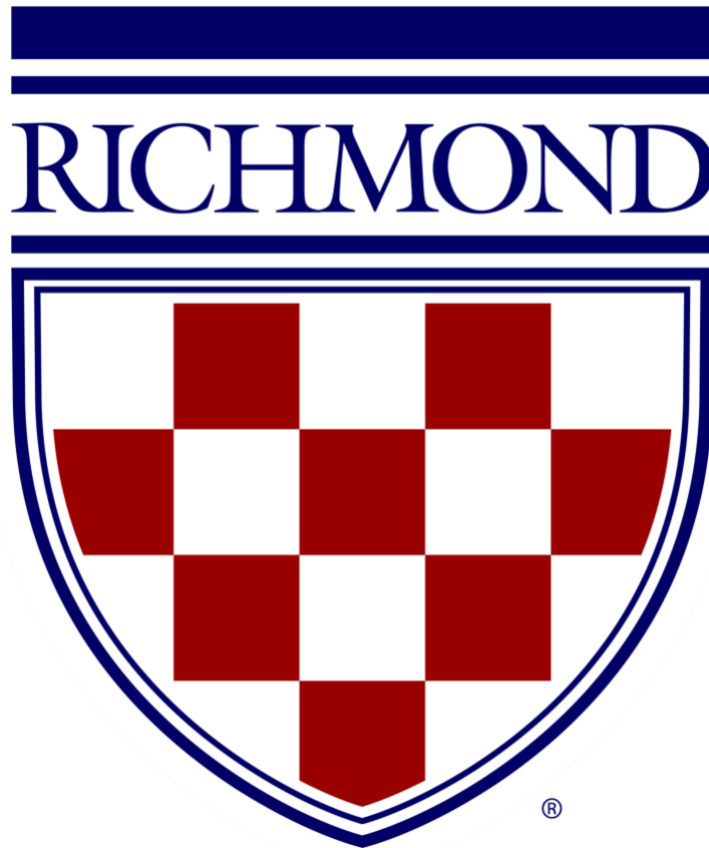


# UNIVERSITY OF RICHMOND

## Chemical Hygiene Program



## **Overview**

### **Policy**

The University of Richmond is committed to fostering a safe and healthful working environment for faculty, staff, and students. This Chemical Hygiene Plan includes policies, procedures, and responsibilities designed to promote awareness of potentially hazardous chemicals in the workplace and encourage safe work practices in the laboratory. This includes not only the use of chemicals in the laboratory, but also lab-specific safety hazards.

### **Scope**

This program applies to all University of Richmond faculty, staff, and students who perform operations in the company's research, teaching and academic laboratories. This document will serve as the University of Richmond's written Chemical Hygiene Program (CHP).

### **Applicable Regulations**

- 29 CFR 1910.1450 – Occupational Exposure to Chemical Hazards in the Laboratory
- 29 CFR 1910.1200 – Hazard Communication
- 29 CFR 1910.1000 - Air Contaminants

### **Additional References**

National Research Council's (NRC) "Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards", 2011 edition

## Table of Contents

Overview .....	2
Definitions .....	4
General Laboratory Procedures .....	8
Standard Operating Procedures .....	9
Chemical Inventory and Storage .....	10
Chemical Handling.....	13
Control Measures and Exposure Monitoring.....	14
Particularly Hazardous Chemicals.....	15
Personal Protective Equipment.....	16
Safety Data Sheets.....	18
Training .....	19
Labeling and Signage .....	20
Medical Consultation.....	21
Emergency Response.....	22
Recordkeeping .....	22
Annual Program Review .....	23
Appendices .....	24
Appendix A: Standard Operating Procedures.....	25
Appendix B: Hazardous Materials Spill Response.....	26
Appendix C: Hazardous Waste Procedures.....	27
Appendix D: Laboratory Door Signs .....	30
Appendix E: Personal Protective Equipment .....	31
Appendix F: Electronic SDS System.....	32

## Definitions

*Hazardous Chemicals* means any chemical which is classified as a health hazard, simple asphyxiate or physical hazard.

*Health Hazards* include chemicals which are carcinogens, toxic or highly toxic agents, reproductive toxins, irritants, corrosives, sensitizers, hepatotoxins, nephrotoxins, and neurotoxins, agents which act on the hematopoietic system and agents which damage the lungs, skin, eyes or mucous membranes.

*Laboratory Use* includes the handling of chemicals in which all of the following conditions are met:

- I. Chemical manipulations on a “laboratory scale;”
- II. Multiple chemical procedures are used;
- III. The procedures conducted are not part of a production process nor do they simulate a production process; and
- IV. Protective laboratory practices and equipment are available and in use to reduce employee exposure to chemicals

*Laboratory Scale* means work with substances in which the containers used for reactions, transfers, and other handling of substances are designed to be easily and safely manipulated by one person.

*Safety Data Sheet (SDS)* means written or printed material concerning a hazardous chemical. These are developed by the manufacturer of the chemical.

*Physical Hazards* means a chemical that is classified as posing one of the following hazardous effects: Explosive; flammable; oxidizer; self-reactive; pyrophoric; self-heating; oxidizers; corrosive to metal; gas under pressure; when in contact with water emits flammable gas; or combustible dust.

## Responsibilities

### **Director of Environmental Health and Safety**

The Director of Environmental Health and Safety (EHS) has the responsibility of oversight for this plan. The Director of EHS will serve as the Chemical Hygiene Officer for the University of Richmond. As the Chemical Hygiene Officer, the Director of EHS retains responsibility for implementation and continued effectiveness of the Chemical Hygiene Plan. This includes the following:

<b>Written Chemical Hygiene Plan</b>
Develop and implement this Chemical Hygiene Plan.
Ensure that all faculty and staff comprehend the requirements set forth in the Chemical Hygiene Plan.
Report any violations of the Chemical Hygiene Plan to the appropriate University personnel, e.g., Department Head and/or the Chemical Safety Committee.
Audit the program at least annually to ensure continued effectiveness.
Produce copies of the Chemical Hygiene Plan upon request by any faculty, staff or regulatory agency.
Establish and maintain for 30 years records regarding any exposure assessments or medical consultations in accordance with 29CFR1910.1020.
Conduct assessments of chemical exposures to ensure levels are below those of the OSHA Permissible Exposure Limits.
Determine and implement control measures to reduce employee exposures. Ensure that these control measures are functioning properly.
Assist faculty and staff with selection of appropriate Personal Protective Equipment.

