laboratory coat
Corrosive Liquids – concentrated	• Heavy duty non-disposable gloves • Splash goggles • Laboratory coat • Apron if available

Hazard	PPE Selection
Corrosive Liquids –Diluted	• Safety glasses or splash goggles • Disposable gloves • Laboratory coat
Reactive Liquids and Solids	• Safety glasses and face shield • Heavy duty gloves • Fire resistant laboratory coat
Biological Materials	• Safety glasses • Disposable gloves • Laboratory coat • Respiratory protection if agent is high risk

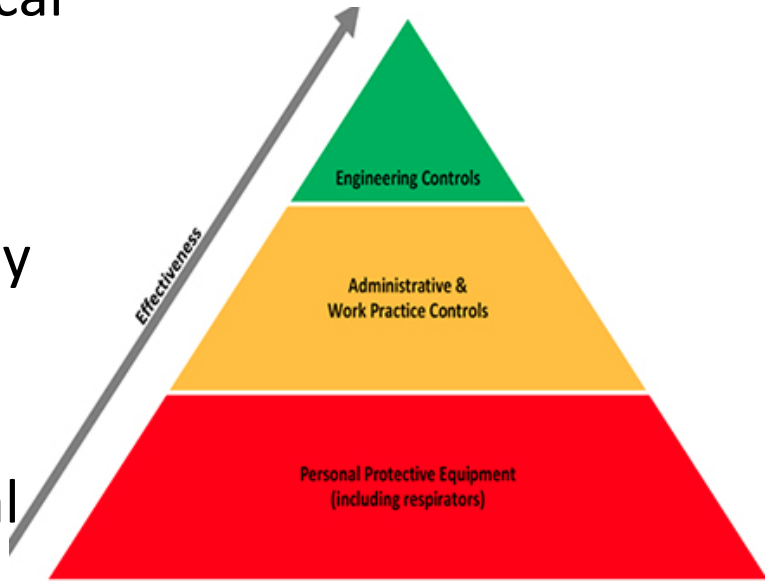
Respiratory Protection

Respiratory protection protects your respiratory system from dangerous chemical and/or biological agents.

You may recall from the Chemical Hygiene training module the discussion of hierarchy of controls.

The most effective control is Engineering while the least effective control is Personal Protective Equipment.

Respiratory protection is considered personal protection equipment and is therefore the ***least*** effective way to protect against chemical and biological inhalation exposures.



Contact EHS at safeheal@drexel.edu for assistance regarding respiratory protection!

Chemical Fume Hoods

CFH Management

- The chemical fume hood in Bossone 520 will be split into 1/3 sections.

- 1/3 of the area will be designated for general and short-term use
  - Pouring and mixing of hazardous materials
  - Actions that require less than 1-2 hours

- 2/3 of the area will be available for long-term synthesis or other experiments that must be scheduled in advance.

CFH Management

- Each section will be guaranteed one hot plate – extras may be available.

- An online calendar will be created to reserve long term needs.
  - Any experiment longer than a week will need authorization.

- All samples must be labeled in accordance with the University's CHP.

CHF Management

- Spent chemicals must **not** be stored in the hood.
- Degassing of spent chemicals must be performed in the hood to allow for capping and safe handling.
- All containers must be labeled in accordance with the CHP.

HAZARDOUS WASTE

Compatibility

EHS requires only compatible chemical waste be combined into one waste container. Refer to the safety data sheet (SDS) for chemical compatibilities or contact EHS for assistance. Combining incompatible wastes will cause adverse reactions that will cause injury.

