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1/11/19	1.0	Added EHS instead of EH&S, added SDS, removed all specific labs and added teaching and research lab	Cathy St Louis
2/26/19	1.1	Removed term Safety Officer and replaced with EHS	B. Welmaker

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Section 1: Introduction

Nova Southeastern University (NSU) is committed to insuring all safety practices are utilized in laboratories and that all facilities are safe for the NSU Community. Maintaining compliance with federal, state, local laws, and regulations pertaining to laboratory safety and hazardous materials management is essential to this commitment. The Environmental Health and Safety Office (EHS) has overall responsibility for providing information and training concerning health and safety to faculty, staff and students. Implementing safety and assuring all individuals concerned are informed and have a safe laboratory to conduct activities are the responsibility of individual colleges, departments, and/or centers. Colleges, departments, centers, or other units may develop internal policies and procedures for laboratory safety, but they must be at least as stringent as University guidelines and are subject to review by EHS.

EHS is responsible for developing, maintaining and monitoring University safety policies and guidelines related to conducting research, teaching, and clinical activities. In addition, EHS is responsible for designing and overseeing the training programs for University personnel regarding regulatory requirements for safely conducting activities in NSU laboratories. Colleges, departments, or other units are responsible for maintaining accurate records related to departmental student training and incident/accident investigation consistent with University safety plans and policies. Records of training performed by EHS will be retained by EHS for at least 30 years.

This laboratory manual is an internal document of Nova Southeastern University's Oceanographic Center and is an abridged version of the NSU Laboratory Safety Plan. This document provides laboratory specific information that is supplemental to the full NSU Laboratory Safety Plan, the NSU Chemical Safety Plan, and the NSU Biological Safety Plan.

Section 2: Management and Responsibilities

The Laboratory Safety Plan may differ from laboratory to laboratory depending on the size and the areas/departments of analytical testing and research, but ultimately the goals for implementation of the safety plan will be the same and should cover the following:

- Reduce the risk of chemical and biological exposure.
- Reduce the risk of work-related injury and illness.
- Minimize the risk to the environment.
- The compliance with applicable federal, state, county, and city regulations and standards.

The Laboratory Safety Plan can be divided into four parts that represents the acronym – SAFE.

S - Selection of equipment and supplies to maximize safety
A - Annual mandatory employee education
F - Formal documented inspections
E - Evaluation of safety documentation on a monthly basis.

The Laboratory Safety Plan should include the following policy objectives:

- Prevention – will emphasize strategies to prevent any occurrence that would have an adverse effect on all personnel, contractors and visitors.
- Surveillance – will provide systematic inspection of facilities; collection, analysis, interpretation, and evaluation of safety and health data essential to the planning and implementation of the safety program with a timely dissemination of this data.
- Protection and Control – will be maintained and include engineering controls; the use of less hazardous alternatives; the use of PPE's and administrative procedures.
- Emergency Preparedness and Response – will seek to identify circumstances requiring advanced preparation and immediate action; develop and maintain contingency plans and procedures to address these circumstances; provide and communicate plans of action for response to fire, medical, first aid, chemical, violence, biohazard, adverse weather, and other incidents that may require advanced preparation and timely response.
- Education, Promotion, and Training – health, safety and chemical awareness will be promoted among all employees, visitors, contractors, and community members through orientation programs, regular education and training sessions.

Laboratory management and EHS have a duty to assure that laboratory personnel work in a safe and healthy environment with a minimum burden on laboratory activities. EHS should provide and promote a safe workplace that will foster a positive health and safety attitude in all personnel including visitors and contractors. Safety knowledge is the responsibility of all personnel and a good relationship between management and employees is essential for an effective safety, health and environmental program. Specific responsibilities for the Environmental Health and Safety Office, Physical Plant, and Utilities are detailed in the EHS Laboratory Safety Plan and the NSU Biological Safety Plan. Specific responsibilities for laboratory supervisors, principal investigators, and employees, staff and students are set forth below.

2.1 Laboratory Managers and Principal Investigators

a. Design and conduct laboratory processes and operations to assure that employee exposure to risk conforms to procedures and objectives contained in this plan and those contained in any supplemental information developed in the college in response to specific clinical activities or areas of research.
b. Monitor the procurement, safe use, and proper disposal of chemicals.

c. Write Standard Operating Procedures and other information relevant to lab processes in their specific areas as needed to supplement those contained in this plan.
d. Instruct employees on the contents of this plan, and any supplements, and the location of the plan and related materials within the workplace.
e. Take all reasonable precautions to protect the safety and health of laboratory workers and the environment.
f. Schedule services via Center administration or main campus relevant administration for hazardous waste disposal and oversee the handling of hazardous waste pending proper disposal.
g. Conduct regular laboratory safety self-evaluations.
h. Complete and update annual laboratory chemical inventories in accord with the instructions and schedule provided by the Environmental Health and Safety office.
i. Inform employees of the permissible exposure limits for the hazardous chemicals listed on inventories and the signs and symptoms associated with exposures to these chemicals.
j. Provide site specific training on laboratory hazards as described in the University's Hazard Communication Program.
k. Determine the required levels of personal protective equipment, fire extinguishers, fume hoods, flammable liquid storage cabinets, biological safety cabinets, eye washes, safety showers, and spill cleanup kits. Assure that all required equipment is available and in working order and that appropriate training for each item has been provided.
l. Have readily available a current copy of a Safety Data Sheet for all hazardous chemicals in the laboratory.
m. Post emergency telephone numbers on the outside of the laboratory door and by all telephones in the area.
n. Report to the EHS office if there is reason to believe that exposure levels for a hazardous chemical exceed the action level or the permissible exposure limits and document the incident.
o. Forward documentation on laboratory accidents and exposures to the EHS office.
p. Provide for the safety of visitors.

2.2 Employees, Faculty and Students

a. Maintain a thorough understanding of and follow the laboratory policies, and procedures in this plan and those contained in any supplemental information developed in the college in response to specific clinical activities or areas of research.
b. Use and maintain personal protective equipment (i.e. lab coats, chemical splash goggles, face shields, respiratory protection, and gloves) as mandated in this plan for laboratories.
c. Use flammable liquid storage cabinets, acid storage cabinets, biological safety cabinets, fume hoods, and other laboratory safety equipment provided.
d. Inform supervisor immediately of any laboratory safety equipment that is needed but not available or that is not in good working order.
e. Inform supervisor immediately of exposure symptoms, accidents, or chemical releases and document incident.
f. Attend Hazard Communication and all other applicable training sessions.

Section 3: General Safety Guidelines

Laboratories are workplaces with the potential to expose employees, faculty, and students to many kinds of hazards and risks, possibly more so than anywhere else in the business workplace. Therefore, a risk plan is necessary to help identify, control, or reduce the hazards, protect employees, faculty and students and reduce operational costs. Good laboratory practices should be introduced and will be achieved if employees, faculty and students follow the basic guidelines.

3.1 Preparing for Laboratory Work

Before starting to work in a laboratory, familiarize yourself with the following:

- Job Safety Analysis (JSA) indicating the hazards of the materials in the laboratory, as well as appropriate safe handling, storage and emergency protocols.
- Labels and safety data sheets (SDS's) before moving, handling or opening chemicals. Never use a product from an unlabeled container, and report missing labels to your supervisor.
- The agents, processes, and equipment in the laboratory. If you are unsure of any aspect of a procedure, check with your supervisor before proceeding.
- The location and operation of safety and emergency equipment such as fire extinguishers, eyewash and shower, first aid and spill response kits, fire alarm pull stations, telephone, emergency numbers, and emergency exits.
- Emergency spill response procedure for the material you will handle.
- Emergency reporting procedures and telephone numbers.
- Designated and alternate escape routes.
- Any employee, faculty, or student who has a disability and the precautions necessary.

3.2 During Laboratory Work Hours

- Restrict laboratory access to authorized persons only.
- **Eating, drinking, smoking** and applying cosmetics and handling of contact lenses are prohibited in a laboratory. Do not store food in a refrigerator used for research or clinical purposes.
- Wear labs coats (knee length) and safety glasses in laboratories as applicable. Open shoes, such as sandals, should never be worn in the lab.
- Tie back or otherwise restrain long hair when working with chemicals, biohazards, radioisotopes, or moving machinery.
- Keep work places clean and free of unwanted chemicals, biological specimens, radioactive material and idle equipment. Avoid leaving reagent bottles empty or full, on the floor.
- Work only with materials that you know their flammability, reactivity, toxicity, safe handling, and storage and emergency procedures.
- Never pipette by mouth, use mechanical transfer devices.
- **Walk, do not run in the** lab particularly if carrying any hazardous material.
- **Know the evacuation** procedures for the work area.
- **Do not use** hallways as storage areas.
- Keep exits and passageways clear at all times.

- Ensure that access to emergency equipment (eyewashes, safety shower, and fire extinguishers) and controls are not blocked.
- Working alone is an unsafe practice at any time. However, if the nature of the work makes it unavoidable, take measures to ensure that others are aware of your location and have someone check in with you from time to time, either in person or by telephone.
- Any work conducted outside normal working hours requires necessary approval. Security must also be notified.
- Report accidents and dangerous incidents ("near-misses") promptly to your supervisor and EHS. Complete the prescribed form.
- Wash your hands thoroughly before leaving the laboratory.
- Any procedures involving the release of volatile toxic or flammable materials should be conducted in a chemical fume hood.
- Perform procedures that release infectious bio-aerosols in a biological safety cabinet
- Handle all human blood and body fluids as if potentially infectious.

3.3 Cleaning up Before Leaving the Laboratory

Perform a safety check at the end of each procedure and before leaving the labs. Make sure to:

- Turn off gas, water, electricity, vacuum, and compression lines and any heating apparatus.
- Return unused materials, equipment and apparatus to their proper storage locations.
- Label, package and dispose of all waste material properly and promptly.
- Remove defective or damaged equipment immediately and arrange to have it repaired or replaced.
- Decontaminate any equipment or work areas that may have been in contact with hazardous materials.
- Leave behind protective clothing (lab coats, gloves, etc.) when leaving the laboratory.
- Close and lock the door to the laboratory if you are the last one to leave.

3.4 Evaluating Laboratory Hazards

There are many categories of hazards that might be encountered in a laboratory setting, and the situation can change frequently. Even after current risks have been identified and controlled, it is critical to understand that new and unexpected dangers can arise. Regular inspections shall be conducted on the following items as applicable for a particular laboratory:

- Fire extinguishers (EHS)
- Emergency eyewashes and showers. Run these for several minutes weekly
- First aid kit. Contents must relevant to the risk of the laboratory.
- Spill kit.
- Fume hood and other ventilation devices. Annual certification required.
- Any tubing / piping for circulating water, vacuum, gases
- Chemical storage compartments. Ensure compatibility.
- Ensure that fire extinguishers and emergency showers are inspected, tested recorded.

Remain alert for the following potential laboratory hazards:

- Chemicals
  - Flammable
  - Toxic
  - Oxidizing
  - Reactive
  - Corrosive
- Microbiological disease-producing agents and their toxins
  - Viruses
  - Bacteria
  - Parasites
  - Rickettsiae
  - Fungi
- Physical or mechanical hazards
  - Ionizing and non-ionizing radiation
  - Electrical and other energy sources
  - Poor equipment design or work organization (ergonomic hazards)
  - Tripping hazards
  - Excessive noise or heat
- Psychosocial conditions that can cause psychological stress.

3.5 Labels, Safety Data Sheets, and Training

Labels or hazardous material information are essential as they alert people to the dangers of the product and the basic safety precautions. All individuals are to ensure that all labels are intact on the containers and comply with labeling protocols. Replace and re-label as necessary.