<b>Hazard communication requirements</b>
Maintain the central chemical inventory for all hazardous chemicals.
Maintain a master set of current Safety Data Sheets (SDSs) for laboratory operations.
Obtain new and updated Safety Data Sheets from suppliers for all hazardous laboratory chemicals. Review these SDSs to determine hazards and the need for additional training and/or controls.
Produce copies of SDSs and of the Chemical Hygiene Plan upon request by any faculty, staff, students or regulatory agency.
Make the SDSs available to emergency services during an emergency involving a chemical.
Follow up with suppliers when SDSs are not received or are found to be inadequate.

<b>Standard Operating Procedures</b>
Develop Standard Operating Procedure relevant to safety and health considerations for laboratory processes involving the use of hazardous chemicals.
Monitor Chemical Hygiene Plan activities to ensure that they are being properly implemented and procedures are being followed after implementation.

<b>Employee Training</b>
Assist Deans, Directors and Heads of Units ensure that all employees have received the appropriate training for the use of hazardous materials and for laboratory.

## **Deans, Directors, and Heads of Academic and Administrative Units**

Deans, Directors and Heads of Academic and Administrative Units have a primary responsibility in providing for the health and safety of their faculty, staff, students, and visitors, and ensuring that work activities do not violate health, safety or environmental standards. Management responsibilities include:

- Establish environmental, safety, and regulatory compliance as a unit priority.
- Support participation in and activities of the Chemical Safety Committee.
- Strive to provide adequate resources to meet safety and regulatory needs.
- Implement programs to assure compliance with applicable EHS rules and regulations.
- Ensure that laboratory safety training is completed by all incoming faculty, staff and students who will work in a laboratory where biological, chemical or radiological materials are used. (See Training section.)

## **Principal Investigators (PIs) and Lab Supervisors**

Principal Investigators (PIs) and Lab Supervisors have specific responsibilities toward providing a work environment free from environmental, health and safety hazards for those supervised.

The PI/Lab Supervisor must:

- Ensure that laboratory staff are adequately trained
- Ensuring that basic lab safety training is completed by EHS or on-line.
- Conducting task-specific laboratory safety training for staff (See Training section.)
- Provide information about relevant environmental, health, and safety rules, regulations, standards, or practices.
- Assure that required safety-related equipment and personal protective devices are provided, maintained, and used.
- Take prompt action when unsafe acts or hazardous conditions are reported or noted.
- Provide or arrange for environmental, health, and safety training and education as needed.
- Promptly investigate and report to the Director of EHS all on-the-job accidents and/or job-related health problems and requesting medical treatment, if needed.
- Promptly report to the Director of EHS any spills or releases to the environment or any observed illicit environmental actions.
- Taking prompt action to prevent and clean up spills to the environment. Encourage and train laboratory workers to use recommended best management practices to prevent and reduce EHS risks on campus.
- Request the assistance of the next higher level of supervision regarding budget requests for environmental, health, and safety improvements.

## **Laboratory Personnel**

Laboratory Personnel (Faculty, Staff, Students) are responsible for complying with existing environmental, health and safety rules, regulations, and standards. Employee responsibilities include:

- Following all applicable environmental, health, and safety regulations, standards, campus plans, or policies.
- Wearing or using required safety-related equipment and personal protective devices.
- Refraining from operating any mechanical equipment that has the potential to harm personnel or the environment without proper instruction, training or authorization to safely use the equipment.
- Reporting unsafe acts or hazardous conditions to the supervisor.
- Attending prescribed environmental, health, and safety training and education.
- Reporting all on-the-job accidents and/or job-related health problems to the supervisor and requesting medical treatment, if needed.
- Reporting any spills or releases to the environment or any observed illicit environmental actions.
- Using recommended best management practices to prevent and reduce pollution to the environment.

## **Office of Environmental Health and Safety**

The Office of Environmental Health and Safety is committed to assisting campus units to identify and manage biological, chemical, and radiological hazards. EHS responsibilities include:

- Providing periodic laboratory inspections at least once per calendar year.
- Providing advice and technical assistance in using these hazardous chemicals safely.
- Facilitating the campus community's understanding of and compliance with required regulations.
- Developing, implementing, and overseeing comprehensive safety programs and policies, in partnership with campus safety oversight committees. Unit heads and supervisors remain responsible for promoting safety and ensuring regulatory compliance in their research area. Such programs are designed to:
  - Ensure the health and safety of faculty, staff, students, and visitors.
  - Protect the environment.
  - Facilitate compliance with regulatory requirements.

## General Laboratory Procedures

These General Laboratory Safety Procedures (SOPs) represent a minimum set of guidelines for the handling of hazardous chemicals on campus. Individual laboratories or units are expected to develop more detailed Standard Operating Procedures as their situations warrant. Rules or SOPs that apply to all laboratories on campus include the following:

**Apparel:** Appropriate personal apparel must be worn in the laboratory. In particular, loose-sleeved shirts and blouses should be avoided as should sandals and open-toed footwear of any type.

**Accident response:** If an injury requiring emergency medical assistance has occurred, call Campus Police at 8911. All employee injuries should be reported immediately to the supervisor. Supervisors must fill out a Supervisor's First Report of Injury form and forward it to Risk Management within 24 hours.

**Chemical spills:** If a toxic/hazardous chemical has made contact with the skin, start flushing the area immediately. If emergency assistance is required, call Campus Police at 8911. Spills must be cleaned up immediately and under the guidance of laboratory supervisor if and only if clean up can be done safely and the following circumstances exist:

- Less than 500 ml
- Familiarity with the hazards and properties of the spilled material.
- Sufficient supplies for clean-up and containerization, including personal protective equipment.
- Adequate ventilation.

See Appendix B for more information on hazardous materials spill response.

**Children and unauthorized persons:** Children and other unauthorized persons should not be in laboratories where hazardous materials or hazardous equipment are being used.