Some compatible waste streams are as follows:

- Halogenated Organic Waste – organic solvents and solutions that contain halogen groups - Flourine, Chlorine, Bromine, Iodine, and Astatine. Chloroform, methylene chloride, and chlorobenzene are examples of halogenated organic solvents.
- Non-halogenated Organic waste - organic solvents that do not contain halogen groups. Acetone, alcohols, Tetrahydrofuran (THF), acetonitrile.
- Aqueous Acid waste that contains aqueous acid solutions that do not contain heavy metals, toxic compounds, or oxidizing acids like sulfuric acid, nitric acid, and perchloric acid. Waste -

- **Aqueous Basic Waste** - waste that contains aqueous basic solutions that do not contain heavy metals.
- **Toxic Metal Waste** - waste that contains toxic metals like chromium, lead, selenium, arsenic, etc.
- **Oxidizing Acid Waste** - waste that contains oxidizing acids like nitric acid, sulfuric acid and perchloric acid. Each oxidizing acid should be collected in a separate waste container to avoid reactions.
- **Toxic Waste** - waste that contains toxic chemicals like acrylamide, benzo(a)pyrene, cyanide compounds, etc.

Compatibility

- **Reactive Waste** - waste that contains reactive chemicals like metal perchlorate complexes, oxidizers, sodium azide, etc. These wastes must be collected separately from each other to avoid reactions.

- **Non-Hazardous Waste** - waste that contains non-hazardous chemicals like sodium chloride, buffers, etc.
- **DEA Controlled Substances** - waste that is regulated by the Drug Enforcement Agency (DEA). This waste stream must be handle in accordance with DEA regulations.
- **Infectious Waste** - waste that contains infectious biological materials like bloodborne pathogens, DNA, RNA, body fluids, used needles, etc.
- **Radioactive Waste** - waste that contains radioactive materials like P32, C14, H3, etc. This waste must be completely separated from all other waste.

Compatibility

- Waste stream compatibility will be analyzed over the next few months to determine which streams can be combined.

- We are looking at the experimental process to find an easy way to combine streams.
  - Using the risk assessment tool
  - Chemical pickup request

- EH&S has identified a few streams that may be combined:
  - Acid, Inorganic Non-oxidizing:
    - Hydrofluoric acid
    - Hydrochloric acid
    - Phosphoric acid
    - Hydroiodic acid
  - Acids, Inorganic Oxidizing:
    - Nitric acid
    - Sulfuric acid
- This may be very complicated way to process the waste generated in the laboratory.

SATELLITE ACCUMULATION AREA

Satellite Accumulation Area

A satellite accumulation area is an area at or near a process that generates chemical wastes.

The area must be under the control of the operator of that process.

Each laboratory shall designate a location in the laboratory for hazardous waste storage.

The storage of hazardous waste must be in accordance with the chemical storage guidelines outlined in the University's Chemical Hygiene Plan (CHP).

Laboratory personnel are responsible for adhering to all waste management policies regarding satellite accumulation areas.

Accumulation

The amounts of hazardous waste a laboratory is permitted to accumulate are as follows:

- Five (5) gallons (19 liters) of non-acutely hazardous waste;
- One (1) quart (0.9 liters) of acutely hazardous waste (immediately hazardous to life and health);

The 5 gallon (19 liters) limit of non-acutely hazardous waste is the total amount of waste in all the waste containers whether or not the containers are full.

The limit does not permit a laboratory to store 5 gallons (19 liters) for each waste stream.

The one quart or 0.9 liters of acutely hazardous waste is the total amount of waste in all the waste containers whether or not the containers are full.

Accumulation

EH&S recommends reviewing the acutely hazardous chemical list to identify these chemicals in the laboratory. The list is located in the back of the University's Chemical Hygiene Plan.

Once identified, the laboratory personnel must pay attention to the amount of waste generated in an effort to not exceed the limit of one quart or 0.9 liters.

Laboratory personnel are required to submit a chemical pickup request immediately:

- Once a container (e.g. a 4-liter bottle) becomes full; or
- 5 gallons (19 liters) of non-acutely hazardous waste (e.g. total amount of waste in all containers whether full or not); or
- 1 quart or 0.9 liters of acutely hazardous waste (e.g. total amount of waste in all containers whether or not the containers are full) is accumulated.

The full container or excess waste must be removed from the laboratory and moved to the accumulation area within 72 hours.

Do not wait until several containers are full! Do not exceed the 5 gallon limit! Do not exceed the one quart or 0.9 liters of acutely hazardous waste limit!