Safety Data Sheet's (SDS) provide more safety and hazardous details of the product than the labels. Technical bulletins provide chemical, physical, and toxicological information about each controlled product, as well as information on precautionary and emergency producers. This information must be readily accessible to anyone who work with, or who may otherwise be exposed to, controlled products. A hard copy of all SDSs for chemicals used in the laboratory should be in an easily accessible area. (See Chemical Hygiene Plan)

Hazard-specific or job-specific training refers to instruction in the procedures for the safe handling and storage of the controlled products that are unique to each laboratory. Hazard-specific training also covers spill or leak remediation, waste disposal, and basic first aid instructions which are critical to the proper functioning of any lab. Topics to be covered in safety training are:

a. *Emergency information*
b. *Fire safety devices*
c. *Emergency devices*
d. *Personal protective equipment (PPE)*
e. *Chemical fume hoods, biological safety cabinets, and laminar flow hoods (clean benches)*.
f. *Safety Data Sheets (SDSs)*
g. *Chemical labels, hazard warning signs, and Designated Areas*

h. *Chemical categories and properties*
i. *Biomedical, radioactive, and chemical waste disposal*
j. *Hazard Communication Policy*
k. *Infection Control Programs*

Federal Law (OSHA's Hazard Communication Standard) mandates that the above listed training information be reviewed whenever the employee is reassigned to a new task or if a new hazard is introduced in the workplace.

3.6 Postings and Signage

The main entrance to each laboratory in which chemical, biological or radiological materials are used or stored must be posted with the following:

- Names and phone numbers of the lab supervisor and other responsible parties to be contacted in the event of a fire, accident or spill.
- Special hazards that may be encountered in the laboratory (e.g. laser in use, cylinders, biohazardous material, radioactive material, etc.)
- Safety instructions for persons entering the laboratory such as: required protective equipment, access restrictions, etc.
- Prohibitions (e.g., No Food or Drink Allowed).
- National Fire Protection Association (NFPA) 704 diamond

Laboratory signage is supplied by EHS upon request once chemical inventory is submitted.

The interior of the laboratory must be posted with the following:

- Emergency Action Plans near the exit. Refer to the next section for development assistance.
- Hazardous Waste Accumulation Area sign marking location where unwanted laboratory materials will be accumulated for collection by EHS.
- Signs identifying location of safety equipment (e.g., fire extinguisher, safety shower, eyewash fountain, etc.).
- Signs, labels and/or warning/caution tape identifying designated use and storage areas for materials or equipment requiring special procedures.

All required signage and postings are available from EHS upon request.

Section 4: Emergencies and Spill Guidelines

During normal operations in the laboratory, accidents will occur despite our best efforts to prevent them. Spills can be from different sources but require immediate attention by an employee knowledgeable about the spill clean-up procedure, which kit to use and the emergency response if necessary. All spills are to be reported and investigated. If a situation arises that employees have to evacuate due to a hazardous spill, employees must know how to act and react during an emergency by following the emergency procedure using the acronym NEAR; **N**otify, **E**vacuate, **A**ssemble, **R**eport. A spill clean-up guide must be posted for quick reference. See Appendix A for an example of a quick reference on spill clean-up.

4.1 Spill Kit Materials

Laboratories should be prepared for chemical spills by having a spill kit or other materials available for spill clean-up and supervisory personnel trained to respond. The spill kit must be in an obvious location and all persons responsible for the activities conducted in the laboratory must be knowledgeable in the use of the spill kit. Spill kits can be specialized for individual laboratories or can contain general supplies necessary to handle a variety of spills. Spill kits are commercially available, or you may request a listing from the EHS office on what items must be included in a spill kit. Departments and laboratories are responsible for purchasing and refurbishing spill kit items.

4.2 General Chemical Spill Guidelines

Determine the extent and type of spill. Contact EHS if any of the following applies:

- Large spill category
- Release to the environment
- Acutely hazardous chemical spill
- No one trained in the proper procedures for cleaning chemical spills

Chemical Spill Categories

Category	Quantity	Response	Treatment Materials
Small	Spilled material: <300 milliliters	Chemical Treatment	Neutralization or Absorption Spill Kit
Medium	Spilled material: > 300 ml and < 5 Liters	Absorption	Absorption Spill Kit
Large	Spilled material: >5 Liters	Call EHS office	

Types of Chemical Spills

Type of Spill	Neutralizing Agent / Clean up supplies
Acid	Sodium bicarbonate
Bases	Citric Acid
Organic Solvents	Absorbent pads, charcoal if available
Mercury	Amalgam sponges
Metals e.g., sodium	Sand, Class D fire extinguishers

Clean-up Procedure:

1. Immediately alert area occupants and supervisor, and evacuate the area, if necessary.
2. Contact 911 in the event of a large spill, fire, or when medical attention is required. Refer to the posted signs for location information.
3. Attend to any people who may be contaminated. Contaminated clothing must be removed immediately, and the skin flushed with water for at least fifteen minutes. Clothing must be laundered separate from other clothing before reuse.
4. Immediately warn everyone when a volatile flammable material is spilled. Control sources of ignition. Ventilate the area by turning on the fume hoods with the sashes completely open and open all windows.
5. Use the appropriate personal protective equipment for the hazard involved. Refer to the Safety Data Sheet or other available references for information.

6. The use of respiratory protection requires specialized training and medical surveillance. DO NOT enter a contaminated atmosphere without protection or use a respirator without training. Call EHS when respiratory protection is required and there are no trained personnel available. When respiratory protection is used in an emergency situation, another trained person must be outside the spill area and have communication abilities with the trained person in the spill area.
7. Cover or block floor drains or any other route that could lead to an environmental release.
8. Use the appropriate media when cleaning spills. Begin by circling the outer edge of the spill with absorbent. Next, distribute spill control materials over the surface of the spill. This will effectively stop the liquid from spreading and minimize volatilization.
9. Place absorbed materials in an appropriate container using a brush and scoop. Small spills can be placed in polyethylene bags. Larger quantity spills may require five-gallon pails or 20-gallon drums with polyethylene liners.
10. Absorbent materials used on the chemical spill will most likely require disposal as hazardous waste. Place a completed hazardous waste label on the container. Contact EHS for information concerning preparing waste for disposal and for a waste pick-up.
11. Clean the surface where the spill occurred using a mild detergent and water.
12. Immediately report all spills to your supervisor.

4.3 Solvent Spills

1. Apply activated charcoal to the perimeter of the spill.
2. Mix until the spill has been completely absorbed.
3. Transfer the absorbed solvent to a hazardous waste bag, tie and attach an appropriate label.
4. Contact EHS for pick-up.
5. Clean the area with soapy water.

4.4 Corrosive Spills (Acids and Bases)

Hydrofluoric acid requires special treatment. Products are commercially available for absorbing hydrofluoric acid. Purchase of hydrofluoric acid spill and personnel exposure material (see first aid kits) is mandatory for laboratories using hydrofluoric acid. Bases can be equally as harmful as acids. Never add a strong acid to a strong base.

1. Apply the appropriate neutralizer to the perimeter of the spill.
2. Mix thoroughly until evolution of gas has stopped.
3. Check the mixtures pH with pH paper.
4. Transfer the waste to a bag, fill out the appropriate waste label & call EHS for pick-up.
5. Clean the spill area with soapy water.

4.5 Mercury Spills

Mercury is classified as a persistent bio-accumulative toxin (PBT). Additionally, some forms of organic mercury readily absorb through gloves and skin. Laboratories utilizing mercury must be prepared with an appropriate cleanup kit. Do not use sulfur to clean up mercury.

When **more than ten milliliters** of mercury have been spilled:

1. Alert others in the area.
2. Mark off the area.

3. Contact EHS immediately.

Procedure for use with commercially available mercury clean-up sponge:

1. Dampen the sponge with water and wipe the contaminated area.
2. Perform the procedure slowly to insure complete absorption of mercury onto the sponge.
3. Place the sponge in its plastic bag, seal shut and fill out an appropriate waste label. Call EHS for disposal. A hazardous label should be attached to the bag to identify contents.
4. Wash hands, arms and face thoroughly when finished working with mercury.

4.6 Radioactive Material Spills

Spills of quantities of radiological materials present at NSU cause little or no immediate external hazard. Of bigger concern, is the spread of contamination and the internal contamination of employees, faculty and students. Radioactive material spills must therefore be handled in a manner that prevents this. Prevent the spread of contamination by limiting the movement of persons present in the area of the spill until they have been found free of contamination. A minor radiation spill is one that can be handled safely without the assistance of the radiation safety staff. Most spills at NSU will be small spills due to the small quantities of radioisotopes that are utilized in campus laboratories. For response procedures to a large or major radioactive spill, see the NSU Radiation Safety Plan.

Small/Minor Radioactive Material Spill

1. Alert persons in the immediate area.
2. Distinguish the spill area with radioactive label tape. Indicate the isotope spilled.
3. Notify the laboratory supervisor or principle investigator.
4. Wear personal protective equipment to include, safety goggles, disposable gloves, shoe covers and long sleeve lab coat. If the substance is a beta emitter a plastic lab apron may be used to provide additional body shielding.
5. Place absorbent towels over liquid spills and dampened towels over spills of solid materials.
6. Clean the spills beginning from the outside edge and moving towards the center.
7. Place the towels in a plastic bag and put in a radiation waste container.
8. Verify the area and responder hands and shoes are free from contamination by using a survey meter or by performing wipe tests. Repeat the cleaning process until there is no contamination remaining.
9. Submit a written account to the Radiation Safety Officer within 24 hours of the occurrence.

4.7 Spill of Biohazardous Radioactive Material

The procedure for spill cleanup of a radioactive biological material requires emergency procedures which protect the person from exposure to the radiochemical while disinfecting the biological material.

1. Avoid inhaling airborne material, notify other room occupants, and quickly leave the area.
2. Remove all contaminated clothing by turning exposed areas inward. Place in biohazard bag.
3. Wash all exposed skin areas with a disinfectant soap. Rinse for a minimum of 5 minutes.

4. Inform the laboratory supervisor and contact the Radiation Safety Officer (RSO).
5. Post a spill sign and do not reenter the lab for at least 30 minutes.
6. Contact the radiation safety officer to confirm safe entry into the laboratory.
7. Utilize appropriate protective clothing and reenter the spill area. The use of respirators requires special training. Call EHS if a respirator trained individual is required but not available for spill cleanup.
8. Cover the area with disinfectant soaked towels. Pour the disinfectant around the perimeter of the spill area. As the spill becomes diluted with disinfectant, increase the concentration of the disinfectant. Allow 20 minutes for disinfection. **Please note that the use of bleach on iodinated material may cause the release of radioiodine gas. An alternative such as, phenolic compounds or an iodophor should be used when radioactive iodine has been spilled.**
9. To clean splashed material, spray with disinfectant solution and wipe clean or saturate a paper towel with disinfectant solution and wipe clean.
10. Personal protective equipment (PPE) must be disinfected with bleach solution and disposed of as radioactive waste. Place the used PPE on absorbent paper. Spray the PPE with 10% bleach solution and allow a 20 minutes contact time.
11. Place all decontaminated waste materials in an approved container for radiation and label appropriately. Do not autoclave the waste unless the Radiation Safety Officer approves the procedure.
12. Wash hands and potentially exposed areas with a disinfectant.
13. Monitor laboratory occupants for contamination of radioactive materials.
14. Decontaminate under the advisement of the Radiation Safety Officer.
15. All contaminated persons must seek medical assistance after decontamination procedures have been completed.
16. Monitor the area for residual activity and handle it according to the Radiation Safety Plan guidelines.

4.8 Biological Spills or Exposures

A minor spill of a biological agent is defined as one that has occurred and is contained within the biological safety cabinet and which provides personnel protection. It is assumed that no one is contaminated by the spill. Most clinical and research activities conducted at NSU is classified as Biological Safety Level 1(BSL-1).

If a spill contains BSL 2 agents or greater, or the spill is too dangerous or large to be safely cleaned up by laboratory personnel, EHS must be contacted immediately. Detailed information on BL2 biological spills are found in the NSU Biological Safety Plan. Contact your department supervisor or EHS for a copy of this plan.