**Disposal of chemicals:** Procedures for proper disposal of hazardous chemicals are found in Appendix C.

**Electrical:** Access to electrical equipment (e.g. plugs, switches and electrical panels) should be maintained free from obstructions to allow immediate access in an emergency. All receptacle outlets in laboratory spaces should be the polarized grounding type. Ground Fault Circuit Interrupters (GFCI's) should be used in those locations involving wet processes or outdoor work, including electrical outlets within six feet of sinks. All electrical hand tools used inside laboratories should be grounded or double insulated.

All electrical extension cords used should be visible and inspected on a periodic basis for damage and/or defects. Cords should not run in aisles or corridors where they might be damaged or create a tripping hazard. Cords should not be run through doors, walls or partitions, under rugs, or above dropped ceilings. They should not be wrapped around fixtures, tied in knots, or draped over pipes, lights, or ventilation ductwork.



Extension cords should not be used as substitution for fixed receptacle outlets. Cords used for 110-120 volt service should be UL listed standard heavy-duty three-wire equipped with a polarized three prong plug. Two-wire type extension cords should not be used.

**Emergency eye wash/safety showers:** Be certain safety showers/emergency eye washes are properly located and maintained. These units should be located in areas which will be immediately accessible (reachable within 10 seconds). There should be no obstructions that might inhibit the use of this equipment.

Eye washes and safety showers will be flushed and tested annually by the Office of EHS. The eye washes should also be flushed weekly by laboratory personnel to verify that the units are working and to clear the lines of stale water and debris.

Whenever these emergency units are checked for proper functioning, written documentation shows the date and person's initials performing the check should be maintained.

**Equipment:** Use proper equipment that is in good condition. For example, never use chipped or cracked glassware. Shield pressurized or vacuum apparatus and safeguard against bumping or overheating. All laboratory equipment shall be used only for its intended purpose. Storage or cooking of edible items in the laboratory equipment is strictly prohibited.

**Fire extinguishers:** Fire extinguishers should only be used by individuals who have received training. No one is required to use a fire extinguisher. There should be no obstructions that might inhibit the use of this equipment. Make sure that all extinguishers are checked annually. Each extinguisher should have a tag indicating the date it was last checked. Contact the EHS Fire Safety Specialist at 804-287-6886 for assistance with fire extinguishers.

## Standard Operating Procedures

**Food, drink, cosmetics, smoking:** Eating, drinking and the application of cosmetics are forbidden in areas where hazardous chemicals are used and should be done only in well-defined, designated non-chemical areas. Do not store food in the same refrigerator with chemicals, biohazards or radioactive materials. Smoking is not permitted in areas where hazardous chemicals are used or stored. If you have been using chemicals, be sure to wash your hands before eating, drinking, smoking or applying cosmetics.

**Horseplay:** Practical jokes or other behavior which might confuse, startle, or distract, another worker is forbidden when hazardous chemicals are present.

**Housekeeping:** Good housekeeping, cleanliness and neatness are of paramount importance to maintain a safe laboratory environment. Individual employee/student responsibility for maintaining a safe and clean work area should be emphasized by the laboratory supervisor or designate. Good housekeeping includes:

- All working surfaces shall be cleaned on a regular basis.
- Exits, aisles and safety equipment must NOT be obstructed in any way with equipment, furniture, or other items.

- Work areas and floors are not to be used for excessive storage. Chemicals shall not be stored on floors.
- Aisles within the laboratory should be 36 inches in clear width.
- Doors which are not in use but which are accessible from a corridor or adjacent room should be appropriately labeled if they are blocked on the interior of the room.
- Hallways are not to be used as storage areas unless approved by the Office of EHS.

**Mouth pipetting:** Mouth pipetting is forbidden.

**Signs:** Laboratories where hazardous materials or operations are present must place a Laboratory Door Sign at all entrances to the laboratory. Laboratory Door Signs are posted and reviewed periodically by the Chemical Hygiene Officer and Lab Supervisor. Information on the Laboratory Door Sign is found in Appendix D.

**Spill preparedness:** Before working with chemicals, assess potential spill hazards. Each laboratory worker should be familiar with general spill response procedures. General spill response procedures are found in Appendix B. Lab specific written protocols addressing spill response should be developed when extremely hazardous or large quantities of chemicals are used. See Appendix B for more detailed information.

**Unattended experiments:** If operations involving hazardous substances are carried out with no one present, it is the responsibility of the worker to design procedures to prevent the release of hazardous substances in the event of interruptions in utility services such as electricity, cooling water, and inert gas. Lights should be left on, and signs should be posted identifying the nature of the operation and the hazardous substances in use. Consideration should be made for secondary containment in the event of spillage or container breakage. If appropriate, arrangements should be made for other workers to periodically inspect the operation.

Similarly, if unattended experiments require the use of running water, the worker should develop procedures to make sure the experiment is checked periodically for water leaking from the system.

**Working Alone:** No solitary work is permitted in laboratories. A buddy system or means of ensuring the safety of the researcher must be used and the permission of the researcher.

## Chemical Inventory and Storage

### Procurement and Inventory

All chemicals for the Gottwald Center for the Sciences shall be received by the Stockroom Manager. The Stockroom Manager shall add the chemical to the laboratory inventory and ensure that the chemical is properly labeled before delivery to the laboratory. The Stockroom Manager shall also delete chemicals from the inventory as barcodes for empty containers are received from the laboratory.

The Stockroom Manager is responsible for maintaining a current chemical inventory for all laboratories. This inventory shall be provided to the Director of EHS at least annually.

## **General Chemical Storage**

In general, store chemicals and equipment in cabinets and on shelving designated for such storage. Such shelving may have a lip to prevent containers from sliding off.

- The amount of chemicals stored in the laboratory should be minimized to the lowest amount feasible to conduct routine operations.
- Chemicals shall not be stored on the floor and storage on bench tops should be minimal.
- Avoid storing material on top of cabinets or on shelves higher than five feet.
- All stored items must maintain a clearance of at least 18 inches from the sprinkler heads.
- Store heavy materials and more hazardous materials on lower shelves.
- Chemical storage in fume hoods should be limited.
- Chemical containers that are opened or damaged must be stored securely in secondary containers until the chemical can be transferred to a new container.
- Stored chemicals shall be inspected monthly for deterioration, container integrity, and proper disposal.
- Avoid storing chemical containers in hard-to-reach areas.
- Avoid storing chemicals in direct sunlight or near a heat source.
- Store volatile toxic or odoriferous chemicals in a ventilated cabinet.
- Label all chemical containers appropriately including date received and/or date opened.
- Consider the security needs for the materials.