WASTE COLLECTION CONTAINERS

Hazardous waste collection containers must be compatible with the waste they contain.

Refer to Safety Data Sheets (SDS) for container compatibility. If the SDS is not available contact EH&S for assistance.

All containers must be maintained in good condition and have a capping device. (i.e. no rust, dents, or leaks, etc.).

EH&S does not provide containers for waste collection.

It is the responsibility of the laboratory to have appropriate containers for collecting waste.

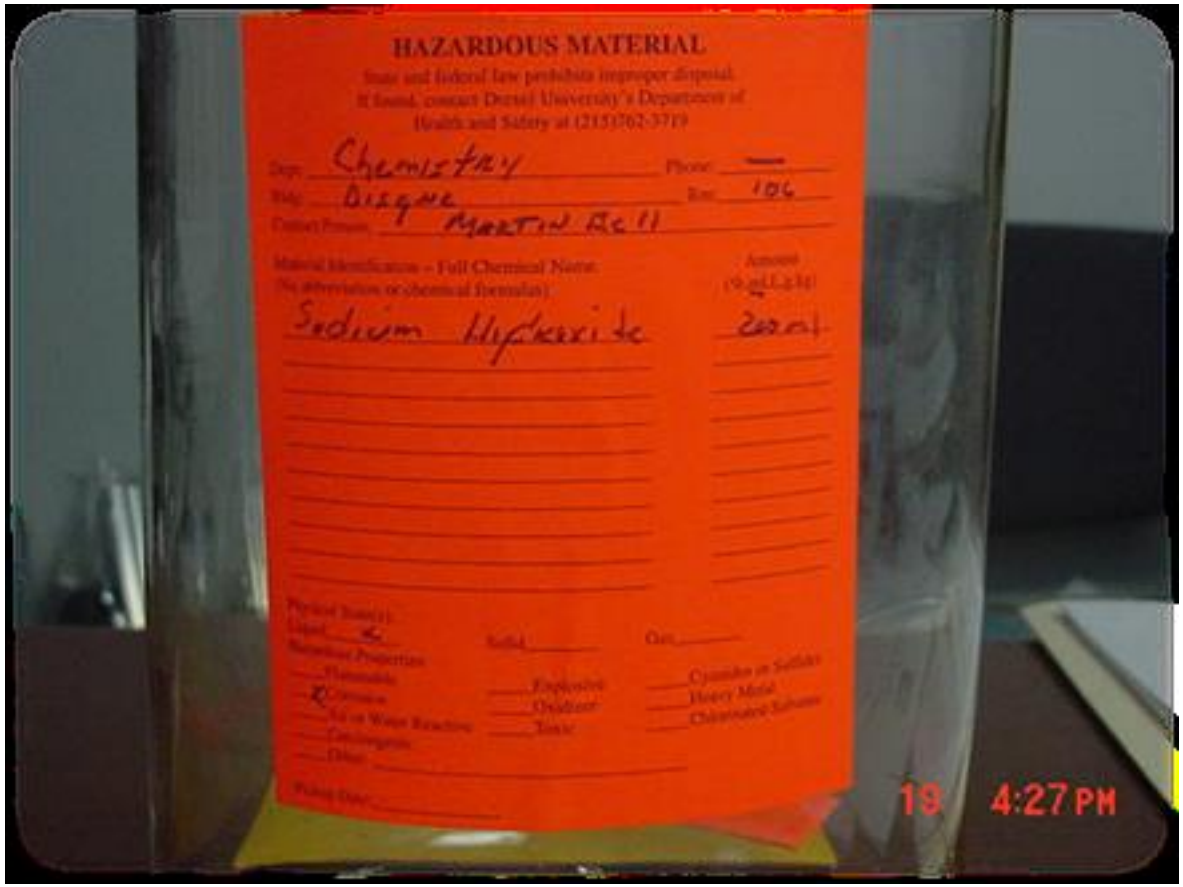
The following types of containers are **acceptable**:

- Used primary capped chemical containers - 1 and 4 liter bottles or smaller.
- Capped centrifuge tubes.
- Polyethylene containers with a cap.