A. Biological Spill Kit

Laboratories utilizing biological materials must be prepared with a biological spill kit. Biological spill kits can be assembled to fit specific laboratory needs although basic kits must contain the following items:

- Concentrated household bleach
- A spray bottle for bleach solutions
- Face protection

- Utility gloves and nitrile gloves
- Paper towels or other sorbent
- Biohazard bags
- Forceps for handling sharps
- Biohazard symbol labels (for use on the bucket when the cleanup is complete)

B. Biological (Blood and Body Fluid) Spill Procedures

Blood and body fluid spills with low concentrations of infectious microorganisms must be handled in the following manner:

1. Wear at least the minimal required laboratory personal protective equipment.
2. Absorb fluid with paper towels and place in a biohazard bag.
3. Collect any broken glass with forceps and place in an appropriate broken glass collection container.
4. Clean the area with a detergent.
5. Spray the area with a 10% bleach solution and allow to air dry for 15 minutes.
6. Wipe the area with disinfectant soaked paper towels.
7. Place all contaminated items in an autoclavable biohazard bag, autoclave, and dispose of according to NSU guidelines.

4.9 Ethidium Bromide Spill Clean-up and Disposal

Ethidium bromide is a potent tumorigen. When handling ethidium bromide it is imperative that no skin contact occurs and thorough hand-washing is performed after handling. For a small spill:

1. Absorb freestanding liquid with a compatible absorbent material.
2. Use ultraviolet light to locate the location of the spill material.
3. Prepare decontamination solution by mixing 4.2 grams of sodium nitrite and 20 mL of hypophosphorous acid (50%) in 300 mL of water.
4. Wash the spill area with a paper towel soaked in the decontamination solution. Wash the spill area five more times with paper towels that have been soaked in the decontamination solution (using fresh paper towels each time).
5. After cleaning the area put all the used towels in the decontamination solution for 1 hour.
6. Check the completeness of decontamination using an ultraviolet light.
7. When the decontamination procedure is complete, transfer all the decontamination solution to an appropriately labeled waste container. Call the EHS office for waste pick-up.

<u>To Clean Contaminated Equipment</u>:

Laboratory equipment (e.g. transilluminators, laboratory floors and countertops, etc.) contaminated with aqueous solutions of more than 10 mg/L (0.01 %) EtBr should be decontaminated using the spill clean-up procedures listed above.

4.10 Biological Safety Level1 Spill Procedure

Biosafety Level 1 is the classification that applies to agents that are not known to cause disease in healthy adults.

1. Notify other laboratory occupants.

2. Remove contaminated clothing. If necessary, use the safety shower or emergency eyewash. Wash affected area with a disinfectant.
3. Wear at least the required laboratory personal protective equipment.
4. Cover the spill with paper towels. Pour disinfectant around the outside of the spill area and then add disinfectant over the spill area until the spill area has been completely covered. Allow the disinfectant at least 15 minutes to work. To clean splashed material spray with disinfectant solution and wipe clean or saturate a paper towel with disinfectant solution and wipe clean.
5. Pick up any pieces of broken glass with forceps and discard in a broken glass container.
6. All clean up materials must be placed in a biohazard bag, autoclaved and appropriately disposed.
7. Wash hands thoroughly with soap and a handwashing disinfectant.

4.11 Fires

All employees at the time of hire and all students must be informed at the beginning of each semester of building evacuation routes. It is the laboratory supervisor's responsibility to provide this information. In the event of a fire, immediate evacuation is essential. On the way out of the building remember these safety precautions:

- Never enter a room containing a fire.
- Never enter a room that is smoke filled.
- Never enter a room in which the top half of the door is hot to the touch.

A. Small Fires

1. Pull the fire alarm and call the Public Safety Office at 2-8999 or 911.
2. Alert people in the area to evacuate. Assist those individuals with disabilities.
3. Turn off gas main.
4. If you have been trained to use a fire extinguisher, do so while maintaining a clear exit path behind you.
5. Operate the extinguisher using the P-A-S-S method:

    P – Pull the pin located on the extinguishers handle.
    A – Aim the nozzle at the base of the fire.
    S – Squeeze or press the handles together.
    S – Sweep from side to side at the base of the fire until it is out.

B. Large Fires

1. Pull the fire alarm, when in a safe area; call 911.
2. Alert people in the area to evacuate. Assist those individuals with disabilities.
3. Turn off gas mains, only if time permits.
4. Close the doors to confine the fire.
5. Move to a designated assembly area away from and upwind from the building.
6. Persons having knowledge about the incident and location must provide this information to emergency response personnel.

4.12 Weather Alerts

When a severe weather siren is identified, immediately request all persons in the laboratory to turn off any gases, hotplates, and pressure reactive experiments. Immediately leave the area in an orderly manner. Use the innermost stairway and take cover in the lowest most internal compartment of the building.

4.13 Responding to Injuries and Inhalation Exposures

The first line of defense to avoid injuries and inhalation exposure for any person working or performing clinical or research procedures in a laboratory is knowledge. Always be aware of what you and others in the surrounding area are working with and the associated hazards. This information is available on the product safety data sheet (SDS). SDS must be available for review by faculty, staff, researchers and students prior to utilizing any new chemical product or procedure involving the chemical product at all times.

Following an injury the person in charge of the laboratory at the time of occurrence must complete an incident report form. The incident report form serves as a guideline for appropriate information communication to the injured person and as a notification to the Safety Committee. The information will be used to better prepare the University faculty and staff in the prevention and response of accidents and injuries.

A. Inhalation of a Biological Material

1. Immediately notify all other persons in the laboratory, hold your breath, and evacuate.
2. Remove all personal protective equipment by turning it inwards to decrease the spread of contamination.
3. Wash hands and any other potentially exposed area with soap and water for a minimum of 15 minutes.
4. Post a spill sign and do not reenter the lab for at least 30 minutes.
5. Notify the Biosafety Officer and call 911.
6. Immediately seek medical assistance.

B. Needle Sticks and Puncture Wounds

1. Wash well with disinfectant or antiseptic soap (preferably a type with iodine) and water for 15 minutes.
2. Squeeze around affected area to encourage bleeding.
3. Notify the laboratory supervisor.
4. Seek medical assistance immediately.
5. If needle stick wound had the potential for exposure to infectious material, report this information to medical professionals ASAP.

C. **Chemical Injury or Exposure Response**

1. Protect yourself from exposure and stabilize the injured person. When possible wash your hands prior to and after giving first aid. Use gloves whenever possible.
2. Call 911 when emergency medical attention is required or when not sure how to respond.
3. Utilize the safety shower available in the laboratory when appropriate. Clothing must be removed to prevent prolonged chemical contact with the skin. Rinse the exposed area for at least 15 minutes.
4. Use the emergency eyewash stations to rinse harmful chemicals from the eyes when appropriate. Eyes must be rinsed for a minimum of 15 minutes.
5. Offer the injured person medical attention. Contact 911 immediately if he or she desires medical attention by an emergency room physician. Contact a family member to transport the injured person during non-emergency situations.
6. Contact EHS to report all injuries and complete an accident report. An accident report must be completed within 24 hours of the incident.
7. Report all accidents involving injuries to NSU Risk Management Office.

D. Cuts and Scratches

In treating small cuts and scratches, clean the area with soap and water and apply a clean dressing over the wounded area**.** If there is significant bleeding, take the following steps:

1. Immediately call 911.
2. Reassure the injured person.
3. Lay the injured person down.
4. **Do not** remove any objects that may have impaled the person.
5. Place direct pressure on the wound with a clean cloth or sterile bandage. Do not apply a tourniquet.
6. If the pressure does not slow the bleeding, elevate the wound above the heart.
7. If the bleeding is severe, elevate the person's legs approximately 12 inches.

E. Thermal Burns

First degree burns are characterized by pain, redness and swelling.

1. Run cool water over the burn or soak it for a minimum of 10 to 15 minutes.
2. Cover the burn with a sterile bandage or clean cloth.
3. Do not apply any ointments, salves, or sprays.

Second and third-degree burns are characterized by red mottled skin and blisters. White or charred skin is indicative of a third-degree burn.

1. Call 911.
2. Do not remove any burnt clothing.
3. Cover the burns with dry sterile or clean bandages.
4. Do not apply ointments, salves, or sprays.

F. Chemical Burns

When necessary, use the eyewash or safety shower as instructed in the procedures below. Insure your own safety by wearing the appropriate personal protective equipment.

1. Chemical Burns to the Skin
   - Remove the victim's clothes, including his/her shoes.
   - Rinse the area for a minimum of 15 minutes.
   - Do not apply burn ointments to injured areas.
   - Call 911, when the burn is large.

2. Chemical Burns to the Eyes
   - Forcibly open the eyelids to insure the all the chemical is removed.
   - Wash from the nose to the ear to insure the chemical does not wash back into the eye.
   - The wash must continue for a minimum of 15 minutes.
   - Cover the injured person's eyes with clean or sterile gauze.
   - Call 911.

3. Hydrofluoric Acid Burns

NSU requires supervisors having responsibility for laboratories that use or store Hydrofluoric acid (HF) to maintain a commercially prepared gel of calcium gluconate in the laboratory area. The gel is used for immediate treatment of skin exposures to HF. HF causes serious damage to tissues and bones. The faster the treatment, the smaller the chance of serious injury. In the event of a burn caused from HF, the following steps must be immediately taken:

- The skin must be copiously washed, beginning immediately after exposure.
- Apply a bulky dressing soaked in a commercially prepared quaternary ammonia compound, calcium gluconate or magnesium oxide topical ointment. Always follow the manufacturer's directions supplied with the HF burn ointment/solution if they differ from these.
- Seek immediate medical attention.

G. Chemical Ingestion or Inhalation

1. Ingestion of Chemicals
   - Immediately call 911.
   - Refer to the SDS to effectively treat the injured person.
   - If the injured person is unconscious, turn his/her head or entire body onto the left side. Be cautious about performing CPR; use a mouth-to-mouth resuscitator if available.
2. Inhalation of Chemicals
   - Evacuate the area and move the victim to fresh air.
   - Immediately call 911.
   - When the victim is not breathing, perform CPR. Be cautious as the mouth-to-mouth contact can result in the responder becoming poisoned. Where available use a mouth-to-mouth resuscitator.
   - When the victim is breathing, loosen his/her clothing and maintain the airway.
   - Place one hand under the injured person's neck and gently lift.

- Rotate the injured person's head back to obtain maximum extension of the neck by pressing down on his/her forehead with your free hand.
- If additional airway extension is necessary, pull the injured person's lower jaw into a jutting-out position.
- Treat the person for chemical burns of the eyes and skin.

4.14 Reporting Injuries

Any person who responds to a laboratory injury is required to complete an incident report. This form serves as a record, provides standardized procedures for the responder, and provides the Safety Committee information that will assist in the detection and prevention of injuries in NSU laboratories. A copy of the incident report form must be submitted to Risk Management, and one retained for the departmental files. Please note that the incident report form does not take the place of the accident report required to be submitted (due within 48 hours of the incident).

Section 5: Emergency Equipment

Proper maintenance of the safety equipment is vital to the health and welfare of all laboratory personnel. The emergency items (showers, eyewash stations and fire extinguishers) described below, common to all laboratories, must be properly maintained and regularly inspected to prevent or respond to laboratory accidents or emergencies.

5.1 Safety Showers and Eyewash Stations

All laboratories using hazardous chemicals, particularly corrosive chemicals, and biological specimens must have access to eyewash and/or an emergency shower. Each emergency eyewash and shower station must be activated weekly by laboratory staff to check that it works correctly. This weekly test should be recorded in your lab equipment maintenance record book.

A. Safety Showers

1. Use and Maintenance
    - Safety showers should be in a **clearly marked and accessible** location. The station should be no more than 50 feet, or 10 seconds, away from every lab workbench.
    - Laboratory workers should be able to locate the shower(s) with their eyes closed (emergency situations may leave victim temporarily blind).
    - Safety showers are operated by grasping a ring chain or triangular rod.
    - The pull mechanism is designed for people of all heights. It should always be accessible and hang freely.
    - Safety shower should supply a continuous stream of water to cover the entire body.
    - Individuals should remove clothing, including shoes and jewelry, while under an operating shower.
    - Safety showers should be located AWAY from electrical panels or outlets.
    - Plumbed equipment shall be activated weekly to verify proper operation.
    - Safety showers should be inspected annually to assure conformance with ANSI Z358.1 section (4) requirements.

