

# **LABORATORY SAFETY TRAINING**

**VA PORTLAND HEALTH CARE SYSTEM  
RESEARCH AND DEVELOPMENT SERVICE**

**Once you have completed all of the sections, there will be a short test for you to complete.**



# Safety in the Laboratory

## Overview

The VAPORHCS R&D Safety Program adheres to the guidelines described in **VHA Handbook 1200.08, Safety of Personnel and Security of Laboratories Engaged in VA Research**. This program mandates that:

- All research activities must undergo annual safety reviews by the Subcommittee on Research Safety (SRS).
- All research activities must be conducted in a manner that ensures the security of hazardous or potentially hazardous research materials.
- All research personnel must undergo annual safety training that covers both general and research-specific activities.
- All research laboratories must be inspected semi-annually by general safety and laboratory safety specialists.
- All research projects and proposals must be reviewed by the SRS and the R&D Committee.



# Safety in the Laboratory

## Implementation of the Research Safety Program

- The **VAPORHCS SRS** and the **R&D Committee** are responsible for communicating research safety guidelines to Research Service personnel.
- The **Principal Investigator** is responsible for ensuring that assigned research laboratories and laboratory research personnel comply with these research safety guidelines, regardless of funding support or source.
- The **Principal Investigator** is also responsible for ensuring that research personnel receive appropriate safety training with respect to lab-specific research activities.



# Safety in the Laboratory

## Research Safety Resources

**All** research personnel **must** be familiar with the information contained in, and the location of, the following manuals:

- **The Chemical Hygiene Plan**
  - A clearly-labeled binder that must be maintained in every research (“wet”) laboratory.
- **The VAPORHCS Biosafety Manual**
  - This manual must also be maintained in every “wet” lab. It can be located in same 3-ring binder as the Chemical Hygiene Plan.
- **The Research Emergency Plan**
  - A yellow, 3-ring binder located in a common or break room in your research area.



# Safety in the Laboratory

## **Safety Information in The Laboratory**

The following information should be posted in or near each lab:

- The Emergency Response flip chart (available by calling x56317).
- A list of phone numbers for reporting fire (\*20), hazardous spill (\*20), and medical (\*22) emergencies.
- The NRC Form 3 (version 8-17), “Notice to Employees” regarding use of radioactive materials.
- The BSL-2 SOP for spill response and general disinfection practices for these biohazardous agents.
- A sign posted on the lab door noting any BSL-1 or BSL-2 biohazards used in the room (form available from Biosafety Officer or last page of VAPORHCS Biosafety Manual)

NOTE: the last three are only needed if those materials are used or stored in that room.



# Safety in the Laboratory

## General Do's and Don'ts

### Do Not:

- Eat, drink, or apply makeup in areas where hazardous materials are used or stored.
- Use a chemical, biological, or radiological agent if you don't know its potential hazards.
- Discard hazardous materials in the general waste stream.

### Do:

- Wear appropriate Personal Protective Equipment (PPE) - goggles, gloves, lab coat, etc.
- Refer to Safety Data Sheets (SDS) for info on hazardous chemicals.
- Ask your supervisor or the Safety office when unsure of how to handle or dispose of hazardous materials.



# Safety in the Laboratory

## **Fire Safety in the Laboratory**

Fire is the most potentially devastating emergency in the research laboratory. It is imperative that you know how to prevent fires and how to respond should a fire occur:

- Know the R-A-C-E procedure (Rescue, Alarm, Contain, Extinguish/Evacuate). Also know the location of the nearest fire extinguisher.
- Keep the lab aisles and evacuation routes free of equipment and other objects that could obstruct safe passage. Remember: safe passage is for your benefit and for the benefit of emergency responders.
  - All interior lab corridors must maintain 30” of clearance.
  - All hallway corridors must maintain 36” of clearance.
- Observe the 18-inch clearance rule for all overhead storage.



# Safety in the Laboratory

## **Fire Safety in the Laboratory (cont.)**

Use of flammable reagents is the primary cause of lab fires.

Always follow these prudent practices:

- Working solutions of flammable reagents should be limited to small quantities (e.g., the volume to be used daily).
- Larger stock solutions of flammable chemicals must be stored in a flammables cabinet. If flammable chemicals require cold storage, store only in refrigerators approved for such use or in a flammables cabinet in the cold room.
- Always separate flammable reagents from sources of ignition. For example, never use a Bunsen burner in any area where flammable reagents are handled.
- Use hot plates rather than Bunsen burners when heating solutions.





# Safety in the Laboratory

## **Physical Safety**

A biomedical research laboratory presents a variety of physical hazards that can be minimized by using good laboratory practice and common sense, by staying alert, and by always thinking about where potential hazards may exist.