The following types of containers are **unacceptable**:

- Drink containers
- Household cleaning products container
- Open top bottles, centrifuge tubes, and drums.
- Open top buckets

CONTAINER LABELING



Labeling

All containers must be labeled with the complete chemical name of each primary component.

Formulas, acronyms, and abbreviations are not acceptable.

The label must be in accordance with the University's Chemical Hygiene Plan.

The label should include the approximate percentage of each chemical constituent.

The label information and the request are used to determine the handling method.

Do **not** place the date or the words "Hazardous Waste" on the waste collection container. EH&S will re-label the container during pick-up as either a recyclable/redistributable material or as hazardous waste at which time the container will be dated and moved to the temporary storage vault.

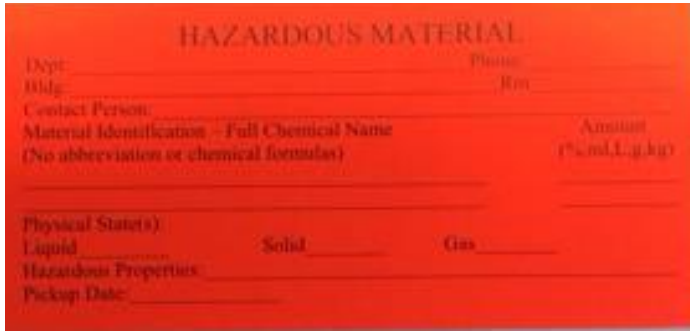
Use "used", "discarded", or similar terms.

Labels

EH&S provides orange Hazardous Material labels for every laboratory.

The labels are designed to comply with the University's waste management program.

You can request the labels by emailing EHS at **safeheal@drexel.edu**.



Waste containers labeled as "Unknown Chemicals" will not be removed from the laboratory at the time of the pick-up!

EHS will meet with you to determine the best solution.

CHEMICAL PICK-UP REQUEST

Chemical Pick-up Request

EH&S utilizes an on-line service request form to allow laboratory personnel to request waste removal from the laboratory.

Personnel can complete the **Chemical Pick-up Request** form when:

- Unwanted and old chemical reagents need to be removed.
- One waste collection container is full.
- A total of five gallons (19 liters) of non-acutely hazardous waste is accumulated, whether or not the containers are full.
- A total of one quart or 0.9 liters of acutely hazardous waste is accumulated, whether or not the containers are full.

Chemical Pick-up Request

All sections of the Chemical Pick-up Request form must be completed.

The requester must provide all contact information, the pick-up location, and the chemical information.

The request must provide the phase (liquid, solid, etc.) of the chemical, hazard classification, container type, number of containers, and the total estimated weight in pounds.

The form has a one pound limit for the weight field. As such, input one in the weight field if the total estimated weight is less than one pound.

The requester will be contacted to re-submit the request if it is incomplete.

Chemical Pick-up Request

EH&S will immediately be notified of the request once submitted.

A receipt of the request will be sent to the requester indicating the EH&S has received it.

The waste will be removed within 72 hours upon receiving the request.

EH&S will not contact the requester to schedule the pick-up unless contacted to do so.

It is recommended to print the receipt and place it with the chemicals to be removed.

Chemical Pick-up Request

The chemical request form must list all the materials that need to be removed.

Any materials not listed will not be removed until a chemical request form is filled out.

If the material is improperly labeled it will not be removed until proper labeling is present.

Open containers will not be removed from the laboratory.

Unknown chemicals will not be removed from the laboratory.

INFECTIOUS WASTE SORTING

Infectious waste must be sorted at the point of generation in the laboratory.

It must be sorted into the following three waste streams in a separate container:

- Used Sharps
- Fluid quantities greater than 20 cubic centimeters (cm^3)
- Non-sharp infectious waste

Used Sharps

Used sharps, regardless of whether or not they are infectious, must be disposed in approved sharps containers.

Sharps containers must be rigid, tightly lidded, and puncture resistant. EH&S supplies every laboratory upon request with 17 gallon sharp containers for disposal of sharps waste.