- If at all possible, safety shower facilities should be installed near appropriate drainage systems.

2. Types of Safety Showers
   - Ceiling/Wall Emergency Shower: provides a continuous water flow and mounts directly to overhead vertical pipes or horizontal wall pipes.
   - Deck-Mounted Drench Hose: a hand operated for quick spot washing of injuries.
   - Floor-Mounted Emergency Combination: eye wash/face and body wash mounts directly to horizontal wall pipes.

B. Eyewash Stations

Eyewash stations should be readily available and accessible to all laboratory personnel. The station should be clearly marked and in accessible locations no more than 10 seconds or 50 feet away from every lab work station. Laboratory workers should be able to locate the nearest eye wash station with their eyes closed (eye injuries may involve temporary blindness). Eye injury usually accompanies a skin injury. For this reason, eye wash stations should be located near the safety shower so that eyes and body can be washed.

1. Use and Maintenance
   - **Water/eye solutions should not be directly aimed onto the eyeball, but rather, aimed at the base of the nose.** This increases the chance of effectively rinsing the eyes free of chemicals (harsh streams of water may drive particles further into the eyes).
   - Eyelids have to be **forcibly** opened to ensure effective washing behind the eyelid.
   - Be sure to wash from the nose out to the ear this will avoid washing chemicals back into the eye or into an unaffected eye.
   - Flood eyes and eyelids with water/eye solution for a minimum of 15 minutes.
   - Remove contact lenses as soon as possible to rinse eyes of any harmful chemicals.
   - Cover both of the victim's eyes with clean or sterile gauze.
   - Call 911.
   - Plumbed equipment shall be activated weekly to verify proper operation.
   - Eye wash stations should be inspected annually to assure conformance with ANSI Z358.1 section (6) requirements.
   - Plumbed eye wash stations should have protective covers to protect nozzles from airborne contaminants.
2. Types of Eye Wash Stations
   - Gravity Feed Self-Contained: provides the laboratory worker with emergency eye wash treatment in areas inaccessible to plumbing.
   - Faucet-Mounted: (pin or push plate activators) provides continuous water flow while freeing hands to open eyelids. It turns a standard faucet into a practical emergency eye wash station.
   - Laboratory Bench: sprays with a squeeze handle can be installed through the bench top for instant availability.
   - Swivel Eye Wash: mounts on lab bench or counter top adjacent to a sink. It swivels 90 degrees over the sink for use, or out of the way for storage.
3. Personal Wash Unit (Eye Wash Bottles)

Eye wash bottles should never replace permanent emergency eye wash facilities when they are required. The main purpose of Eye Wash Bottles is to supply immediate flushing. When this has been done, the injured person should go to an emergency eye wash and flush the eyes for the required 15 minutes. **Due to the flow requirements outlined in the ANSI standard, hand held bottles do not qualify as approved eyewashes**.

5.2 Fire Safety Equipment

Ignition sources must be located away from flammable and combustible materials. There are many potential ignition and fuel sources in laboratories. Common laboratory ignition and fuel sources include Bunsen burners, hot plates, and heating mantles, peroxides and peroxide formers, damaged electrical cords and extension cords, class III and IV lasers, and flammable and combustible chemicals. Always use heating apparatus, Bunsen burners, and flammable and combustible chemicals in the fume hood.

A. Fire Alarms

Alarms are designed so that all endangered laboratory personnel are alerted. All faculty, staff and students should become familiar with the EXACT LOCATION of the fire alarm stations nearest to their laboratory.

B. Fire Extinguishers

Fire Extinguishers are classified according to a particular fire type and are given the same letter and symbol classification as that of the fire.

TYPE A -- Combustibles wood, cloth, paper, rubber and plastics
TYPE B -- Flammable Liquids - oil, grease and paint thinners
TYPE C -- Energized Electrical Equipment - electrophoresis
TYPE D -- Combustible Metals (magnesium, titanium, sodium, lithium, potassium)

Multipurpose Extinguishers are highly recommended because they are an effective agent against Types A, B, and C fires. Extinguishers should be identified by appropriate signage and securely located on the wall near an exit. All extinguishers should be inspected at least every 12 months and replaced or recharged if they have been used, damaged, or discharged.

How to Use a Fire Extinguisher

Fire extinguishers are not designed or intended to extinguish large fires, but if used properly, can control or extinguish a small fire. A small fire is defined as one that could occur in a standard office trash can. When a fire or suspected fire, i.e., smoke, is discovered, the first reaction should always be to activate the fire alarm system, call 911, and evacuate the building according to the evacuation plan. Fire extinguishers are provided in all University buildings and can be used provided the person is properly trained to use the extinguisher. The following are guidelines in making the decision as whether to use the unit, and how to use the extinguisher.

1. SHOULD I USE THE EXTINGUISHER?
   If you ask yourself this, it's too late. Don't use the unit, leave the building.

2. HOW TO USE AN EXTINGUISHER: Remember the "PASS" word.

PULL THE PIN: Place your hand on the top of the cylinder and pull the pin. This will unlock the handle and allow you to activate the unit.
AIM: the nozzle of the hose at the base of the fire.
SQUEEZE: the handle (lever) releasing the firefighting agent.
SWEEP: the nozzle from side to side over the fire. Keep the nozzle/hose directed at the base of the flame. Empty the fire extinguisher onto the fire.

3. PERSONAL SAFETY PRECAUTIONS
   - Never reach over the fire.
   - Never allow the fire to get between you and the exit from the room.
   - Never enter an unknown area to fight a fire, especially in a chemistry lab.
   - Always notify the proper fire officials.

C. Blankets

Laboratory personnel are DISCOURAGED from using fire safety blankets as a means to extinguish a fire. Fire safety blankets should be used as a means to keep shock victims warm.

D. Sand/Absorbent Material

Sand and other absorbent material is designed for fast and easy extinguishing of **small** fires in the laboratory. These materials should be stored in a handy dispenser, appropriately labeled, and used according to the type of fire. Do not use sand buckets as ash trays!

E. Sprinklers

Sprinkler systems are installed throughout University buildings and are automatically activated. Laboratory workers should not attempt to shut off the system.

- Items in the lab should be stored at least 18 inches away from the sprinkler heads.
- Items should not hang from the sprinkler heads.
- Intense heat should not be used near the sprinkler heads.

Section 6: Personal Protective Equipment (PPE) and Latex Allergy

Personal Protective Equipment (PPE) is used by employees to protect them from the risk of injury and chemical exposure by creating a barrier against workplace hazards. PPE must be used when administrative and./or engineering controls are not effective. PPE is not a substitute for good work practices.

6.1 Protective Devices

The University shall supply personal protective equipment to all laboratory personnel. Protective equipment must meet the ANSI and OSHA standards. The design should be safe and constructed so as not to restrict or impede movement or the ability to work.

Hazards vs PPE (minimum PPE requirements)

Hazard	Eyes	Face	Body/Hands
Any laboratory or general use of chemicals	Safety glasses (all times in lab)		Normal work/lab attire (no sandals, shorts, etc) with over-garment (smock, lab coat, or coveralls), & gloves
Use of corrosive chemicals, strong oxidizing agents, carcinogens, mutagens, etc.	Chemical splash goggles	Full face shield over goggles (if gallon or more liquid)	Resistant gloves (see glove selection guide), resistant apron or over-garment (full protective suit for work with over 5 gal corrosive liquids)
Sharp objects, glass, insertion of tubes into stoppers	Safety glasses		Heavy cloth barrier or leather gloves
Temperature extremes	Safety glasses (goggles if possible splash)	Recommend full face shield (large quantity gas/liquid or sparking)	Insulated gloves for ovens, furnaces, cryogenics & devices over 100C or below -1C, use over-garment for hot/cold liquids & sparking

A. Eye and Face Protection

Employees who are exposed to hazardous chemicals and infectious materials must wear face protective equipment to prevent contamination of the mucosal membranes from splashing or aerosols. Safety glasses or goggles are made of impact resistant lenses and stronger frames than regular glasses. Face shields must be worn when working with materials that can affect facial skin or when goggles do not provide adequate protection from splashes. Eyewear must be maintained and cleaned before use, and contaminated eyewear cleaned immediately.

Prescription Safety Eyewear

Prescription glasses worn on their own do not meet the standards. OSHA regulations require that employees who wear prescription lenses while engaged in operations that involve eye hazards shall wear eye protection that incorporates the prescription in its design, or must wear eye protection that can be worn over the prescription lenses (goggles, face shields, etc.) without disturbing the proper position of the prescription lenses or the protective lenses. Additionally, contact lenses by themselves are not considered protective eyewear. Contact lens wearers exposed to hazardous chemicals must also use the appropriate face protection.

Safety Glasses

Safety glasses provide eye protection from moderate impact and particles associated with grinding, sawing, scaling, broken glass, and minor chemical splashes, etc. Side protectors are required when there is a hazard from flying objects. Safety glasses do not provide adequate protection for processes that involve heavy chemical use such as stirring, pouring, or mixing. In these instances, splash goggles should be used.

Splash Goggles

Splash goggles provide adequate eye protection from many hazards, including potential chemical splash hazards, use of concentrated corrosive material, and bulk chemical transfer. Be aware that goggles designed for woodworking are not appropriate for working with chemicals. These types of goggles can be identified by the numerous small holes throughout the facepiece. Ensure the

goggles you choose are rated for use with chemicals.

Face Shields
Face shields consist of an adjustable headgear and face shield of tinted or clear lenses or a mesh wire screen. They should be used when the entire face needs protection and should be worn to protect the eyes and face from flying particles, metal sparks, and chemical/biological splashes. Face shields with a mesh wire screen are not appropriate for use with chemicals. Face shields should always be worn with a primary form of eye protection such as safety glasses or goggles.

Protective Clothing
Laboratory gowns or coats must be worn to protect street clothing and provide protection against biological and chemical spills as well as provide additional body protection. Laboratory personnel are to wear the correct attire when working with hazardous materials. Employees should wear clothing that will protect them. Open-toed shoes or sandals are prohibited.

A laboratory gown should be the traditional knee-length, long sleeved, cuffed coat that can be snapped closed to protect clothing. Plastic or rubber aprons can be worn over laboratory coats for extra protection when working with corrosive or irritating liquids. When a coat becomes contaminated or torn, it must be removed immediately and either discarded if disposal or placed in the soiled laundry container.

Gloves
Gloves should be worn whenever there is a possibility of skin contact with chemical, radiological and biological agents, hazardous materials, and rough or sharp objects. Dermatitis, inflammation of the skin or latex allergies accounts for a high number of work-related diseases. Nitrile gloves seem to be the most popular in clinical laboratories today. Always wash hands thoroughly before and after glove use. See the NSU Laboratory Safety Plan for detailed information on the selection and correct usage of gloves.

D. Respiratory Protection
Respirators are not recommended for routine laboratory work but should be used when general ventilation or a fume hood does not reduce the chemical exposure to acceptable levels. The use of respirators requires the training of employees and each respirator has to be specially fitted.

E. Foot Protection
Open-toe shoes and clogs are prohibited. It is preferred that the soles be non-slip and the shoes made from leather, it is not advisable to wear perforated shoes, sandals, or cloth sneakers.

6.2 Latex Allergy
Latex allergic reactions to natural rubber latex are becoming more common. Latex gloves expose employees through two routes – skin contact with the latex allergens and inhalation of latex proteins that are released into the air bound to the powders used to lubricate the gloves. Employees that are repeatedly exposed to latex products are at an increased risk of developing an allergy to latex. Sensitization can develop over time. A person with an allergic reaction to latex

exposure develops symptoms such as skin rash and inflammation, respiratory irritation, asthma and can lead to life-threatening anaphylactic reactions. Rashes can also be a result of the powder in the gloves or not related to the use of latex gloves at all. The sensitization will decrease when the exposure to latex is stopped.