## **Labels**

Make sure all labels on stored chemicals are legible. If a label is not legible, create a temporary label and request a replacement label from the Stockroom Manager.

## **Storage Containers**

- Make sure all chemical containers are of good integrity. If deteriorated containers are found, dispose of the chemical, or transfer it to a new container.
- Make sure that the container is appropriate for the chemical stored; for example, hydrofluoric acid must not be stored in glass and some oxidizers should not be stored in plastic containers.
- Waste halogenated solvents may not be stored in metal safety cans due to the potential for corrosion.
- Flammable materials, if removed from their original containers, should be stored in appropriate containers, such as safety cans or other Department of Transportation (DOT) approved containers.

## **Volatile chemicals**

Volatile chemicals should be stored in volatile storage cabinets (flammable liquid or acid cabinets), or temporarily in fume hoods when cabinets are unavailable. If volatile substances are stored in a hood, other uses of the hood should be restricted to activities compatible with the chemical and physical properties of the stored or used chemicals. When volatiles must be stored

in a cooled atmosphere, flammable material refrigerators, explosion-proof refrigerators or cold rooms designed for this purpose must be used.

## **Time-sensitive chemicals**

Certain chemicals have a limited shelf-life requiring special procedures. These chemicals should be ordered on an as-needed basis in quantities no greater than that anticipated for six-month use. Container sizes should be minimized, and containers should be inspected on a frequent basis dependent on the hazards. Procedures should be written into a laboratory's standard operating procedures. These chemicals include the following:

- Peroxidizable solvents, e.g., diethyl ether.
- Chemicals which decompose upon storage to form potentially dangerous pressures, e.g. formic acid.
- Chemicals which can become unstable upon storage, e.g. moist picric acid which can become explosive upon water-evaporation.

## **Segregation of Incompatibles**

Chemicals should be segregated by hazard classification. Once segregated by hazard class, chemicals may be stored alphabetically. Basic segregations should include:

**Acids** – Segregate from bases and store on lower shelves or in an acid-certified cabinet.

**Bases** – Segregate from acids. Store solutions of inorganic hydroxides in approved safety cans or cabinets.

**Cyanides** – Segregate from acids

**Oxidizers** – Store in a cool dry place away from flammable or combustible materials.

**Flammables** – Store in approved safety cans or cabinets.

**Water reactive chemicals** – Store in a cool dry place. Area shall be labeled with a sign reading “do not fight fire with water.”

**Pyrophoric chemicals** – Store in air-tight containers in a cool dry place.

**Peroxide formers** – Store in air-tight containers in a cool dry place. Label containers with receiving, opening, and disposal dates.

**Carcinogens/teratogens** – Store according to SDS or in accordance with chemical category, date, and ensure that all containers are properly labeled.

Laboratories with large numbers of hazard classifications may choose to further segregate chemicals.

## Chemical Handling

Hazards associated with chemicals and gases vary widely. Understanding the hazards associated with a compound and minimizing the quantity used and stored in the lab will decrease chance of injury.

### Compressed gases

- Use appropriate hand carts to move compressed gas cylinders.
- Gas cylinders should be capped and secured to a cart during transport.
- Highly toxic gases should not be moved through the corridors while classes are in session in the area.
- Always consider cylinders as full and handle them with corresponding care.
- Gas cylinders should be secured (e.g., strapped or chained in place) to reduce the chance of being knocked over.
- Gas cylinders should be stored in well-ventilated areas with their protective caps on.
- Do not store cylinders near heat or high traffic areas.
- Do not store flammables and oxidizers together.
- Segregate empty and full cylinders.
- Storage of large quantities of cylinders is allowed only in an approved gas cylinder storage area.

### Cryogenic liquids and low temperature operations

- Cryogenic liquids such as liquid nitrogen present the potential hazards of explosion from pressure build-up, embrittlement of structural materials, frostbite, and asphyxiation.
- Work areas must be well ventilated.
- Cryogenic liquids must be stored, shipped, and handled in containers that are designed specifically for this purpose.
- Glass Dewar flasks should be taped to avoid flying glass resulting from failure and shielding should be considered.
- Because of the extreme cold and splash hazards, skin protection and eye protection - preferably a face shield - should be worn when handling cryogenic liquids.
- First time users of cryogenic liquids should have direct supervision and instruction from an experienced user when attempting transfers from one container to another.

### Glassware

- Glassware shall be used and stored to minimize breakage.
- Do not use cracked, chipped, or badly scratched glassware at any time.
- When breakage occurs it shall be cleaned and disposed of in a broken-glass container immediately. Use gloves when picking up broken glassware to prevent cuts and chemical contamination.
- Protect hands with gloves when inserting tubing into stoppers.
- All evacuated glass apparatus shall be shielded to contain chemicals and glass fragments.

## **Transporting chemicals**

- When transporting chemicals within the building, use a cart or a bottle carrier.
- Close caps securely and never transport an open container.
- Follow proper glove hygiene so as not to contaminate common surfaces.

## **Transferring chemicals**

- Pour chemicals carefully.
- Never add water to concentrated acid; rather prepare dilute solutions by adding acid to water.
- Containers holding more than five gallons should be grounded when transferring flammable liquids. EHS does not recommend the use of larger volumes of hazardous chemicals within laboratories unless secondary containment is used.

# **Control Measures and Exposure Monitoring**

## **General Criterion**

Laboratory workers must not be exposed to substances in excess of the OSHA permissible exposure limits (PEL) or a more stringent limit adopted by the University of Richmond. An employee's workplace exposure to any regulated substance must be monitored if there is reason to believe that the exposure will exceed an action level or a PEL.

The laboratory supervisor must evaluate the nature of chemical exposures from laboratory procedures and determine when monitoring and other control measures are necessary. The supervisor is encouraged to contact the Director of EHS for assistance in this evaluation.