The sharps container must remain closed at all times except for disposing of sharps waste.

All containers more than 3/4 full must be closed and sealed until it is picked up for disposal.

Overfilled sharps containers will not be removed from the laboratory.

Only dispose sharp items in the sharps containers.

Waste Management

- Two laboratory personnel will be responsible for managing the waste in the lab.:
  - Submitting chemical pickup requests.
  - Confirming all full waste containers are logged into the waste spreadsheet.
  - Regular inspection of the waste cabinet.
- Lab personnel are responsible for adding chemicals ready for disposal to the spreadsheet.
- Lab personnel must mark containers ready for disposal with either a colored marker or sticker.
- All waste will be stored in the vented flammable cabinet.

EMERGENCIES DO OCCUR!

Be Prepared

Be prepared for emergencies. Laboratory operations can create many types of emergencies. Students and/or employees may interact with ....

Life threatening emergencies

- Heart attacks, major chemical burns, seizures, chemical asphyxiation, major chemical releases, fires, etc.

Non-Life threatening injuries

- Minor chemical burns, small cuts, small chemical spills, ventilation failures, etc.

You need to know how to respond in situations where people are injured and chaos has ensued.

Stay Calm! Think! Act!

HAZARDOUS MATERIAL RELEASE IDENTIFICATION

Major Release Identification

Non-Acutely Hazardous Chemicals

- Spills greater than 500 milliliters or grams or any amount release in non-laboratory space.

Acutely Hazardous Materials

- Any amount released. EH&S recommends reviewing the acutely hazardous list in the University's chemical hygiene plan to identify all chemicals that fall into this category.

Blood

- Spills greater than 500 milliliters.

Select Agents

- Any amount released. Examples are tetrodotoxin, b. anthracis, etc.

Hazardous Gases

- Any amount released. Examples are chlorine, phosphine, silane, ammonia, hydrogen, carbon monoxide, hydrogen sulfide, methane, etc.

Mercury and Mercury Compounds

- Any amount released.

Radioactive materials

- Releases where the nature of the potential hazard cannot be ascertained, someone is contaminated, the release is in unrestricted areas, there are airborne radioactive materials generated, there are injuries that might involve the material, uptake potential is high, and evacuation of the room or building is necessary.

Minor Release Identification:

- Spills less than 500 grams or 500 milliliters of non-acutely hazardous and nonradioactive materials.

A release of radioactive material is considered a minor release when:

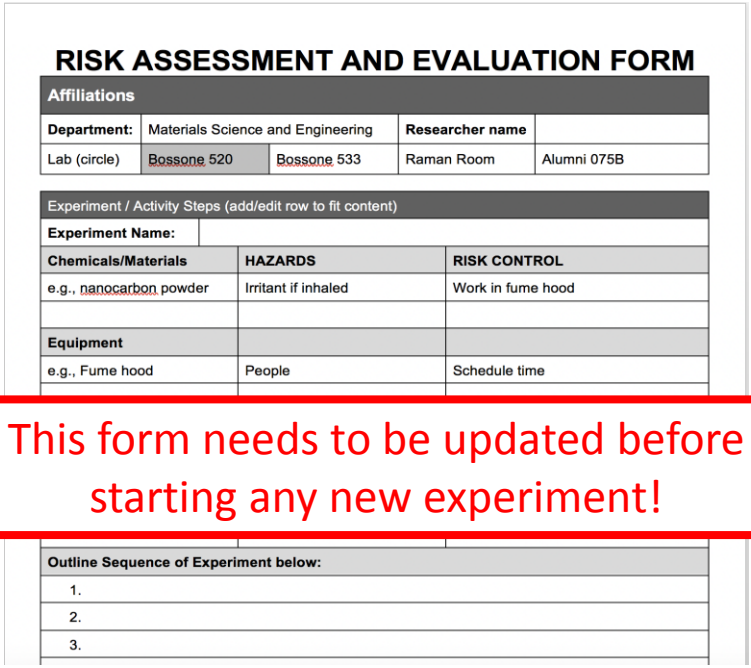
- The nature and potential hazards are known.
- There is no contaminated personnel.
- The release can be cleaned up within one hour by one person.
- There is no release into unrestricted areas.
- There is no airborne radioactive material.
- There are no injuries, no medical attention required and no potential for uptake.