Section 7: Engineering Controls

Engineering controls are usually automatic devices that will protect employees from the risk of hazardous exposure and is considered the first line of defense in the laboratory for protection. Examples may include chemical fume hoods, glove boxes, safety shields, and proper storage facilities. General room ventilation is not adequate to provide proper protection against bench top use of hazardous chemicals.

The OSHA Laboratory Standard requires that fume hoods and other protective equipment function properly and that specific measures are taken to ensure proper and adequate performance of such equipment. Laboratories must maintain equipment according to manufacturer's specifications or established guidelines. Routine inspections should also be performed to check for common problems like: damaged electrical cords, corrosion, worn parts, excessive contamination, leaks, etc. Alarms, guards, interlocks or other safety devices should also be checked to ensure that they have not been disconnected or defeated. The equipment will be inspected annually by Facilities Management or EHS. An inspection tag/card/sticker should be attached to the equipment with a record of inspection dates.

It is the responsibility of laboratory personnel to immediately report malfunctioning protective equipment, such as fume hoods, or mechanical problems to EHS as soon as any malfunctions are discovered.

7.1 Fume Hoods

A fume hood prevents the inhalation of potentially harmful substances, deters uncontrolled splashes and spills from entering the lab environment, and removes flammable vapors from the indoor atmosphere.

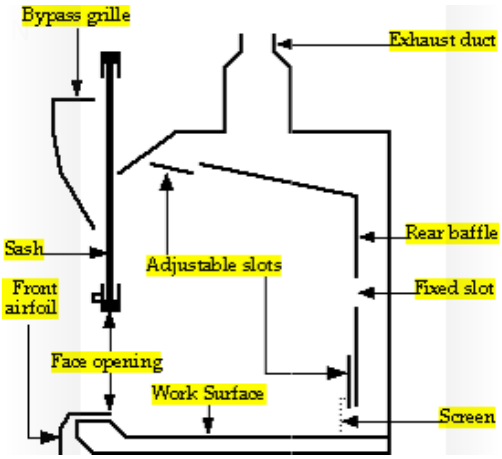
A. When to Use a Chemical Fume Hood

A chemical fume hood is a necessary part of your laboratory procedure when:

- Working with hazardous or suspect hazardous chemicals
- Working with chemicals having unknown properties
- Pouring, mixing, weighing and dispensing chemicals

B. How to Use a Fume Hood

Fume hoods are minimally equipped with a blower, cabinet, and exhaust ductwork. The cabinet is designed to contain hazardous chemicals. The blower is designed to pull air away from the front of the cabinet and keep the hazardous chemicals from reaching the indoor environment and user. The exhaust ductwork is independent from other indoor air ductwork and is used to transport any hazardous chemical fumes, gases, vapors, or aerosols to the outside environment.



Baffles are located across the inside rear of the hood. They assist in controlling the airflow pattern through the hood. Baffles can be adjusted to minimize hazards caused by the different characteristics of chemicals being utilized in the hood system.

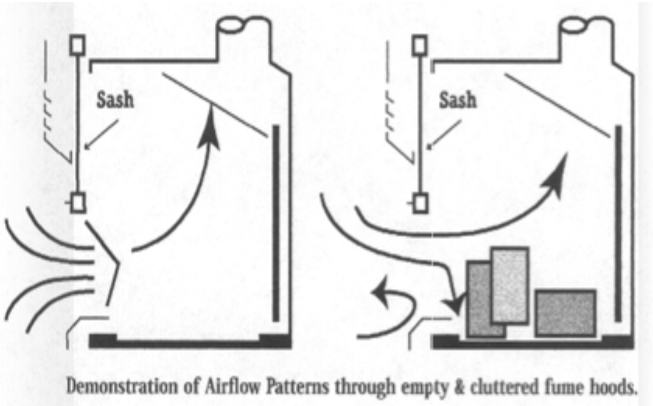
- For normal use, the top, bottom, center, and side slots are all adjusted to the open position to provide an even airflow.
- Gases or fumes that are heavier-than-air require the baffles to be adjusted for the maximum airflow at the bottom of the hood. To adjust the hood, close the top slot then arrange the center, bottom, and side slots in the open position.
- Gases or fumes that are lighter-than-air require a maximum airflow at the top of the hood. In those instances, open the top baffles to their maximum position and maintain the side and center baffles in their normal position and completely close the bottom slot.

A fume hood must have a face velocity sufficient to pull the air away from the user. ANSI recommends that laboratory fume hood face velocity be between 80 to 120 feet per minute (fpm) for optimal safety. Exhaust rates in newer fume hoods are often controlled by a variable air volume system. Variable air volume technology allows for the maintenance of a constant face velocity while varying exhaust volume in response to changes in the sash position. The exhaust volume is varied in response to a series of sensors that receive and send signals to the exhaust valve. Annual calibration of the VAV system is necessary to ensure the appropriate flow is being afforded the user. The point of optimal flow is established through calibration of the equipment. When the sash is opened above or below the optimal flow point the face velocity will decrease.

C. Fume Hood Safety Practice

A functioning fume hood an appropriate laboratory ventilation will provide adequate protection during standard manipulations. The fume hood laboratory should be used in conjunction with other safety equipment when toxic chemicals having exposure limits in the low parts per billion ranges are being utilized.

1. Keep all apparatus at least 6 inches from the face of the hood.
2. Do not put your head in the hood when contaminants are being generated.
3. Do not use the hood to evacuate containers of volatile waste chemicals.
4. All protective clothing should be worn when working with chemicals in the hood. In addition to gloves, safety glasses, and lab coats, a face shield will measure of safety from reactive chemicals.



Demonstration of Airflow Patterns through empty & cluttered fume hoods.

5. Minimize the quantity of chemicals and apparatus being used in the hood. Excessive storage of items in the fume hood will impair its performance.
6. All operations that may generate air contaminants above their exposure limits must be

conducted inside a fume hood.

7. Do not use a fume hood if it is not working appropriately. Test the airflow periodically. If a flow meter is not available, a kimwipe placed at the base of the hood will be gently lifted when appropriate airflow is provided. The kimwipe should not be pulled into the exhaust. This indicates the airflow is too high.
8. Maintain the slots in the hood baffle free from obstructions.
9. Do not remove the hood sash, panels or sensors. Keep all wiring between hood electronics and sensors intact.
10. The laboratory supervisor must approve the use of hazardous solids (powders). (Many potential problems arise when the solid is fine enough to become airborne.)
11. Do not place receptacles or other sources of sparks inside the hood when flammable liquids or gases are present.
12. Use an appropriate barricade if an explosion or other violent reaction is possible.
13. Do not remove hood labels that indicate the maximum safe operating level of the sash.
14. Use only specially designed fume hoods for operations that may require the use of perchloric acid. The use of this material may cause the formation of explosive perchlorate crystals. Special fume hoods, commonly known as **Perchloric Acid Fume Hoods**, **MUST** be used for this purpose. These hoods have self-contained wash-down units to inhibit crystal formation.
15. Ensure all fume hoods have a spill protection lip.

D. Maintenance

Solid objects or materials should not be allowed to enter the exhaust ducts at the rear of the hood, as they can become lodged in the duct or fan. Any hood or component of ventilation not properly functioning must be taken out of service and clearly tagged. The lab worker should not be able to detect strong odors released from materials in the hood area. If odors are detected, check to make sure that the ventilation fan is turned on. If the operating condition of a fume hood needs to be checked, call EHS. An emergency plan should exist in case of hood ventilation malfunction.

7.2 Perchloric Acid Fume Hoods

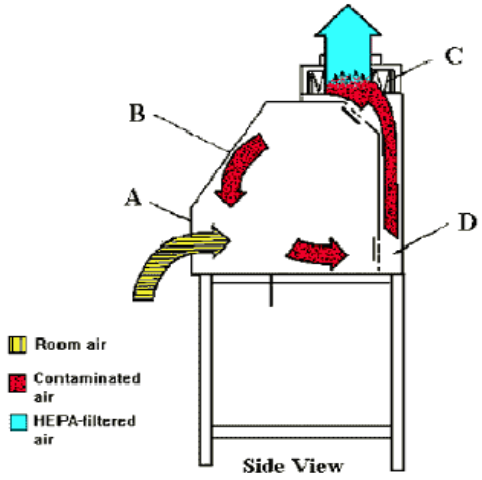
Procedures using concentrated perchloric acid (>70%) or which heat any amount or concentration of perchloric acid must be performed in a closed system or within a specially designed perchloric acid fume hood with wash down systems to prevent the accumulation of explosive perchlorates in the hood and ducting. For assistance in locating a perchloric acid fume hood call EHS.

7.3 Glove Boxes

A glove box is a sealed container that is designed to allow one to manipulate objects where a separate atmosphere is desired. Positive pressure glove boxes are used when you are trying to protect your material from contamination. Negative pressure glove boxes are used to provide increased operator protection. Glove boxes should be thoroughly tested before each use and there should be a method of monitoring the integrity of the system (such as a pressure gauge).

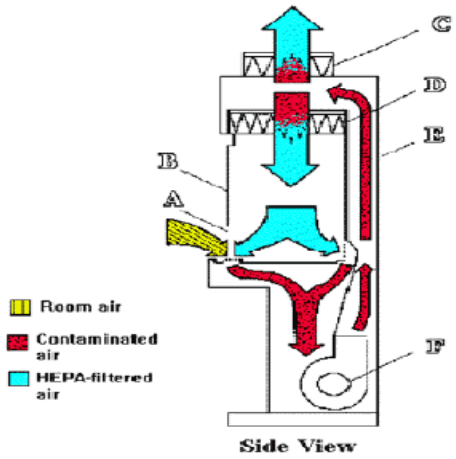
7.4 Biological Safety Cabinets (BSC)

Biological safety cabinets are the most common and effective primary containment devices in the laboratory for working with infectious agents. Appendix A "*Primary Containment for Biohazards :Selection, Installation and Use of Biological Safety Cabinets"* of the CDC Biosafety in Microbiological and Biomedical Laboratories 5th Edition is a valuble resource and available on their website at: https://www.cdc.gov/labs/BMBL.html.



The Class I BSC

A. front opening
B. sash
C. exhaust HEPA
D. exhaust plenum



The Class II, Type A BSC

A. front opening
B. sash
C. exhaust HEPA filter
D. rear plenum
E. supply HEPA filter
F. blower

Biological safety cabinets are designed to combine directional airflow with high efficiency particulate (HEPA) filters to protect employees and the environment from airborne microorganisms. Discharged air passes through the HEPA filters which remove 99.97% of the particles with a mass median aerodynamic diameter (MMAD) of 0.3 microns thus eliminating most bacteria, viruses and spores from circulation. The Class II BSC is most common for clinical laboratories and approved for BSL-2 and BSL-3 use while the Class III BSC is approved for BSL-4 microbiological agents.

A. Certification

The functional operation and integrity of each BSC should be certified to current performance standards at the time of installation, if equipment is moved and annually by qualified technicians, according to the manufacturer's instructions.

B. Cleaning and Disinfection

All items within BSCs, including equipment, should be surface-disinfected and removed from the cabinet when work is completed, since residual culture media may provide an opportunity for microbial growth. The interior surfaces of BSCs should be disinfected or decontaminated before and after each use. At the end of the work day, surface decontamination should include a wipe-down of the work surface, the sides, back and interior of the glass. A solution of bleach or 70%

alcohol should be used where effective for target organisms. A second wiping with sterile water is needed when a corrosive disinfectant, such as bleach, is used. It is recommended that the cabinet is left running. If not, it should be run for 5 min in order to purge the atmosphere inside before it is switched off.

C. Decontamination

BSCs must be decontaminated before filter changes and before being moved. BSC decontamination should be performed by a qualified professional.

D. Personal Protective Equipment

Personal protective clothing should be worn whenever using a BSC. Laboratory coats are acceptable for work being performed at Biosafety Levels 1 and 2. Gloves should be pulled over the wrists of the gown rather than worn inside. Elasticized sleeves can be worn to protect the investigator's wrists. Masks and safety glasses may be required for some procedures.