# Safety in the Laboratory

## **Physical Safety (cont.)**

- Keep floors dry and uncluttered to prevent slips and falls.
- Whenever possible, open flames should be replaced by hot plates, safety Bunsen burners (e.g., a Fireboy), or pre-sterilized disposable instruments.
- Never use personal space heaters for labs or offices.
- Never use electrical extension cords, unless pre-approved by FMS.
- Compressed gas cylinders must always be secured with both upper and lower restraining straps.
- When not in use, outlet nozzles on compressed gas cylinders should be covered with metal caps.



# Safety in the Laboratory

## Physical Safety (cont.)

- **High voltage equipment**

When using high voltage equipment such as electrophoresis units, be sure that the power is off before you start making connections. Handle power leads one at a time, and beware of loose connections that could allow sparks or electrical arcing. Keep the equipment away from a sink or wet area. And, if you feel a tingle when you touch the unit, immediately stop using it until it is repaired.

- **Microwave ovens**

Microwave ovens can be dangerous pieces of equipment when not used properly. Capped containers can explode. Superheating of liquids can occur. Inappropriate plastic containers can melt.



# Safety in the Laboratory

## Physical Safety (cont.)

- **Autoclaves**

Steam, heat, and pressure are the principal physical hazards associated with using autoclaves. Improper use of autoclaves can result in significant personal injury from exposure to steam, scalding liquids, and shattering glassware. Review the autoclave manufacturer's operating manual for specific use instructions and always have an experienced colleague instruct you in proper use of an autoclave.

- **Centrifuges**

Most centrifuge-related failures are due to user error. Careless centrifugation can mean lost samples or damaged equipment, and also presents a risk to the user and the lab. Again, review the centrifuge manufacturer's operating manual for specific use instructions.



# Safety in the Laboratory

## **Personal Protection Equipment (PPE)**

PPE represent an important line of defense for lab safety. Protect yourself by wearing a **lab coat, gloves, eye protection, and masks or respirators** as needed for each experimental procedure. Don't simply rely on chemical fume hoods or biological safety cabinets for optimal protection.



# Safety in the Laboratory

## Personal Protection Equipment (PPE) (cont.)

### ○ **Gloves:**

- Choose the right gloves. You should know the characteristics of the different glove types and understand the hazards of the chemicals or materials being used.
- No glove material is impermeable to all chemicals. The most effective practice in using protective gloves is to change them frequently and whenever they are contaminated.
- Always wash your hands thoroughly with soap and water when changing into fresh gloves and after working with any hazardous substances.
- Regularly check the expiration date on boxes of gloves. Old gloves become brittle, develop tiny holes, and provide decreased protection.



# Safety in the Laboratory

## **Personal Protection Equipment (PPE) (cont.)**

### **Always protect your eyes**

Safety glasses, splash goggles, and full-face shields offer varying degrees of protection against splattering chemicals and airborne objects.



# Safety in the Laboratory

## Personal Protection Equipment (PPE) (cont.)

- **Safety Glasses:** Choose safety glasses with side eye shields when there is a splash hazard with a small quantity of a hazardous material (e.g., when opening a liquid chemical bottle or popping open a microcentrifuge tube containing biohazardous material).
- **Goggles:** Wear goggles when handling chemicals that are highly caustic or in large volumes (e.g., greater than one liter).
- **Face Shields:** Wear a face shield when you are handling large volumes of a hazardous chemical, or when you need to protect your face and your eyes. For example, wear a face shield when you are removing a closed container from liquid nitrogen or working at an ultraviolet light transilluminator.





# Safety in the Laboratory

## Personal Protection Equipment (PPE) (cont.)

### Masks and Respirators

- **Surgical masks** are primarily a barrier against droplets, splashes, and larger particulate matter. They are the simplest form of protecting the nose and mouth, and are commonly used for animal procedures, weighing toxic powders, and when using any hazardous material that may splash.
- **N95 and N100 respirators** protect against finer particulate matter, including airborne infectious agents, but do not protect against chemical vapors. These can only be used after medical clearance and a fit test by Safety personnel.
- **Cartridge or air-purifying respirators** are used when a fume hood is unavailable or inadequate to control chemical vapors. Contact the Industrial Hygienist for selection and fit.



# Safety in the Laboratory

## Safety Equipment

### Eye Wash Stations

Eye injuries represent one of the most serious injuries that can occur in the laboratory. All research personnel should be familiar with the location and proper operation of the eye wash station.

- The eyewash station must be checked (i.e., inspected, flushed and recorded) **every week** by laboratory personnel.
- Do not block the eyewash stations with dirty glassware, reagent containers, etc.
- **Remember: you should be able to reach and operate the eyewash station in your area within 10 seconds from anywhere in the lab with your eyes closed!**



# Safety in the Laboratory

## **Safety Equipment (cont.)**

### **Emergency Showers**

- Emergency showers are used for larger spills affecting the whole body. These showers are located in the corridors and in a few labs within the research areas.
- Familiarize yourself with the location and proper operation of these units, and never block them with carts, chairs, or other objects.
- Maintenance and inspection of the emergency showers is performed by FMS.