Evidence that air monitoring is necessary includes:

- OSHA standards that require initial monitoring such as methylene chloride
- Recommendations from the Safety Data Sheets
- Employee complaints of odors or illness associated with chemical use

## **Air Sampling**

Air sampling shall be arranged through the Director of EHS. Air sampling will be conducted according to established industrial hygiene practices.

## **Laboratory Fume Hoods**

Fume hoods are available in the University of Richmond labs. These will be utilized if the procedure exhibits any of the following characteristics:

- Airborne concentrations of chemicals that might approach the action level.
- Flammable vapors that might approach one-tenth of the lower explosion limit.
- Materials of unknown toxicity are used or generated, or

- The odor produced is annoying to laboratory occupants of adjacent units.

Hoods will be maintained in good working condition and will be inspected at least annually by EHS personnel. A record of these inspections will be maintained by the EHS office. A sticker will be posted on the fume hoods to indicate the date of testing and the air flow measured at the marked sash height on the day of testing.

Each fume hood should have a continuous monitoring device to ensure adequate hood performance. Alarm systems on the hoods shall not be tampered with and may be turned off only upon approval of the Director of EHS. Inadequate hood operations will be reported to the laboratory supervisor and a work order sent to the UR Physical Plant for corrective action. Deficient hoods will be prominently tagged out of service and not used until EHS has retested and certified proper fume hood function.

## **Particularly Hazardous Chemicals**

### **Special Procedures & Precautions**

The responsibility for approval of the acquisition and use of “particularly hazardous chemicals” rests with the Laboratory Supervisor. These materials include known or regulated carcinogens, reproductive toxins, and substances that have a high level of acute toxicity. Information regarding toxicity is available in the chemical’s SDS.

Should the University of Richmond laboratory plan to utilize any of these types of materials, pre-approval by the Laboratory Supervisor is required prior to the use. Certain materials including radioactive materials, recombinant DNA and certain bio-hazardous materials require prior internal (campus) or external approval. Questions concerning the need for approval should be directed to the Director of EHS.

Depending upon the materials, special precautions may be deemed necessary. This may include any or all of the following provisions:

- Establishment of a designated area for the operation.
- Signage and controlled access to the work area.
- Scheduling work for off-hours.
- Use of containment devices such as glove boxes.
- Planning for accidents and spills.
- Special storage and waste disposal practices.

# Personal Protective Equipment

## General

The Lab Supervisor is responsible for conducting hazard assessments and selecting appropriate personal protective equipment (PPE) for specific operations occurring in their laboratories. PPE selection should be included in the laboratory's standard operating procedures for each task.

When deciding on the appropriate PPE to wear when performing any operations or experiments, a number of factors must be taken into consideration such as:

- The chemicals being used, including concentration and quantity.
- The hazards the chemicals pose.
- The routes of exposure for the chemicals.
- The material the PPE is constructed of.
- The permeation and degradation rates specific chemicals will have on the material.
- The length of time the PPE will be in contact with the chemicals.

Careful consideration should be given to the comfort and fit of PPE to ensure that it will be used by laboratory personnel.

Laboratory workers shall use PPE that is clean and in good working condition. Where PPE is assigned to the individual, he or she will ensure that it is maintained in a clean and sanitary fashion and is stored in a location where it cannot be damaged.

## Eye and Face Protection

Faculty, staff, and students shall wear appropriate eye and face protection whenever there is a potential for exposure to hazards from flying particles, UV or IR light sources, molten metal, biological materials or bodily fluids, splashes from injurious liquids or solids such as acid, bases, toxics, flammables, and any other potentially hazardous chemical(s). Use of eye and face protection shall be in compliance with both this policy and the OSHA 1910.132 Standard. All equipment used must be approved by the American National Standards Institute (ANSI) and marked in compliance with the ANSI Z87 standard or appropriate modal standard certification.

It is the recommendation of the Environmental Health and Safety Department that at a minimum, safety glasses be worn at all times within a research or instructional laboratory, even when potentially hazardous operations are not being conducted. This ensures the individual will be wearing eye protection should a hazardous activity be initiated and does not rely on them to remember to don protective equipment.

Each researcher or instructor must conduct a hazard assessment of any activities that may present eye and face hazards. The appropriate type of protection to be used during hazardous processes shall be noted in the standard operating procedure (SOP) for that process(s). All individuals within the area shall wear appropriate PPE at any time hazardous operations are being conducted.

- Safety Glasses are designed to protect the wearer from projectiles and minimal chemical splash hazards. Safety glasses will not prevent large splashes from reaching the eye.



- Splash goggles are designed to protect the wearer from larger splashes but will not protect the face. These should be designed with indirect ventilation.
- Splash Shields are designed to protect the face of the wearer but may not protect the eyes. If there is a potential for wearer to be exposed to larger volumes of injurious liquids, then both a splash shield and safety goggles are required.
- Ordinary prescription glasses do not meet the criteria for safety glasses. Not only must the lenses meet these testing criteria, they must also have side shields.
- If contact lenses are worn beneath eye protection, the wearer must be aware that in the case of a chemical exposure the lenses may trap residual amounts of chemical against the eye and may be difficult to remove.
- In the event that a non-routine activity is conducted, for example working with UV or IR light sources that require special eye and face protection, EHS will work with the laboratory to select the appropriate type of PPE.

The researcher or instructor is responsible for ensuring compliance during research or teaching laboratory activities.

## **Protective Clothing**

Lab coats are designed to protect the skin of the wearer from chemicals that may be spilled or splashed as well as from physical hazards. The lab coat should fit properly and extend to the knees. Loose clothing such as an overlarge lab coat may pose a hazard as it may catch on equipment or chemicals.

- In addition to a lab coat, when working with large volumes of corrosive or acutely toxic materials, an impervious apron and arm gauntlets or other specialized protective clothing may also be necessary.
- Lab coats must be chosen based on the hazard; for example, when working with pyrophoric chemicals, a fire-resistant lab coat must be used.
- Full length pants or other articles of clothing that cover the lower leg must be worn even while wearing a lab coat.
- Shorts, torn clothing, and unrestrained hair may pose a hazard in the laboratory.
- Lab coats are to be laundered by the University or a contract laundry.