E. Alarms

BSCs can be equipped with one of two kinds of alarm. Sash alarms are found only on cabinets with sliding sashes. The alarm signifies that the operator has moved the sash to an improper position. Corrective action for this type of alarm is returning the sash to the proper position. Airflow alarms indicate a disruption in the cabinet's normal airflow pattern. This represents an immediate danger to the operator or product. When an airflow alarm sounds, work should cease immediately and the laboratory supervisor should be notified.

7.5 Chemical Storage Cabinets

Chemical Storage Cabinets should be labeled with the relevant hazard information associated with the chemicals stored in them. Storage of flammables and corrosives in the lab should be limited to as small a quantity as possible and should be stored in ventilated cabinets which meet OSHA 1910.106d and NFPA 30 specifications.

- Chemicals should **NEVER** be stored in alphabetical order (unless already separated out into compatible groups). This system may contribute to the high probability of incompatible materials being stored next to one another.
- Incompatible reagents should not be stored next to each other.
- Storage outside the cabinet should be kept to a minimum.
- Glass containers should be stored on the bottom shelf of storage cabinets, if possible.

Types of Cabinets:

- Flammable liquid cabinets: designed for storage of flammable or combustible liquids.
- Acid/corrosive cabinets: designed for corrosion resistance.
- Bulk storage cabinets: can be used for storage of flammable and corrosive liquids outside the laboratory setting.

7.6 Individual Storage Containers

Many types of containers are required depending on the quantities and classes of flammable or combustible liquids in use. A ***safety can*** is an approved container of not more than 5 gallons capacity that has a spring closing lid and spout cover. Safety cans are designed to safely relieve

internal pressure when exposed to fire conditions. A ***closed container*** is one sealed by a lid or other device so that liquid and vapor cannot escape at ordinary temperatures.

Section 8: Laboratory Equipment and Procedures

All equipment in the laboratory must be operated in a safe manner and if the equipment is malfunctioning, a sign needs to be placed to warn employees of its unsafe function. Safety devices on equipment must not be tampered with or disconnected.

8.1 Refrigerators

While domestic refrigeration units are appropriate for keeping foods cold, they are not designed to meet the special hazards presented by flammable materials. Therefore, laboratory refrigerators should be carefully selected for specific chemical storage needs. To prevent potential safety hazards, the length of storage of any material should be kept to a minimum. In addition, refrigerators should be periodically inspected.

A. Refrigerator and Freezer Hazards

The potential hazards posed by laboratory refrigerators and freezers involve vapors from the contents, the possible presence of incompatible chemicals, and spillage. Loss of electrical power can produce extremely hazardous situations. Flammable or toxic vapors may be released from refrigerators and freezers as chemicals warm up and/or certain reactive materials may decompose energetically upon warming.

B. Laboratory Refrigerator/Freezer Design

Only refrigerators and freezers designed for laboratory use should be utilized for the storage of chemicals. These refrigerators have been constructed with special design factors, such as heavy-duty cords and corrosion- resistant interiors to help reduce the risk of fire and explosion. Only chemicals should be stored in chemical storage refrigerators; lab refrigerators should not be used for food storage or preparation.

C. Refrigerator / Freezer Labeling

Refrigerators and freezers should be labeled clearly for their intended purpose (e.g., “No Food or Drink to be Stored in this Refrigerator”, “Refrigerator For Food Only”, "NO FOOD - CHEMICAL STORAGE ONLY", "Not For Flammable Storage", etc.)

Flammable Liquid Storage Standard refrigerators have electrical fans and motors that make them potential ignition sources for flammable vapors. Therefore, flammable chemicals or chemical mixtures that must be kept below room temperature must be stored in refrigerators or freezers specifically designed by the manufacturer to be explosion proof.

All other refrigerators or freezers not specifically designed to be explosion proof should be labeled with a prominent warning sign indicating that they are unsuitable for the storage of flammable substances. Electric heaters used to defrost the freezing coils can also spark. To ensure its effective functioning, a freezer should be defrosted manually when ice builds up.

D. Refrigerator/Freezer Contents

All materials in refrigerators or freezers should be labeled with the contents, owner, date of acquisition or preparation, and nature of any potential hazard. All containers should be sealed, preferably with a cap, and placed in secondary containers or catch pans.

E. Refrigerator/Freezer Explosions

Flammable liquids must only be stored in refrigerators which have no internal ignition sources. To prevent refrigerator and freezer explosions, laboratory supervisors must vigorously enforce the following:

- All materials with a flashpoint below 100° F may only be stored in a UL approved flammable materials storage refrigerator or freezer. These units do not have any internal ignition sources.
- All ordinary domestic refrigerators and freezers should be labeled with the phrase "No materials with a flashpoint below 100° F may be stored in this refrigerator/ freezer" or "Not for flammable storage."

8.2 Incubators

Laboratory incubators are used for a number of purposes in different section of science and research. Laboratory personnel are responsible for checking temperatures and CO_2 levels, changing charts on chart recorders if applicable, and for general maintenance and cleaning of incubators. All temperatures and CO_2 values must be documented. When cleaning or maintaining incubators, personnel are to use good laboratory practices. Further, personnel shall wear safety glasses when working with 70% (v/v) Isopropyl Alcohol. Any maintenance of incubators must be documented.

8.3 Centrifuges

A centrifuge is a piece of equipment, generally driven by an electric motor that puts an object in rotation around a fixed axis, applying a force perpendicular to the axis. Centrifugation may present two serious hazards: mechanical failure and dispersion of aerosols.

A. Safe Procedures for Centrifugation

Before centrifugation

- Use only rotors compatible with the centrifuge. Check the expiration date for ultracentrifuge rotors.
- Check tubes, bottles, and rotors for cracks and deformities before each use.
- Make sure that the rotor, tubes, and spindle are dry and clean.
- Examine O-rings and replace if worn, cracked, or missing.
- Never overfill centrifuge tubes (don't exceed ¾ full).
- Always cap tubes before centrifugation.
- Always balance buckets, tubes, and rotors properly.
- Check that the rotor is seated on the drive correctly, close the lid on the centrifuge, and secure it.
- When using swinging bucket rotors, make sure that all buckets are hooked correctly and move freely.

During centrifugation

- Close lids at all times during operation. Never open a centrifuge until the rotor has stopped.
- Do not exceed safe rotor speed.
- Stop the centrifuge immediately if an unusual condition (noise or vibration) begins and check load balances.

After centrifugation

- Allow the centrifuge to come to a complete stop before opening.
- Wear new pair of outer gloves to remove rotor and samples.
- Check inside of centrifuge for possible spills and leaks, clean centrifuge and rotor thoroughly if necessary.
- Wash hands after removing gloves.

B. Spills, Malfunctions and Failures

Centrifuge spills of infectious materials transmitted **by inhalation**

- If a spill has occurred, hold breath, close the centrifuge lid, turn centrifuge off, and immediately leave the lab.
- Notify others to evacuate, close the door, post a biohazard spill sign at the lab door.
- Remove any contaminated protective clothing and place in a biohazard bag. Wash hands and any exposed skin surfaces with soap and water. Seek medical attention as necessary.
- Report spills to laboratory supervisor. Call the EHS Office for assistance.

Centrifuge malfunction, rotor failure, or tube breakage of materials **not transmitted by inhalation**

- If a centrifuge malfunctions while in operation, turn it off immediately and unplug.
- If tube breakage occurs, turn centrifuge off immediately. Leave for 30 minutes to reduce the risk of aerosols. The operator should wear proper gloves, remove debris, clean and disinfect centrifuge interior, rotors, safety cups or buckets following the manufacturer's instructions.

8.4 Autoclaves

An autoclave is a device to sterilize equipment and supplies. No one should use an autoclave unless they have received recent instructions in autoclave procedure or are working under the direct supervision of an experienced employee with autoclave knowledge. Use caution when removing equipment and supplies from an autoclave as glassware may have cracked during autoclaving.

Steam (sterilizing) Autoclaves

The major hazards include, but are not limited to:

1. Burns resulting from physical contact with the structure of the autoclave.
2. Steam burns arising from contact with steam issuing from the apparatus.
3. Explosive breakage of glass vessels during the opening and unloading.
4. Burns arising from careless handling of vessels containing boiling liquids.

Top-loading Autoclaves
Beware of residual steam in the apparatus. Remove the lid cautiously keeping the body as far away from the apparatus as possible. Do not lean over the autoclave to examine the contents.

Front-loading Autoclaves
In using front-loading autoclaves, it is recommended to stand so that as the door is opened it shields your body from the contents of the autoclave. Watch your feet! Sometimes boiling liquid accumulates in the autoclave and runs out as the door opens.

8.5 Vacuum Systems

Vacuum systems pose severe implosion hazards. Conduct all vacuum operations behind a table shield or in a fume hood. Do not underestimate the pressure differential across the walls of glassware that can be created by a water aspirator. When using vacuum systems, follow the below guidelines and requirements to ensure system safety:

1. Ensure that pumps have belt guards in place during operation.
2. Ensure that service cords and switches are free from defects.
3. Always use a trap on vacuum lines to prevent liquids from being drawn into the pump, house vacuum line, or water drain.
4. Replace and properly dispose of vacuum pump oil that is contaminated with condensate. Used pump oil must be disposed as hazardous waste.
5. Place a pan under pumps to catch oil drips.
6. Do not operate pumps near containers of flammable chemicals.
7. Do not place pumps in an enclosed, unventilated cabinet.

The glassware used with vacuum operations must meet the following requirements:

1. Only heavy-walled round-bottomed glassware should be used for vacuum operations. The only exception to this rule is glassware specifically designed for vacuum operations, such as an Erlenmeyer filtration flask.
2. Wrap exposed glass with tape to prevent flying glass if an implosion occurs.
3. Carefully inspect vacuum glassware before and after each use. Discard any glass that is chipped, scratched, broken, or otherwise stressed.

Glass desiccators often have a slight vacuum due to contents cooling. When using desiccators, follow these guidelines:

1. When possible, use molded plastic desiccators with high tensile strength.
2. For glass desiccators, use a perforated metal desiccators guard.

8.6 Compressed Gas Cylinders

Compressed gases are used in many laboratories for analytical or instrument operations, but these gases can be toxic, combustible, explosive, poisonous, corrosive, inert, or a combination of hazards. As compressed gases are under a great deal of pressure, there is the potential for simultaneous exposure to both mechanical and chemical hazards. Thus, careful handling procedures are necessary when working with various compressed gases and cylinders; the regulators or valves used to control gas flow, and the piping used to confine gases during flow. The types of gases that may be found in a laboratory are:

- Compressed - pressurized gas at a temperature greater than their boiling point (oxygen,

nitrogen and argon).
- Liquefied – gases stored under high pressure at a temperature greater than their boiling point (carbon dioxide, propane, butane and chlorine).
- Dissolved – another container is inside the cylinder where the gas is dissolved (acetylene is a gas dissolved in acetone).

Although each DOT approved gas cylinder is designed, constructed, and tested to safely contain its contents, additional procedures should be followed in handling and storing compressed gas cylinder. These additional procedures are:

1. Cylinders must be clearly labeled with their contents.
2. Regulators must be compatible with the cylinder contents and valve.
3. Cylinders must be properly secured at all times.
4. Cylinders must be stored in a cool, well-ventilated area away from sources of ignition, electricity, and heat.
5. Empty or unused gas cylinders must always be capped.
6. Cylinder carts must be used to transport capped cylinders.
7. Cylinders containing flammable gases must not be stored near oxidizers.
8. Cylinders must not be stored near corrosives.
9. Cylinders must be stored away from doors and exits.

The Receiving Department of each campus will handle the delivery and collection of gas cylinders. All cylinders (new, used, or empty) must be secured at all times. Chains, belts, or clamps should be used to secure cylinders to the walls or benches in the laboratory. Do not store gas cylinders in the hallway. The use of disposable or lecture size cylinders is strongly discouraged. If special circumstances warrant the use of these types of cylinders, the Principal Investigator is responsible for the additional costs of disposal.