# Safety in the Laboratory

## Safety Equipment (cont.)

### Chemical Fume Hoods

- The chemical fume hood protects you from exposure to chemical fumes, gases, and aerosols that are generated within the enclosure. Protection is provided by room air that is drawn into the hood and vented to the atmosphere.
- Chemical fume hoods **do not provide protection against infectious agents**. These should be used in a biosafety cabinet.
- The hood should always be on. Notify the Research Office staff, FMS, or the Safety Office immediately if the hood is not functioning properly.
- All chemical hoods are inspected and certified annually by FMS.



# Safety in the Laboratory

## Safety Equipment (cont.)

### Chemical Fume Hoods (cont.)

- Safe operation of the chemical hood depends on the proper sash height, the airfoil sill (front lip) clearance, and the internal exhaust vents and fan. Always maintain a clear perimeter within the fume hood cabinet: 6 inches from the airfoil sill and 2 inches from the sides and back (exhaust sill).
- The interiors of the chemical hoods should not be used for storage of materials, reagents, or equipment. Equipment items placed within the chemical hood may need to be elevated (on "legs" or "stilts") to allow proper air flow.
- Placing the sash at the lowest level for convenient operation will provide the best protection.



# Safety in the Laboratory

## Safety Equipment (cont.)

### Chemical Fume Hoods (cont.)

- Room air drafts, rapid hand movements into and out of the hood, and obstructions at the airfoil or within the cabinet can compromise hood performance. Even a small disturbance near the hood, like someone closing a door or walking by, can create drafts that cause vapor to escape from the hood.
- When planning an experiment with hazardous chemicals, you should ask your colleagues to reduce activities such as walking past the hood or opening and closing the lab doors while you are working.



# Safety in the Laboratory

## Safety Equipment (cont.)

### The Biosafety Cabinet

- The biosafety cabinets (“tissue culture hoods”) in use in VAPORHCS research labs provide two-way safeguards from biohazardous agents by:
  1. protecting the worker from the cell or tissue samples, which may contain an infectious agent, and
  2. protecting the cell or tissue cultures from agents outside the cabinet that could contaminate the culture and ruin an experiment.
- Biosafety cabinets **do not provide protection against chemical fumes**. Chemicals that produce a toxic vapor must be used in a chemical fume hood.



# Safety in the Laboratory

## Safety Equipment (cont.)

### The Biosafety Cabinet (cont.)

- Biosafety cabinets work through a combination of directed airflow and filtration of small particles, including infectious agents, by high efficiency particulate air (HEPA) filters. HEPA filters also treat the cabinet's exhaust air.
- As with fume hoods, proper sash height and airflow are critical elements for safe operation of biosafety cabinets. Do not store excess items in the cabinet or block vents at front or rear. Minimize movements in and out of the cabinet to prevent excess disruption of the airflow.
- All biosafety cabinets are inspected and certified annually by FMS. This includes any necessary HEPA filter changes.





# Safety in the Laboratory

## **Hazardous Materials**

**Hazardous Materials** are biological, chemical, or radioactive substances that are potentially dangerous to your health and safety. Be sure you are properly trained before using a hazardous agent for the first time! Ask for help from the lab director or a more experienced colleague and read any warning statements from manufacturers that might accompany the material.

Individuals working with radioactive materials are required to take a separate radiation safety training module, found on the R&D website.



# Safety in the Laboratory

## **Biohazardous Materials Safety**

- A biohazardous material is any biologically-derived substance, including cells, tissues, fluids, toxins, or microorganisms, that can potentially cause infection or (in the case of toxins) infection-like symptoms in humans or other animals.
- Lab handling conditions for these agents are designated by a “Biosafety Level” (BSL) between 1 and 4. The BSL determines the equipment, PPE, and experimental practices needed to protect workers from infectious agents and to prevent the spread of an agent outside of a designated lab space.
- The physical design of the wet laboratories at VAPORHCS complies with BSL-2 containment. A secured BSL-3 facility is available for work with higher-risk pathogens and agents. BSL-4 work is not permitted at VAPORHCS.



# Safety in the Laboratory

## **Biohazardous Materials Safety (cont.)**

- Detailed information regarding the required practices for work with biological agents and toxins, including PPE, disinfection protocols, and shipping of infectious materials, is outlined in the VAPORHCS Biosafety Manual. A copy of this manual has been provided to each laboratory, and lab staff must be familiar with its contents.
- All investigators must verify, with assistance from the VA Research Biosafety Officer and the Subcommittee on Research Safety, that their research with biological pathogens, agents and toxins complies with the procedures in this manual.