Each researcher or instructor must conduct a hazard assessment of any activities that may present a dermal hazard. The appropriate type of protection to be used during hazardous processes shall be noted in the standard operating procedure (SOP) for that process(s)

## **Hand Protection**

Skin contact with all chemical substances must be minimized. Gloves are provided to laboratory workers for all procedures involving hazardous chemicals and must be worn whenever potential hazards from chemicals, cuts, lacerations, abrasions, punctures, burns, biologicals, or harmful temperature extremes are present.

There is no one type of chemical resistant glove that offers the best protection against all chemicals or one glove that totally resists degradation and permeation to all chemicals. Manufacturers provide glove charts to assist in proper selection for chemical resistant gloves.

Heat-resistant gloves are provided for handling hot materials or working in and around ovens. Gloves for protection against subzero temperatures are also provided for handling cryogenic materials such as liquid nitrogen.

Gloves should be replaced periodically, depending on the frequency of use and permeability to the substance(s) handled. Reusable gloves should be rinsed with soap and water and then carefully removed after use. Discard disposable gloves after each use and whenever they become contaminated.

Laboratory SOPs shall specify gloves requirements.

## **Respiratory Protection**

Respiratory protection is generally not necessary in the laboratory setting and must not be used as a substitute for adequate engineering controls.

If it is believed that a specific procedure requires the use of respiratory protection, the University of Richmond Director of EHS shall be notified and the procedure shall be thoroughly evaluated.

## **Footwear**

Appropriate footwear must be worn within the laboratory. Shoes must fully cover the entire foot including the top.

- Leather shoes, though not required, may be more resistant to chemicals as opposed to shoes constructed with fabric which will more readily absorb chemicals. In the case of a spill, either type of shoe must be removed immediately and may need to be discarded.

Sandals, flip flops, open toe, heels, mesh, and other similar footwear are not appropriate

PPE Selection/Assessment should be documented in Appendix E.

## **Safety Data Sheets**

### **Procurement**

An SDS shall be obtained from the chemical manufacturer or supplier for each hazardous chemical used. These sheets will contain, as well as can be determined, all information required by the OSHA Hazard Communication Standard.

All contracts for hazardous chemicals will include the requirement that University of Richmond shall receive an appropriate SDS prior to the first consignment. Procurement from vendors who do not supply approved SDSs will be discontinued.

If materials are purchased outside the procurement system, the purchaser must obtain an SDS and ensure that the sheet is uploaded into the UR master file.

### **Materials Created in the Laboratory**

Special precautions are required when hazardous chemical mixtures are created in the laboratory exclusively for the laboratory's internal use. If the composition of the material and hazards are known, employees will be trained on these hazards as with other chemicals.

If the chemical is a by-product and the composition is unknown, the material will be assumed to be hazardous and handled accordingly.

If the chemical is produced for use in another area of the facility, a Safety Data Sheet and label will be developed for transmission to the user department.

## **Chemical Inventory and SDSs**

The chemical inventory of all hazardous materials will be available in the laboratory for immediate laboratory worker access. SDSs of Particularly Hazardous Chemicals will also be readily available in the laboratory.

## **Access to Materials**

Both the SDSs and the written Chemical Hygiene Plan are available electronically via University of Richmond's intranet. Details of the electronic SDS program are available in Appendix F. These materials are also available upon written request from the Office of EHS for properly designated employee representative, the Assistant Secretary of Labor for OSHA.

# **Training**

## **Frequency of Training**

Laboratory staff will be provided with information and training on hazardous chemicals in their laboratories at the time of their initial assignment and whenever a new hazardous chemical is introduced into their work area. Incoming research students will receive general laboratory safety training in the Lab Safety 101 course taught in the spring of each year. Research students who do not attend this class will receive general lab safety training by completing an online Lab Safety 101 class. Specific laboratory safety training will be completed and documented by the Principal Investigator or Laboratory Supervisor (Lab Safety 102 or equivalent).

Retraining for employees will be conducted periodically or if the laboratory supervisor or CHO note that safe practices are not being followed.

## **Information for Employees**

Employees shall be informed of:

- The contents of the OSHA Chemical Hygiene Standard.
- The location and availability of the University of Richmond Chemical Hygiene Plan.
- The location and availability of SDSs and other references relating to the safe use of these hazardous materials.
- The PELs for OSHA-regulated substances or recommended exposure limits for other hazardous chemicals; and
- Signs and symptoms of chemical exposure.

## **Training Content**

Employees will receive training that includes the following:

- Methods and observations used to detect the presence of a hazardous chemical.
- The physical and health hazards of hazardous chemicals used in the laboratory.
- Measures employees can take to protect themselves from exposure.
- Tasks that could result in a release of the hazardous chemical.
- Emergency procedures; and
- The components of the University's Chemical Hygiene Plan.

## **Labeling and Signage**

### **Labeling**

Employees shall ensure that each container of hazardous chemicals is labeled with the manufacturer's label. These labels must not be defaced or removed. If a label is damaged, the employee shall contact the laboratory supervisor to temporarily label the container until a new label can be obtained from the manufacturer. The manufacturer's labels must include the following:

- Product Identifier
- Signal word
- Hazard Statement
- Pictogram
- Precautionary statement
- Name, address, and telephone number of the responsible party.

### **Workplace Containers**

When transferring materials from a manufacturer's container to a workplace container, the container must be labeled with at least the following information:

- Name of chemical
- Physical and health hazards of the chemical
- This information is transferred from the source label or from the SDS.

### **Temporary Portable Containers**

University of Richmond is not required to label a temporary portable container into which hazardous chemical is transferred from a labeled container if and only if the chemical is in the absolute control of the person who performed the transfer. The container must be emptied before the user leaves the room for any reason.

### **Containers**

Transferred chemicals must be stored in appropriate containers for storage of chemicals, not plastic soda bottles or other containers originally used for food. The container in which the chemical is stored must be compatible with the chemical, e.g., do not store hydrofluoric acid in glass containers.

## **Laboratory Door Signage**

Laboratory Door Signs are posted and reviewed periodically by the Chemical Hygiene Officer and Lab Supervisor. Information on the Laboratory Door Sign must be kept up to date so will be reviewed by the Laboratory Supervisor periodically (at least at the beginning of each semester.) If changes are needed, the Laboratory Supervisor will notify the Office of EHS. Details of the Laboratory Door Signs are found in Appendix D.