8.7 Cryogenic Liquids

Cryogenic fluids, such as liquid air, liquid nitrogen, or liquid oxygen, are used to obtain extremely cold temperatures. Most cryogenic liquids are odorless, colorless, and tasteless when vaporized, however, they create a highly visible and dense fog when exposed to the atmosphere. All cryogens other than oxygen can displace breathable air and can cause asphyxiation. Cryogens can also cause frostbite on exposed skin and eye tissue. Cryogenic vapors from liquid oxygen or liquid hydrogen may cause a fire or explosion if ignited. Liquid nitrogen or liquid helium, are capable of condensing atmospheric oxygen and causing oxygen entrapment or enrichment in unsuspected areas.

Additional hazards include the following:

Cryogenic Hazard Source	**Hazard**
Hydrogen, methane, and acetylene	Gases are flammable.
Oxygen	Increases the flammability of combustibles.
Liquefied inert gases	Possible oxygen entrapment.
Extremely cold surfaces	Oxygen atmosphere may condense.

Follow these guidelines when working with cryogenic liquids:

- Keep equipment and systems extremely clean.
- Avoid skin and eye contact with cryogenic liquids. Do not inhale cryogenic vapors.
- Pre-cool receiving vessels to avoid thermal shock and splashing.
- Use tongs to place and remove items in cryogenic liquid.
- When discharging cryogenic liquids, purge the line slowly. Only use transfer lines specifically designed for cryogenic liquids.
- Rubber and plastic may become very brittle in extreme cold. Handle these items carefully when removing them from cryogenic liquid.
- Store cryogenic liquids in double-walled, insulated containers (e.g., Dewar flasks).
- To protect yourself from broken glass if the container breaks or implodes, tape the exposed glass on cryogenic containers.
- Do not store cylinders of cryogenic liquids in hallways or other public areas.

IMPORTANT: Be aware of the tremendous expansion and threat of asphyxiation when a cryogenic liquid vaporizes at room temperature.

8.8 Electrophoresis

Electrophoresis equipment may be a major source of electrical hazard in the laboratory. The presence of high voltage and conductive fluid in this apparatus presents a potentially lethal combination. Even a standard electrophoresis operating at 100 volts can deliver a lethal shock at 25 milliamps. A slight leak in the device tank can result in a serious shock. Use appropriate precautions to protect yourself from the hazards of electrophoresis and electrical shock.

8.9 Ultraviolet Light

Ultraviolet light (UV) is non-ionizing radiation in the 180 to 400-nanometer wavelength region of the electromagnetic spectrum. The ultraviolet spectrum is commonly divided into the following three regions:

Region	Region Name	Wavelength (nm)
UVA	Black Light	315-400
UVB	Erythermal	280-314
UVC	Germicidal	180-280

Exposure to ultraviolet radiation is typically limited to the UVA region resulting from exposure to direct sunlight. There are several sources of UV radiation in the laboratory including germicidal lamps in biological safety cabinets, nucleic acid transillumination boxes, nucleic acid crosslinkers and UV lasers. Some equipment can generate concentrated UV radiation in all the spectral regions that, if used without the appropriate shielding and personal protective equipment, can cause injury with only a few seconds of exposure.

A. Hazards associated with exposure to ultraviolet light

Symptoms of overexposure include varying degrees of erythema (sunburn) or photokeratitis (welder's flash) typically appear hours after exposure has occurred.

Skin Injury
UV radiation can initiate a photochemical reaction called erythema within exposed skin. This "sunburn" can be quite severe and can occur as a result of only a few seconds exposure. Effects are exaggerated for photosensitized skin. Chronic skin exposure to UV radiation has been linked to premature skin aging, wrinkles and skin cancer.

Eye Injury
UV radiation exposure can injure the cornea, the outer protective coating of the eye. Photokeratitis is a painful inflammation of the eye caused by UV radiation-induced lesions on the cornea. Symptoms include a sensation of sand in the eye that may last up to two days. Chronic exposures to acute high-energy UV radiation can lead to the formation of cataracts.

B. Special work practices
Never allow the skin or eyes to be exposed to UV radiation sources. The UV radiation generated by laboratory equipment can exceed recommended exposure limits and cause injury with exposures as brief as three seconds in duration.

1. Biological Safety Cabinets**:** Never work in a biological safety cabinet while the UV lamp is on. Close the sash while lamp is on. Turn off after 15 minutes.
2. Transilluminators**:** Never use a transilluminator without the protective shield in place. Shields must be kept clean and replaced when damaged.
3. Crosslinkers**:** Crosslinkers must not be used if the door safety interlock is not working.

C. Equipment labeling
Any equipment that emits UV radiation must be conspicuously labeled with a caution label. The label should contain language similar to:

CAUTION
UV RADIATION HAZARD
USE ONLY WITH SHIELDING IN PLACE
PROTECT EYES AND SKIN FROM EXPOSURE TO UV LIGHT

D. Personal Protective Equipment
Protective Clothing
Wear standard laboratory apparel including a fully buttoned lab coat, long pants and closed toe shoes. While working with UV radiation sources, prevent gaps in protective clothing that commonly occur around the neck and wrist areas.

Eye/Face Protection
If there is any potential for the eyes and face to be exposed to UV radiation, a polycarbonate face shield stamped with the ANSI Z87.1-1989 UV certification must be worn to protect the eyes and face. Ordinary prescription eyeglasses may not block UV radiation. UV certified goggles and safety glasses will protect the eyes, but it is common for lab workers to suffer facial burns in the areas not covered by the goggles or glasses.

Gloves
Wear disposable nitrile gloves to protect exposed skin on the hands. Ensure wrists and forearms are covered between the tops of gloves and the bottom of the lab coat sleeves.

E.

8.10 Glassware

Glass breakage is a common cause of injuries in laboratories. Only glass in good condition should be used.

Handling of glassware

1. Discard or send for repair all broken, chipped, starred or badly scratched glassware. Hand protection should be used when picking up broken glass.
2. Clean all glassware before sending for repair.
3. When using glass tubing, all ends should be fire polished. Lubricate tubing with glycerin or water before inserting into rubber stoppers or rubber tubing.
4. Protect hands with leather gloves when inserting glass tubing. Hold elbows close to the body to limit movement when handling tubing.
5. Do not store glassware near the edge of shelves. Store large or heavier glassware on the lower shelves.
6. Use glassware of the proper size. Allow at least 20% free space. Grasp a three-neck flask by the middle neck, not a side neck.
7. Conventional laboratory glassware must never be pressurized.

Disposal of broken glassware

Inspect all glassware before use. Do not use broken, chipped, starred or badly scratched glassware. All broken glass, whether contaminated or uncontaminated, shall be disposed in rigid, puncture proof containers such as a cardboard box with taped seams, or a plastic bucket or metal can with a sealing lid. All broken glass disposal containers shall be clearly marked "DANGER - BROKEN GLASS" Limit quantities to no more than approximately 15 to 20 pounds so that lifting of the container will not create a situation that could cause back injury.

1. Radioactive glassware: Contact the RSO for specific instructions.
2. Glassware with biological contamination: Glassware that has been in contact with infectious agents may include: used slides, cover slips, test tubes, beakers, pipettes, etc. Contaminated glassware shall be disinfected before disposal. Dispose in a rigid, puncture proof container such as a box with sealed or taped edges or a metal or thick plastic can or bucket with a sealing lid. Label container "DANGER - BROKEN GLASS". Contact EHS if you require further information.
3. Glassware with chemical contamination: Empty the contents of the glassware into a suitable container if safe to do so. Contact EHS for assistance with decontamination and disposal of the contaminated glassware.

Section 9: Oceanographic Center Laboratory-Research and Teaching Safety Plan and Procedures

9.1 Research Laboratory

Care must be used when handling any chemicals, specimens, or equipment in the laboratory. Users are responsible for being familiar with and following correct safety practices while working in the laboratory.

1. Work carefully and cautiously, using common sense and good judgment at all times.
2. Identify the location of all exits from the laboratory and from the building.
3. No sleeveless tops or shorts are permitted. Legs and midriffs must be covered with protective clothing while working in the laboratory. Lab coats are required.
4. Be familiar with the location and proper use of fire extinguishers, fire blankets, first aid kits, spill response kits, and eye wash stations in each laboratory.
5. Report all significant injuries, spills, breakage of glass or other items, unsafe conditions, and accidents of any kind to your PI immediately.
6. Keep sinks free of paper or any debris that could interfere with drainage.
7. Lab benches must be clear of all items that are not necessary for the lab exercise.
8. Wash hands and laboratory equipment/vessels with the appropriate cleaning agents after every use. **Do not leave glassware in the sink overnight.**

Sharp Objects and Broken Glass

1. Pointed dissection probes, scalpels, razor blades, and scissors must be used with great care, and placed in a safe position when not in use.
2. Containers designated for the disposal of sharps (scalpel blades, razor blades, needles; dissection pins, etc.) and containers designated for broken glass are present in the laboratory. Never dispose of any sharp object in the regular trash containers.
3. The first aid kit contains antiseptics, bandages, and Band-Aids to care for minor cuts.
4. Do not touch broken glass with bare hands. Put on gloves and use a broom and dustpan to clean up glass. Dispose of ALL broken glass in the sharps container. **Do not place broken glass in the regular trash.**

Noxious Chemicals

1. Safety Data Sheets (SDS) are available in lab. In case of a spill, an accident or a safety question, users can find chemical safety information in the SDS.
2. Notify the lab manager of any noxious chemical spills immediately. Users should wear protective gloves when using noxious chemical (e.g. ethidium bromide).
3. Only water is to be poured down the sinks; all chemical solutions should be collected in labeled waste containers and logged on the disposal data sheets.
4. Acids must be used under the hood.

Preserved Biological Samples

1. Scraps of biological samples are NOT to be disposed in the sink.
2. All biological samples are to be clearly labeled and stored in designated containers and storage cabinets.

Lab Cleanliness, Organization and Appearance

It is important to keep the overall appearance of the lab in an organized and clean condition.

1. The entire lab is to be kept clean at all times within the context and needs of ongoing research.
2. Do not leave unused instrumentation on bench tops in a haphazard manner. Please store all pippetors and boxes/containers not in immediate use in an organized manner.
3. Lab decorations (pictures, stickers) should not in general be placed in the laboratory setting.

9.2 Teaching Laboratory

Care must be used when handling any chemicals or equipment in the laboratory. Users are responsible for being familiar with and following correct safety practices while working in the laboratory.

1. Work carefully and cautiously, using common sense and good judgment at all times.
2. EATING, DRINKING, AND SMOKING ARE PROHIBITED in the laboratory.
3. Long hair must be tied back during laboratory work.
4. Open toed shoes are prohibited.
5. No sleeveless tops or shorts are permitted. Legs and midriffs must be covered with protective clothing while working in the laboratory. Lab coats are required.
6. Identify the location of all exits from the laboratory and from the building.
7. Be familiar with the location and proper use of fire extinguishers, fire blankets, first aid kits, spill response kits, and eye wash stations in each laboratory.
8. Report all injuries, spills, breakage of glass or other items, unsafe conditions, and accidents of any kind, no matter how minor, to the lab manager immediately.
9. Keep sinks free of paper or any debris that could interfere with drainage.
10. Lab benches must be clear of all items that are not necessary for the lab exercise.
11. Wash hands and laboratory equipment/vessels with the appropriate cleaning agents after every use. Do not leave glassware in the sink

Sharp Objects and Broken Glass

1. Scalpels, razor blades, and scissors must be used with great care, and placed in a safe position when not in use.
2. Containers designated for the disposal of sharps and containers designated for broken glass are present in the laboratory. Never dispose of any sharp object in the regular trash containers.
3. The first aid kit contains antiseptics, bandages, and Band-Aids to care for minor cuts.
4. Do not touch broken glass with bare hands. Put on gloves and use a broom and dustpan to clean up glass. Dispose of ALL broken glass in the broken glass container. Do not place broken glass in the regular trash.
5. When cutting with a razor blade, scalpel or other sharp instrument, forceps should be used to help hold the specimen. Never use fingers to hold the specimen while cutting.