# Safety in the Laboratory

## **Biohazardous Materials Safety (cont.)**

- BSL-1 handling is used for work with biologically-derived material that poses limited infection risk to humans. An example would be handling of tissues from lab rodents not known to be infected with a pathogen. No special barrier or equipment is generally needed, and PPE usually consists of gloves, lab coat or gown, plus eye protection and a surgical mask if a splash hazard exists.



# Safety in the Laboratory

## **Biohazardous Materials Safety (cont.)**

- BSL-2 handling is used with moderate-risk agents derived from human or non-human primate (NHP) sources, including most biospecimens from human research subjects and human- or NHP-derived cell lines (note that some specimens require higher containment, depending on presence of known pathogens). BSL-2 handling is also used with many microorganisms and viral-based gene expression vectors.
- Work must be conducted in a biosafety cabinet whenever possible, particularly for any activity that may generate an aerosol such as vortexing, pipetting, or shaking.
- Samples to be centrifuged must be in tightly-closed containers.
- PPE required for BSL-2 handling consists of gloves, lab coat or gown, plus eye protection and a surgical mask if a splash hazard exists.



# Safety in the Laboratory

## **Biohazardous Materials Safety (cont.)**

- When handling biomaterials at BSL-2, the primary risks are sharps injuries, mucous membrane exposures (e.g., a splash in the eye) and accidental ingestion of infectious materials.
- No cell line or tissue sample, even from a commercial vendor, is guaranteed to be non-hazardous. While some vendors do conduct pathogen testing, generally this is done with a limited panel of common pathogens.
- When working with mammalian blood, tissues or cell lines, particularly of human or NHP origin, always assume that infectious agents may be present!



# Safety in the Laboratory

## **Disposal of Biohazardous Waste**

- All biologically-derived waste should be discarded in red bags and bins as potentially biohazardous. Biohazard bins, including red sharps containers, should always remain closed as much as possible when not in active use.
- Red bags and sharps containers must be discarded when  $\frac{3}{4}$  full by transporting to the designated disposal areas on each floor.
- Benchtops, centrifuges, and biosafety cabinets must be disinfected after use with an appropriate agent. See the VAPORHCS Biosafety Manual for a disinfectant chart.
- Uncontaminated waste, such as clean packaging from tissue culture plastics or paper towels used to dry hands after washing, should be discarded in regular trash, not biohazard bins.



# Safety in the Laboratory

## **Select Agents and Toxins: A Security Concern**

Select agents and toxins are a subset of biological agents and toxins that the Department of Health and Human Services (HHS) and USDA have determined to have the potential to pose a severe threat to public health and safety, to animal or plant health, or to animal or plant products. Possession and use of select agents and toxins is regulated by 42 CFR 73, 9 CFR 121, and 7 CFR 331.3.

The current list of these agents can be found here:

<http://www.selectagents.gov/SelectAgentsandToxinsList.html>





# Safety in the Laboratory

## **Select Agents and Toxins: A Security Concern (cont.)**

- All investigators should review this list, as individuals possessing or using any of the agents on the list **may require registration** with the CDC and the Veterans Health Administration Office of Research and Development (ORD), depending on the quantity of material to be stored in the lab.
- Any investigator who wishes to conduct work with a Select Agent or Toxin should first contact the SRS for help with necessary approvals.
- Possession or use of these agents without previous approval from the required agencies may be subject to penalties such as fines and/or imprisonment.



# Safety in the Laboratory

## Chemical Safety

Chemical manufacturers are required to label containers with one or more of the following symbols, if the chemical is hazardous:



Explosive



Flammable



Corrosive



Acutely Toxic



Health hazard

(Longer term, e.g.  
carcinogen, mutagen)



Irritant



Gas Under  
Pressure



Toxic to  
Environment



# Safety in the Laboratory

## Safety Data Sheets (SDS)

- SDS are documents providing information related to hazardous chemicals or chemical compounds.
- Manufacturers and importers must provide an SDS for each hazardous chemical they produce or import.
- Employers must have an SDS in the workplace for each hazardous chemical or compound they use (29 CFR 1910.1200(g)).
- These sheets are maintained by each lab online using the CEOSH [SDS/Chemical Inventory Service](#). Call Ext. 55241 for access and instructions on how to use the database.



# Safety in the Laboratory

## Information Found on the SDS

- Name and address of manufacturer, as well as an emergency contact number
- Name of chemical, listed as percentage of total content
- CAS Number (a number unique to that chemical)
- The chemical's physical characteristics, including stability/reactivity
- PPE to use when handling the chemical
- Occupational Safety & Health Administration (OSHA) permissible exposure limits, if any



# Safety in the Laboratory

## Information Found on the SDS (cont.)

- Hazards identification such as:
  - One of two “signal” words:
    - “Danger” is used for more severe hazards
    - “Warning” is used for less severe hazards
  - Hazard classifications (e.g., flammable, corrosive)
  - Any hazard statements, such as “Heating may cause an explosion” or “Causes serious eye irritation.”