## **Internal Lab Signage**

Signs and postings should be visible and displayed prominently throughout the laboratory. This includes:

- Emergency telephone numbers of emergency personnel, supervisors, and laboratory workers.
- Location signs indicating safety showers, eye washes, fire blankets and extinguishers as well as all other safety measures pertinent to the laboratory (first aid and spill kits).
- All exits and doors that are not exits.
- Areas where certain outstanding hazards may exist.
- All areas appropriate for food and beverage consumption

## **Medical Consultation**

### **Availability**

University of Richmond laboratory employees will have an opportunity to receive medical attention under the following circumstances:

- Whenever the employee develops symptoms associated with a chemical to which the employee may have been exposed.
- Where exposure monitoring reveals an exposure level routinely above the action level or PEL for an OSHA-regulated substance.
- Whenever an event takes place in the lab such as a spill, leak, explosion, or other event that results in potential exposure to the employee.

### **Procedures**

If the laboratory supervisor or CHO determines that these criteria are met, the Safety Specialist will be contacted to arrange the medical consultation. This does not include situations where employees are injured or ill and must be transported for emergency treatment.

## **Information for Physician**

The Safety Specialist, Laboratory Supervisor or CHO will provide the examining physician with the following information:

- The identity of the hazardous materials to which the employee has been exposed and the appropriate SDSs.
- The description of the workplace conditions under which the exposure occurred.
- A description of the symptoms that the employee is suffering, if any.

## **Physician's Written Opinion**

The examining physician will provide the Safety Specialist with a written report including the results of the examination and testing, recommendations for further medical follow-up, and any condition which may place the employee at an increased risk for harm from exposure to chemicals in the laboratory.

This written opinion will not reveal to the company management specific findings of diagnoses unrelated to the occupational exposure.

## **Emergency Response**

### **Notification**

Telephone numbers of emergency responders and other critical personnel will be posted at the laboratory entrance.

### **Fire**

Fire extinguishers are located in the laboratory and are inspected annually. Only trained employees may fight very small fires with an extinguisher. All non-trained employees will evacuate immediately.

### **Chemical Spill or Release**

For small spills of liquid chemicals, spill cleanup kits will be made available in the laboratory. If there is any doubt about the lab worker's ability to clean up a spill, the CHO shall initiate a wider response by calling 8911. See Appendix B

## **Recordkeeping**

### **SDS**

Either the SDS will be retained or a record of the chemical name of the substance and when and where it was used will be recorded and retained for at least 30 years.

### **Training**

General Laboratory Safety 101 training records will be retained by the Office of EHS for at least 30 years. Laboratory specific training records will be retained by the Laboratory Supervisor for at least the duration of the laboratory worker's employment.

### **Monitoring Records**

All air monitoring records collected for work conducted in the laboratory shall be maintained by the Office of EHS for the worker's term of employment plus 30 years.

### **Medical Records**

All records of medical consultations and examinations including tests and written opinions will be maintained for the term of employment plus 30 years.

## **Annual Program Review**

### **Review**

The Chemical Hygiene Officer will review the laboratory's Chemical Hygiene Plan every October. Results will be used to update and improve the efficiency of the Plan.

## **Appendices**

- A.** Standard Operating Procedures
- B.** Hazardous Materials Spill Response
- C.** Hazardous Waste Procedures
- D.** Laboratory Door Signs
- E.** Personal Protective Equipment
- F.** Electronic Safety Data Sheet System



## Appendix A: Standard Operating Procedures

Laboratory Specific  
Standard Operating Procedures

---

University of Richmond  
Gottwald Science Center

---

Date:

Researcher:

Laboratory Room Number:

1. Describe Process  
*(What are you doing, gels, extractions etc. Can cover a number of similar processes.)*
2. Describe Potential Hazards  
*(Inhalation, contact, ingestion, explosive, UV light.)*
3. Engineering Controls *(Work that should be done in chemical fume hood, BSC, bench appropriate)*
4. Required Personal Protective Equipment (PPE)  
*(Lab coat, safety glasses, shields, gloves, etc)*
5. Special Requirement *(Handling or Storage)*
6. Spill and Accident Procedures *(Can it be cleaned up by laboratory staff or is assistance needed)*
7. Decontamination Procedures *(Personal or research)*
8. Waste Disposal (Hazardous and Medical Waste) *Appropriate containers and procedures*
9. Safety Data Sheets, Chemical Inventory, *(Access where)*

Document training with printed name, signature and date and attach to SOP.

:

## **Appendix B: Hazardous Materials Spill Response**

Students, staff, and researchers must be properly trained to respond to small spills of chemicals used within their research area(s). Researchers may either utilize clean up materials stored within their laboratories or those stored in prep labs to respond to spills.

- Appropriate PPE must be donned prior to cleaning up a spill.
- Compatible materials must be used to clean up the materials. Refer to the Safety Data Sheet for guidance.
- Broken glass must be picked up using tongs, forceps, dustpan/broom, or similar methods and should never be picked up even by even a gloved hand.
- If possible, place all used clean up and spilled materials within a plastic bag and store in chemical fume hood.
- Contact either the laboratory managers or EHS to have the waste material removed.

In the event of a large spill or one involving an acutely toxic material, if it can be done safely, all sources of ignition should be shut down, the laboratory evacuated, and notifications made to University of Richmond Police and Environmental, Health and Safety.

## Appendix C: Hazardous Waste Procedures

### Satellite Accumulation Area

Each laboratory that generates hazardous waste shall establish a Satellite Accumulation Area (SAA). This is a designated area where generated waste is stored until collected. Appropriate procedures are listed below.

### Waste Pickups

Waste pickups may be scheduled by either calling the laboratory manager for your floor or by contacting EHS.

### Waste Containers

Four-liter wide mouth plastic containers are to be used for the collection of hazardous waste. The four waste streams typically found in Gottwald are halogenated, non-halogenated, aqueous, and solid waste. Examples of which chemicals should be deposited in which stream are noted below. If you are unsure of how to dispose of a particular chemical or an unknown, please contact EHS.