Lab Cleanliness, Organization and Appearance

It is important to keep the overall appearance of the lab in an organized and clean condition.

1. The entire lab is to be kept clean at all times within the context and needs of ongoing

research.

2. Do not leave unused instrumentation on bench tops in a haphazard manner. Please store all pipettors and boxes/containers not in immediate use in an organized manner.
3. Lab decorations (e.g., pictures, stickers) should not in general be placed anywhere in the laboratory setting.

Section 10: Emergency Information

All labs using chemicals are required by OSHA to have a Chemical Hygiene Plan (CHP) in place for chemical workers. It is the responsibility of the lab supervisor/PI to ensure that a complete Chemical Hygiene Plan is developed, implemented and shared with all their affected workers. **As applicable, please provide information regarding emergency procedures and equipment specific to the lab(s) under your supervision. Where applicable you may just reference the emergency contact information on your lab door placards.**

A. Evacuation Procedures

During various emergency situations (fire, explosion, bomb threat, etc.) it will be necessary to evacuate the building. Everyone will be instructed to leave the building through the nearest exit and get away from the building. Individuals with mobility impairments should be assisted into the nearest stairwell in the building. Immediately notify the police or fire department if a disabled individual is waiting on a stairwell landing and provide them with the location. Public Safety is responsible for sweeping parts of the building to be sure everyone has evacuated and moved away from the building. During evacuation the building is considered closed; Public Safety should be called if/when patrons refuse to leave the building.

B. First-aid Kits

Every laboratory should contain a first aid kit which should contain: sterile gauze, adhesive tape, adhesive bandages in several sizes, elastic bandage, antiseptic wipes, antibiotic cream (triple-antibiotic ointment), acetaminophen or ibuprofen, calamine lotion, alcohol wipes or ethyl alcohol, plastic gloves (at least 2 pairs), and band-aids.

The PI and/or lab manager is responsible for restocking the first aid-kit.

C. Spill Cleanup Materials

Chemical Spill Cleanup Procedures

You should NOT clean up a spill if:

- You don't know what the spilled material is
- You lack the necessary protection or equipment to do the job safely
- The spill is too large to contain
- The spilled material is highly toxic
- You feel any symptoms of exposure

Instead contact NOVALERT: **954-262-8999**.
Call **9-911** if spill is immediately health-threatening.

Spill Response Scheme

1. Evaluate and notify your instructor/principal investigator!
   - Assess the toxicity, flammability, or other properties of material (see label and SDS).
   - For flammables, remove or turn off all ignition sources such as motors, pumps, fridges.
   - Determine if there is an immediate health threat to you or your neighbors if so, alert neighbors, isolate the area and call for help using the numbers above.
   - If spill is minor, begin cleanup following steps below.

2. Containment/Cleanup
   - Don chemical resistant gloves, eye protection, lab coat, etc.
   - Contain and absorb spill using absorbents appropriate for the material.
   - Protect floor drains from contamination, by putting absorbents or barriers around them.
   - Package and label waste. Include contaminated clothes, rags, equipment, etc.
   - Store temporarily in a fume hood if material is volatile.

3. Follow-up
   - Send Hazardous Materials/Waste Pickup Request to Supervisor.
   - Reorder and restock cleanup materials used.
   - Inform NOVALERT if there were any personnel exposures, or release to the drain system.

D. Fighting Small Fires Safely

In the event of a small fire:

1. Call the fire department (9-911) even if the fire is extinguished.
2. Feel closed doors– if it is hot, leave the door closed. Put towel or shirt in crack to confine smoke. If the door is cool, open it a crack to see if the fire is confined and small enough to fight safely.
3. Select the right type of extinguisher for the specific type of fire.

Labs are equipped with one, or both, of two types of extinguishers: **carbon dioxide and dry powder.** Carbon dioxide extinguishers are distinguished by their flared hoses, versus dry chemical ones which have a straight hose. Also, dry powder extinguishers have a pressure gauge—carbon dioxide extinguishers do not.

All fires and uses of fire extinguishers **must** be promptly reported to 9-911, even if the fire is out. Note, once activated, an extinguisher will slowly leak away its propellant, thus rendering the extinguisher useless. Call to have it properly recharged.

- **Class A:** Ordinary combustibles, such as wood, paper, cloth, rubber, and many plastics.
  Proper Extinguishers:
  - Dry chemical
  - Pressurized Water (corridor)
- **Class B:** Flammable or combustible liquids or gases.
  Proper Extinguishers:
  - Dry chemical
  - Carbon dioxide
- **Class C:** Energized electrical equipment. Cut the power source. Do not use water on such fires unless the equipment has been unplugged.
  Proper Extinguishers:
  - Dry chemical
  - Carbon dioxide
- **Class D** Combustible metals. Do not attempt to extinguish with ordinary fire extinguishers.
  Proper Extinguishers:
  - Special Class D extinguisher (generally yellow and labeled "For Metal Fires Only". If these are unavailable attempt to smother the fire with dry sand).

<u>Procedure for using Fire Extinguishers:</u>

1. Always stay between the fire and your exit when using extinguishing equipment.
2. Never turn your back on the fire - step backwards. If possible, have someone watch your back.
3. Aim the extinguisher or fire hose at the base of the fire, sweeping across the fire in a side to side motion. Start 8-10 feet back from fire.

4. Continue to spray even after the fire is out to soak the burning material.
5. Stay as low as possible, out of the heat and smoke.
6. In case clothing catches fire, the best thing to do is to stop, drop to the ground and roll.
7. Have extinguisher recharged after use

E. Other

Per campus policy, all significant **injuries must be documented** via an Incident Report to NOVALERT (954-262-8999) as soon as possible. This is necessary for potential reimbursement for personal medical costs, or Worker's Compensation Claims.

NOVALERT (954) 262-8999

Medical Help

Call 9-911 and give Emergency Personnel:

1. Your EXACT location - what building, floor, etc
2. The type of injury (bleeding, fracture, etc.)
3. Your name
4. Stay on the line
   Police or fire personnel will request that you wait. Help will be sent, and then you will be asked for additional information.

If Rendering Help to the Injured

1. Do not move the victim (unless in a dangerous area).
2. Restore breathing and/or heartbeat - (CPR if trained).
3. Keep others away from the victim.
4. Stop the bleeding.
5. Know your own limitations on type of aid to render
   DO NOT OVERREACT!

In the Event of a Fire

Pull the nearest fire alarm, call 9-911 for the fire department and give them your location and the following information;

1. The exact location of the fire
2. Type of fire - trash can, smoke, flames, etc.
3. Your name

Take residents, class, team, etc. away from the building within a safe secure distance and keep them together! **BE SURE ALL ARE ACCOUNTED FOR!**

Per Broward County Fire and campus policy, **all fires must be reported to 9-911 immediately** – even if the fire is out. This is particularly true if there is use of an extinguisher (must be replaced); an injury; or property damage.

When a Police Officer is Needed

1. Phone 9-911 (if emergency)
2. Give police -

- The exact location
- Type of problem (disturbance, vandalism, etc.)
- Your name

3. Keep other persons away from the scene
4. DO NOT touch or disturb anything
5. If possible, get a description of suspect, vehicle, etc.
6. Attempt to keep others safe and calm
7. Call NSU Public Safety

Section 11: Laboratory Safety Audit Checklist

Requirements	Yes	No	N/A
Hazardous Communication			
Are entrances marked with emergency contact number(s), NFPA diamond, and other caution signs?			
Do the lab personnel know how to access safety data sheets?			
Are all chemical containers marked with contents name and hazards?			
Are all the cylinders marked to clearly identify the gas contained?			
Are all the cylinders stored in areas protected from external heat sources?			
Are empty compressed gas cylinders appropriately marked?			
Are gas cylinders secured properly?			
Non explosion proof Refrigerator/Freezer appropriately labeled “Do Not Store Flammable Chemicals”?			
Exposure Control			
Is there an emergency eye wash and shower within the immediate work area where employees are exposed to corrosive materials?			
Are the emergency eye wash and shower accessible and not blocked?			
Is the eye wash flushed weekly?*			
Is the chemical inventory up-to-date?			
Are all the fume hoods and biosafety cabinets certified for proper/adequate flow rate and face velocity?			
Are doors leading to the corridors closed?			

Is the lab furniture suitable and can be wiped clean (no cloth)?			
Are fire extinguishers accessible, wall-mounted and annually certified?			
Is the amount of material in the fume hood minimal?			
Personal Protective Equipment			
Appropriate PPE used [lab coat, gloves, approved eye protection, adequate shoes (no sandals)]?			
Is personal protective equipment maintained in a sanitary condition?			
Are respirators used in the lab? Are staff members medically cleared and trained?			
Hazardous Materials Storage & Handling			
Are all flammable liquids kept in closed containers when not in use?			
Are all spilled materials or liquids cleaned up immediately?			
Are peroxide-forming chemicals dated when opened (ethers)?			
Is secondary containment used when necessary?			
Is general housekeeping used?			
Are all flames attended?			
Are employees prohibited from eating in areas where hazardous chemicals are present?			
Waste Management			
Is each hazardous waste container kept closed, except when adding or removing waste?			
Is each accumulation container labeled with the words “Hazardous Waste”?			
Is each accumulation container labeled with NSU’s yellow hazardous waste sticker?			
Are hazardous waste containers in good condition?			
Are hazardous waste containers and areas where they are stored, inspected for leaks at least weekly?			
Are needles, razor blades, broken glass, and pipettes disposed of in an approved sharps container or broken glass box?			
Emergency Procedures			

Is the necessary emergency equipment available (fire extinguishers, spill control supplies, first aid kit)?			
Is there an emergency evacuation plan posted in the lab?			
Is emergency information posted near a telephone?			
Do lab personnel know the proper procedures if an injury/incident occur?			
Do lab personnel know how to contact Environmental Health and Safety?			
Have the lab personnel completed the EHS training modules on blackboard?			
Are training records available? (Copies should be available in the lab)			
Is a sign bearing the radiation caution symbol and the words “CAUTION: RADIOACTIVE MATERIALS” posted as required in areas with radioactive material?			
Are containers containing radioactive material labeled as required?			

Additional resources:

*Eyewash log- https://www.nova.edu/ehs/forms/ehs_eyewash_inspection.pdf

APPENDIX A

QUICK REFERENCE FOR SPILL CLEAN-UP

1	Locate the appropriate spill clean-up kit.
2	Look to see if the kit has the correct contents and add any missing items: **Chemical** / **Mercury** / **Biological** Control pillow / Suction pump / Forceps Absorbents – vermiculite / Zinc powder / Paper towels Neutralizing agent / Sulfuric acid / Biohazardous bags Plastic scoops / Waste bags / Bleach Waste bags / Absorbent sponge 5 gallon container / Plastic vial Signs and barricade tape
3	**Materials required for working with the different kinds of spills:** Type of Spill — Neutralizing Agent / Clean up supplies **Acid** — **Sodium bicarbonate** **Bases** — **Citric Acid** **Organic Solvents** — **Absorbent pads, charcoal if available** **Mercury** — **Amalgam sponges or zinc powder** **Metals e.g., sodium** — **Sand, Class D fire extinguishers** **Biological** — **Bleach**
4	Wear the correct personal protective equipment – gloves (nitrile or rubber), gown (chemical resistant), protective eyewear and a mask.
5	If the spill is in a common area, seal off the area with barricade tape or warning signs.
6	If splashing is anticipated, protect the face with a face shield or mask.
7	Depending on the type of spill; for chemicals neutralize and absorb with vermiculite, mercury requires suction and biological spills need the spill to be decontaminated.
8	For biological spills wait 20 minutes before proceeding.
9	Dispose of all contaminated materials in the correct waste bags.
10	Chemical and mercury require an additional step. Chemical have to be absorbed after being neutralized and mercury requires sulfuric acid.
11	Disposal of all materials either in waste or biological bags.
12	Chemical and biological spills should be washed with water after the spill is removed, while the mercury spill requires that the dried sulfuric acid be swept up.
13	Dispose of all personal protective equipment in the correct waste containers.
14	Wash hands thoroughly.