# Safety in the Laboratory

## **Health Hazard Information on the SDS**

- Common routes of entry
- Nature of health hazards
  - Acute
  - Chronic
- Medical conditions aggravated by exposure
- Carcinogenicity
- Signs/symptoms of overexposure
- Other precautions
- Emergency/first aid



# Safety in the Laboratory

## **Information Found on the SDS (cont.)**

- Storage requirements
- Ventilation requirements
- Spill response procedures
- Type of extinguishing agent to use in case of fire
- Waste disposal procedures
- Shipping and transportation requirements



# Safety in the Laboratory

## Hazardous Chemical Inventory

- As the repository for all Safety Data Sheets for each lab, the CEOSH [SDS/Chemical Inventory Service](#) also serves as the inventory of all hazardous chemicals at VAPORHCS.
  - Each laboratory is responsible for continuously updating their hazardous chemical inventory in this system.
  - Every 6 months, when requested by the Safety office, laboratories must make final updates and then report that their inventory is complete.





# Safety in the Laboratory

## **If there is a Hazardous Materials spill ...**

- All spills must be reported by calling \*20.
- Make a quick initial assessment of the spill. Determine whether a significant hazard exists by looking for any of the following signs:
  - Injured or ailing personnel
  - Symptoms or signs of severe irritation reported by personnel in the area(s)
  - Evidence of a large-volume spill
  - Known carcinogens involved in the spill
  - Presence of very strong odors beyond the immediate area



# Safety in the Laboratory

## **If There is a Hazardous Materials Spill ... (cont.)**

If none of these signs of a significant spill exist, proceed with clean up:

- Wearing all PPE appropriate to handling of the spilled material, wipe up material and place it in either a container with a tightly-fitting lid or in a closed Ziploc bag.
- Label the outside of the container or bag clearly.
- Contact Ext. 51722 for a hazardous waste pickup.



# Safety in the Laboratory

**If there is a significant Hazardous Materials spill...**

**R.I.N.S.E.!!**

- Rescue
- Incident Command
- Notify
- Suppress/Confine
- Evacuate



# Safety in the Laboratory

**R.I.N.S.E**

**R = Rescue**

- Rescue personnel
- DO NOT attempt a rescue that puts you or others at further risk.



# Safety in the Laboratory

## **R.I.N.S.E**

### **I = Incident Command**

- Offer spill victims first aid, emergency showering and/or eye washing, and perform the critical functions that follow.



# Safety in the Laboratory

**R.I.N.S.E**

**N = Notify**

Call \*20 and provide the following details:

- What chemical spilled?
- How much?
- Where?
- Any injuries?



# Safety in the Laboratory

## **R.I.N.S.E**

### **S = Suppress/Confine**

- Confine the spill as much as possible. Know the location of spill kits in hallways.

### **E = Evacuate**

- Alert all personnel to leave the spill area.



# Safety in the Laboratory

## **Disposal of Chemical Waste**

- VA research personnel must comply with strict federal and state Department of Environmental Quality (DEQ) guidelines that regulate waste streams generated at this medical center.
- When in doubt, always consult the GEMS Manager at x51722 for proper procedures for disposal of hazardous chemical waste.





# Safety in the Laboratory

## Disposal of Chemical Waste (cont.)

- **All** solid and liquid chemical waste (even non-hazardous waste) stored in laboratories must be **appropriately labeled** with contents and hazards and stored in **closed** containers.
- Call the Safety office at x51722 or x51726 for orange labels to use for waste containers.
- Lack of proper labeling and storage of chemical waste has resulted in monetary fines against this medical center by state DEQ inspectors in the past.
- **The safest policy for non-hazardous waste:** immediately discard the waste after it is generated, or label it as non-hazardous.



# Safety in the Laboratory

## Disposal of Chemical Waste (cont.)

- Segregate waste bottles according to hazards using the same rules as for the original stock bottles (e.g., corrosives and flammables separated).
- Store liquid waste in a **secondary container**. The secondary container should be an impermeable material (e.g., a plastic tub) and large enough to hold the contents of the largest bottle placed inside, without overflow or leaking.
- All bottles kept in the same secondary container should be chemically compatible (e.g., acids and bases not stored together).
- Waste pickup is every Wednesday. To schedule a pickup, call x51722 or x51726.



# Safety in the Laboratory

## **Laboratory Show & Tell**

The pictures and text on the following pages provide further examples of what to do - and what not to do - in the scientific research laboratory.





Tanks must be properly secured with both top and bottom straps. When tanks are not in use, regulators must be topped with metal caps.





Gas flow regulators should not be attached when tanks are not in use.