EH&S recommends reviewing the University's Hazardous Material Response Plan prior to initiating any experiments with hazardous materials.

Before starting an experiment…

Fill out a Risk Assessment form and email it to Mykola (email: ms4427@drexel.edu)

This form will help you: identify chemicals used and amounts required, the circumstances for use in experiment, and determine the safety concerns associated with your experiments.



RISK ASSESSMENT AND EVALUATION FORM

Affiliations				
Department:	Materials Science and Engineering		**Researcher name**	
Lab (circle)	Bossone 520	Bossone 533	Raman Room	Alumni 075B

Experiment / Activity Steps (add/edit row to fit content)		
Experiment Name:		
Chemicals/Materials	**HAZARDS**	**RISK CONTROL**
e.g., nanocarbon powder	Irritant if inhaled	Work in fume hood
Equipment		
e.g., Fume hood	People	Schedule time

Outline Sequence of Experiment below:
1.
2.
3.

This form needs to be updated before starting any new experiment!

Link: http://nano.materials.drexel.edu/resources/

Before starting an experiment…

Ask and answer the following questions as a simple approach to the hazard assessment:

1. What are the hazards associated with the process and/or the chemicals?
2. What is the worst thing that could happen?
3. What can be done to prevent this from happening?
4. What can be done to protect from these hazards?
5. What should be done if something goes wrong?

In case of Emergency contact EH&S: (215) 895-5919 (215) 895-2222 (24-hr service)

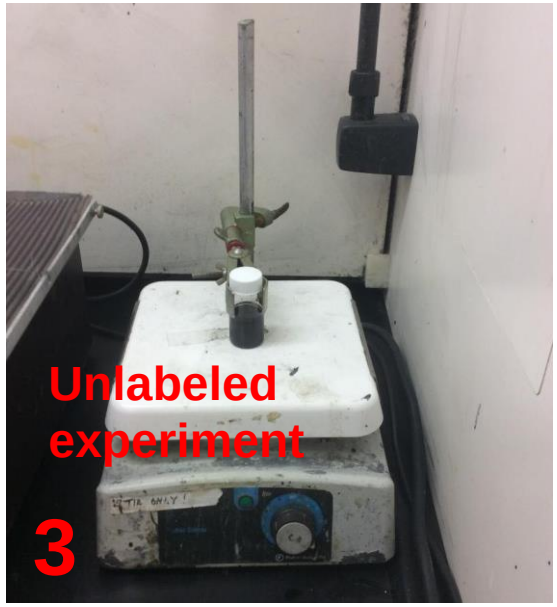
The University maintains a central repository online for all personnel to access the SDSs at any time. The online repository can be accessed on the EHS website.

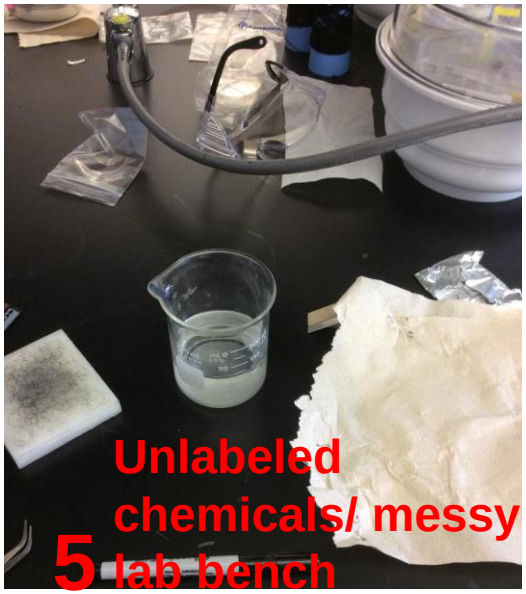
The Principal Investigator and/or Supervisors are responsible for:

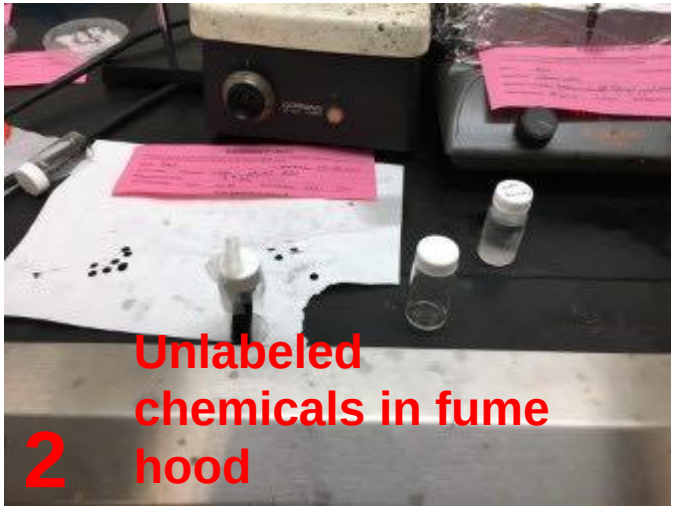
- Keeping the SDSs binder current.
- Making them available to all personnel entering the laboratory.
- Ensuring all personnel review the SDSs prior to initiating any experiments involving potentially hazardous chemicals.

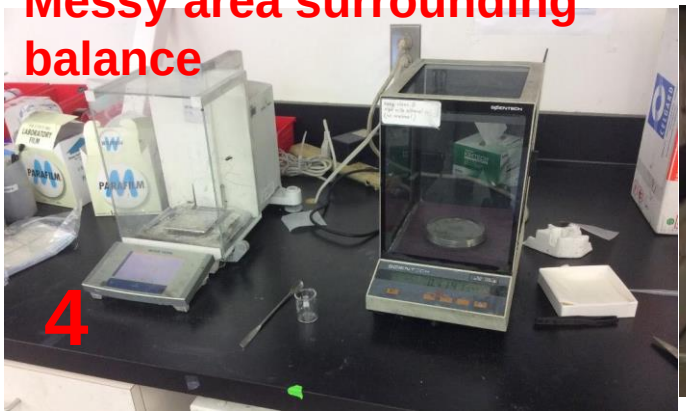
Reviewing the SDS and recording which materials are carcinogenic, mutagenic or teratogenic. The information must be conveyed to all personnel working in the laboratory.

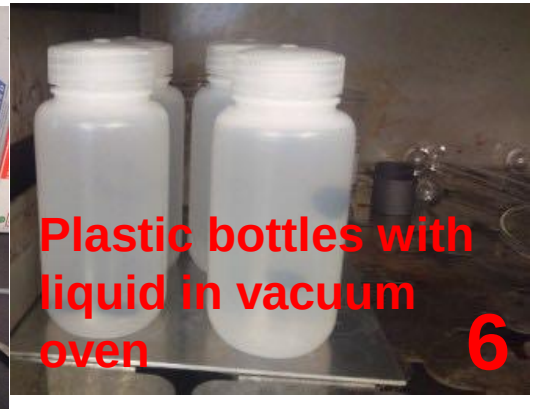
What's wrong with these photos?











What should we do instead?

1) All experiments should be properly labeled (no abbreviations for chemicals).

2) All samples should be labeled and safely contained.

3) Clean and return chemicals, beakers, tools, etc. to their original place.

4) Keep lab bench and balance areas clean.

Reference Materials

- EHS Website -

http://www.drexel.edu/facilities/healthSafety/Overview/

- Chemical Hazards - http://www.chemhat.org
- Prudent Practices -

http://www.nap.edu/catalog.php?record_id=4911

- Center for Laboratory Safety - https://cls.ucla.edu
- Vented Caps - http://www.psix.com
- Chemical Reactivity Worksheet -

http://response.restoration.noaa.gov/oil-andchemical-spills/chemical-spills/response-tools/downloading-chemical-reactivity-worksheet.html