Additional containers and labels may be obtained from the Stockroom Manager.

#### **Halogenated Waste (any organic chemical that contains F, Cl, Br, or I)**

Chloroform (Cl)

Benzalkonium Chloride (Cl)

Bromophenol blue (Br)

Crystal violet (Cl)

Eosin (Br)

Methylene Chloride (Cl)

Methylene blue (Cl)

Safranin (Cl)

#### **Non-Halogenated Waste (organic solvents that do not contain F, Cl, Br, or I)**

Acetone

Acetonitrile

Bis / Tris solutions

Cyclohexane

DAPI

DMSO

EDTA

Ethyl Alcohol \_24%

Ethyl Ether

Fluorescein

Hematoxylin

HEPES

Hexanes

Hybridization buffer (sodium dodecyl sulfate / sodium phosphate dibasic buffer)

Isopropyl Acetate

Isopropyl Alcohol \_24%

Methanol \_24%

Oil Red O  
Petroleum Ether (mineral spirits)  
Phenol  
2-Propanol \_24%  
TEMED  
tert-Butanol  
Tetrahydrofuran  
Toluene  
TAE  
Tris base  
Tris borate (TBE)  
Xylene cyanol

**Aqueous Waste – Predominantly Water-Based**

Buffers (water-based)  
Sulfuric Acid  
Hydrochloric Acid  
Acetic Acid  
Nitric Acid  
Phosphate buffered saline (PBS)  
Sodium Hydroxide  
Any alcohol (Ethanol, Isopropanol, Methanol, 2-Propanol, etc)

**Solid Waste**

Silica Gel  
Magnesium Sulfate  
Sodium Bicarbonate  
Sodium Sulfate  
Calcium Chloride

**Separate Waste Streams for each of these**

Ethidium Bromide gels and contaminated filters (solutions may go through filtration)  
Osmium-containing products (Osmium Tetroxide, Osmium Dioxide)  
Mercury-contaminated debris  
Formaldehyde, Formalin, or Paraformaldehyde aqueous solutions  
Chromium-containing solutions

**Used Oil**

**Unknowns, Please contact EHS for assistance**

# OFFICE OF SAFETY SERVICES AND RISK MANAGEMENT

Office: (804) 289-8824 Fax: (804) 287-6813

<http://safety.richmond.edu/>

## **Satellite Accumulation Areas (SAA's)**

A Satellite Accumulation Area (SAA) is an area where a waste generator may accumulate wastes in containers at or near the point of generation. Specifically, this means within the control, sight, and within the area (i.e. laboratory) of the generator.

## **Satellite Accumulation Area (SAA) Checklist:**

### **SAA Established:**

- ✓ An SAA has been designated
- ✓ SAA Checklist & generator contact information are posted at SAA

### **Waste Containers:**

- ✓ Are in good condition: **Inspected at least once every 7 days (1 week)**
- ✓ Are compatible with material being stored in them
- ✓ Are closed or sealed except when adding material
- ✓ Are labeled with the words “Hazardous Waste” or other words that identify the waste –
  - **NOTE:** Contents of container can be recorded on appropriate “waste label” and affixed to container or separate sheet(s) maintained near the container. **In either case the generator’s name and department should be on the container.**
- ✓ Are properly stored according to waste properties
- ✓ Are removed within 3 days of becoming full

**Waste Container Labeling:** Waste labels should include the information checked below:

- ✓ Words: “Hazardous Waste” or other words that identify the waste
- ✓ **Generator’s contact information: name, department, location, & phone number**
- ✓ **Full, proper chemical name(s) of contents. No formulas or abbreviations**
- ✓ **Percent volume of each waste in container (if applicable)**

Please go to our website link to access and print labels – just fill in your information:

<http://safety.richmond.edu/waste/hazardous.html>

### **Generator Contact Information:**

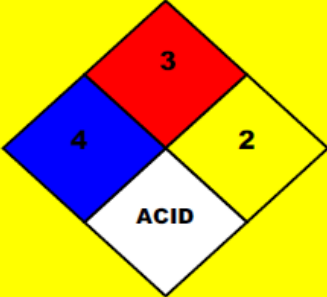
Lab Room Number: \_\_\_\_\_

Name of Responsible Party: \_\_\_\_\_

Office Telephone Number: \_\_\_\_\_

## Appendix D: Laboratory Door Signs

Laboratory Door Signs should be placed at the entrance(s) to laboratory: These signs contain information about laboratory hazards, warnings, and point(s) of contact. Laboratory Door Signs are reviewed periodically by the Chemical Hygiene Officer and the appropriate Lab Manager. An example of the Laboratory Door Sign (below):

<b>CAUTION</b>	
<b>ROOM #00000</b>	<b>AUTHORIZED PERSONNEL ONLY</b>
<b>LABORATORY HAZARDS</b> CANCER HAZARD INHALATION HAZARD COMPRESSED GAS OXIDIZERS FLAMMABLES CORROSIVES	<b>EYE PROTECTION REQUIRED!</b>  NO EATING NO DRINKING NO SMOKING NO OPEN-TOED SHOES NO HORSEPLAY  
IN CASE OF EMERGENCY: (804) 289-8911 LOCATION: CONTACT: PHONE – OFFICE: HOME: HAZMAT TEAM: CONTACT CAMPUS SECURITY – (804) 289-8911 MSDS LOCATION: AVAILABLE ON LINE @ <a href="http://oncampus.richmond.edu/administration/safety/hazard.htm">http://oncampus.richmond.edu/administration/safety/hazard.htm</a> CHEMICAL INVENTORY LOCATION:	

# Appendix E: Personal Protective Equipment

## Appendix F: Electronic SDS System

To access Safety Data Sheets (SDS) formerly known as Material Safety Data Sheets (MSDS), faculty, staff, and students should follow these steps:

1. Access the EHS website on the UR web site. <http://safety.richmond.edu/>
2. Click on the Hazard Communication header.
3. Click on the MSDSOnline link. You will be asked to enter your net ID and password.
4. You will be directed to the MSDSOnline system. You can access SDS either by department or entering the chemical name/CAS# in the search line.

An emergency backup is kept in the UR Police Department Dispatch Office in the event of a power or computer system failure.