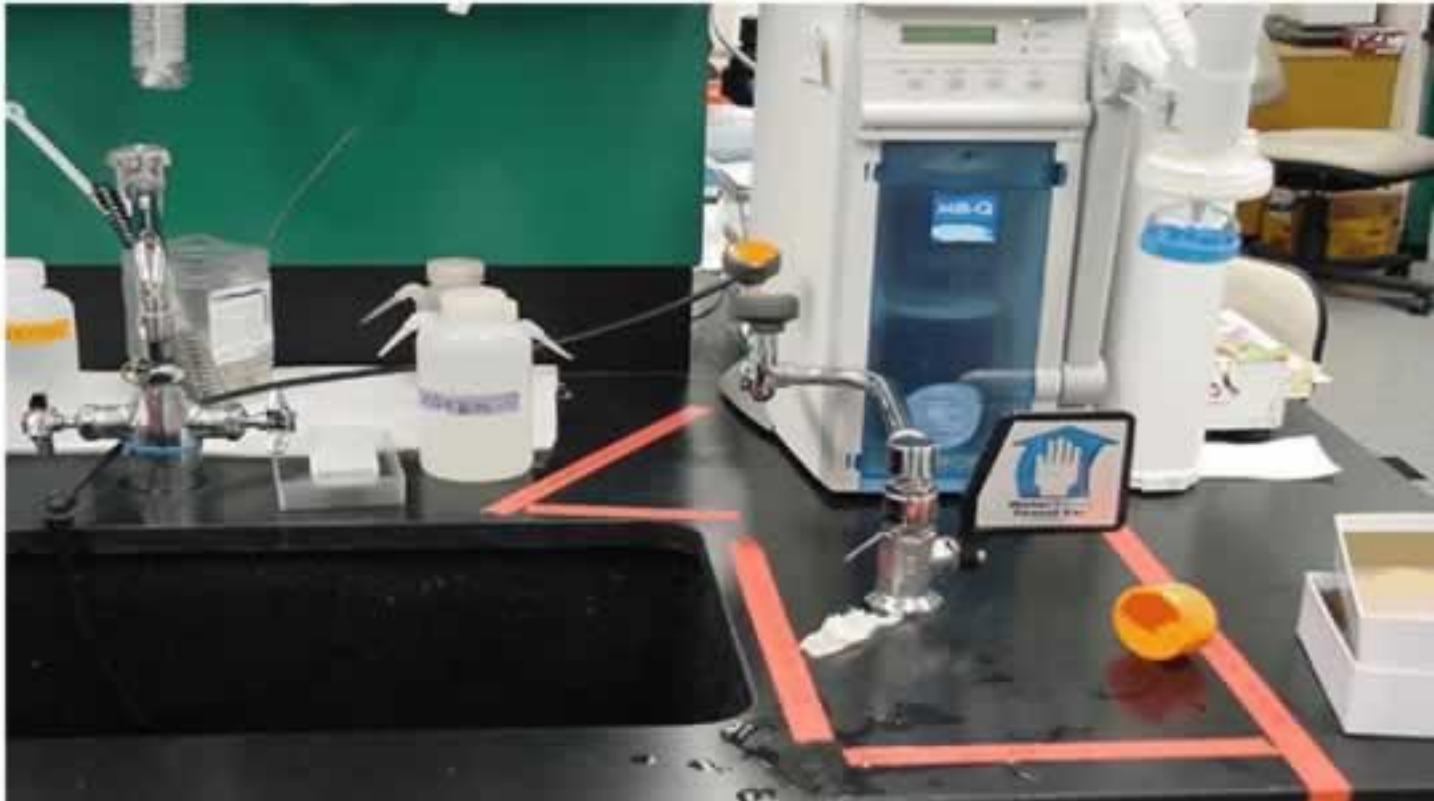
Eye wash stations must be checked (flushed) **every week**.  
The inspection date must be recorded and signed.





Access to eye wash stations must not be blocked.





Tape off areas of the lab bench that must remain clear - and keep them clear.

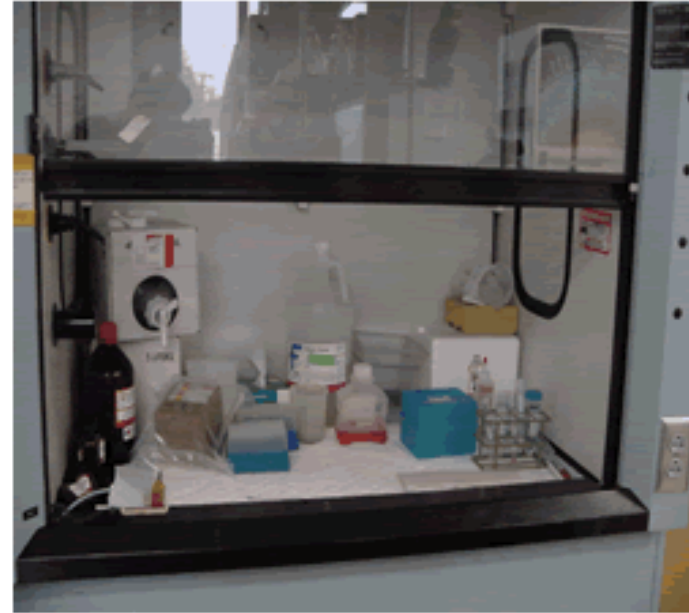
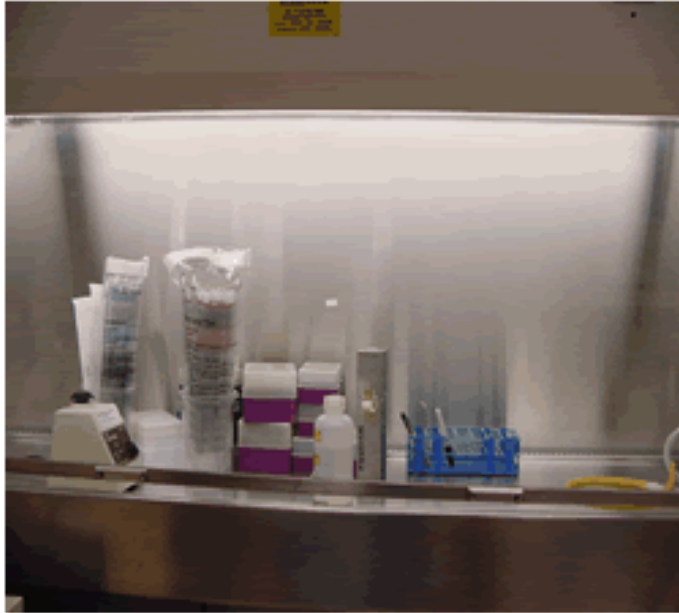






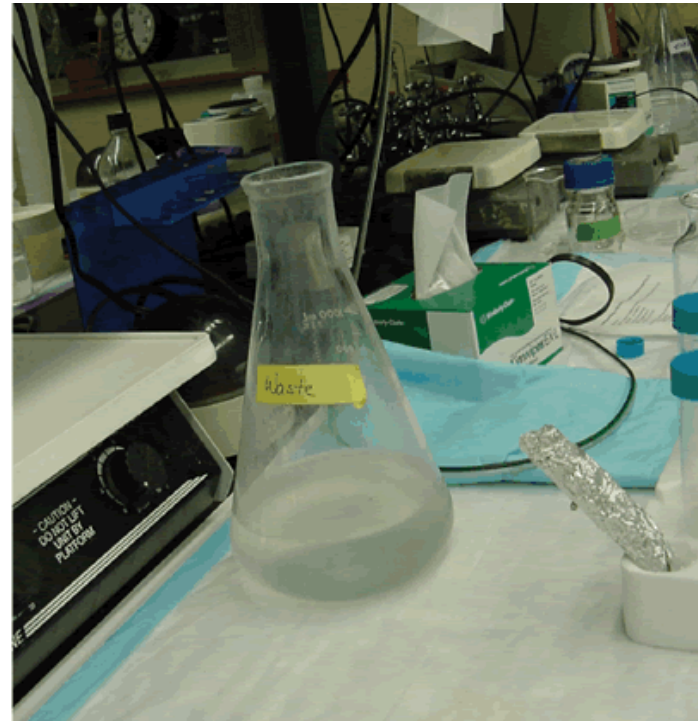
Keep laboratory corridors open and uncluttered.





Clutter in biological safety cabinets and chemical fume hoods will compromise their proper functioning.





Label waste containers with chemical name and hazard type (e.g., irritant, flammable). Seal waste containers with a tightly-fitted lid, not aluminum foil or plastic wrap.





Nice hazardous waste labeling!



Funnels may be left in waste containers **ONLY** if tightly inserted into small hole in waste container lid and sealed at top of funnel when not in use.





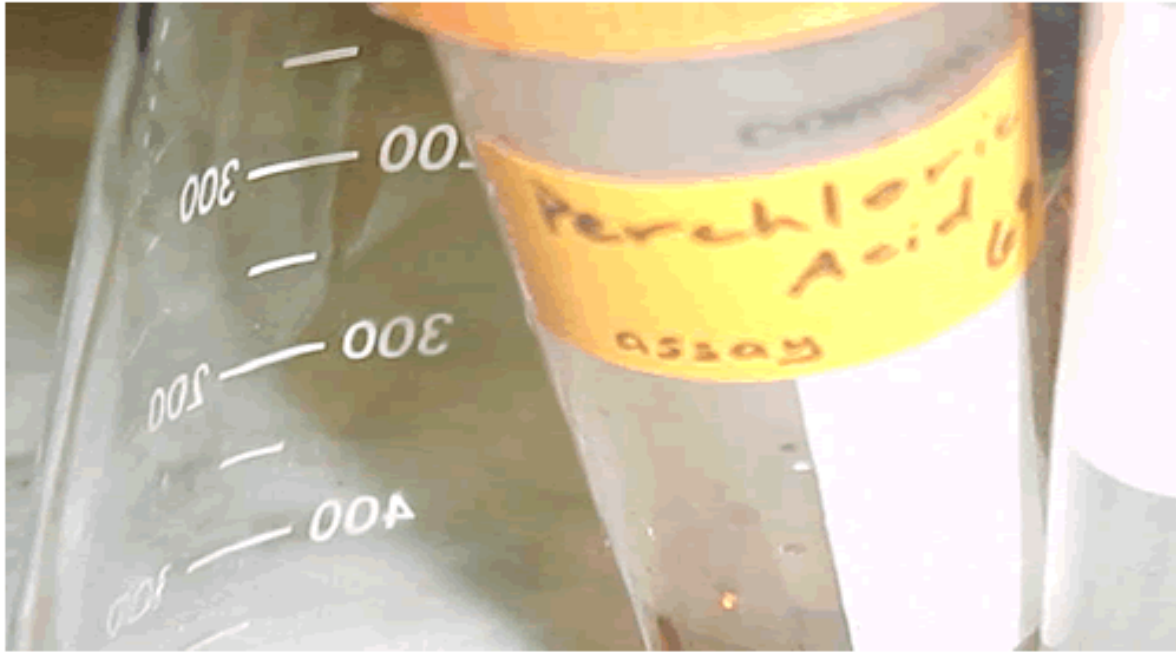
Working solutions must be labeled with the hazard (e.g., "flammable", "irritant", or "non-hazardous"), not just the chemical name.





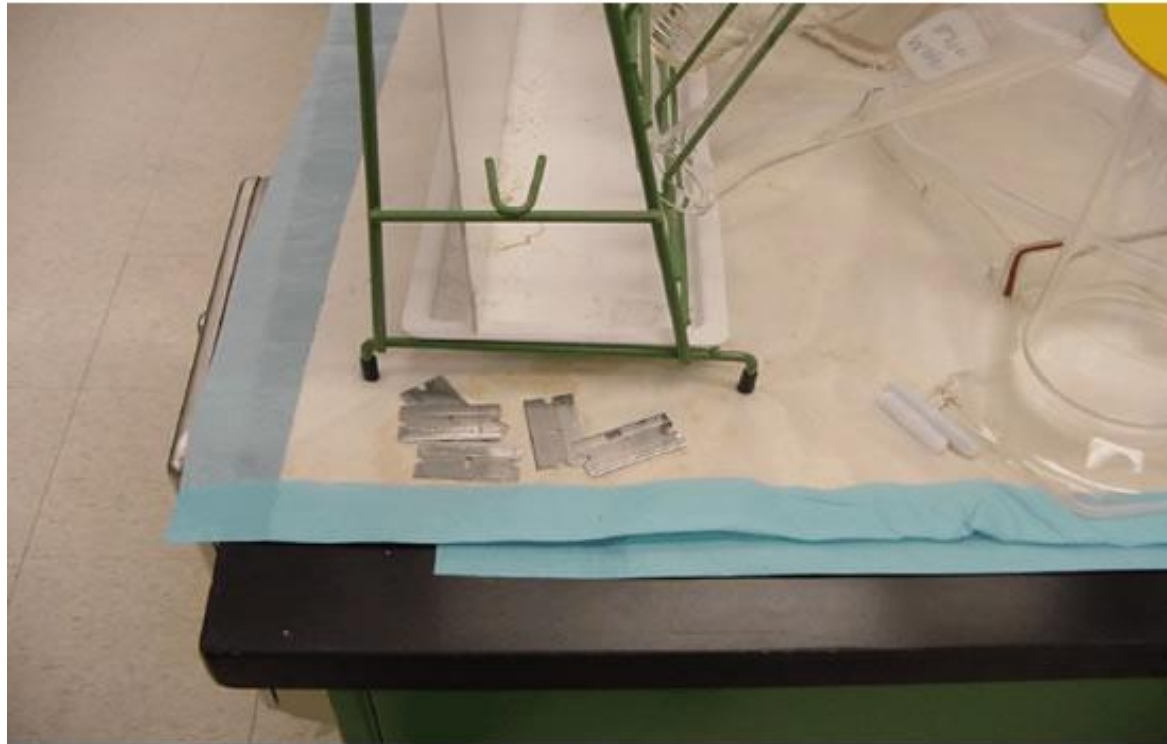
Be aware of containers that are rusted, moldy, or past their shelf life. These should be discarded if at all possible.





The use of perchloric acid is not allowed at VAPORHCS.





All sharps (needles, broken glass, razor blades, etc.) must be discarded in designated and secured "sharps" containers.







Hazardous waste containers must not be overfilled.





Take all spills seriously and handle them properly!



You have now completed the  
Lab Safety training.

[Click here to take the Post-Test](#)

