# Saint Louis University

# CHEMICAL HYGIENE PLAN

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# SAINT LOUIS UNIVERSITY

# CHEMICAL HYGIENE PLAN

# FOR:

_____

(Principal Investigator/Laboratory Manager)

_____

(Building/Room Location)

_____

(Department)

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## PURPOSE

All laboratories using hazardous chemicals are required to comply with the Occupational Safety and Health Administration (OSHA) 29 CFR 1910.1450, Occupational Exposure to Hazardous Chemicals in Laboratories. This standard requires that the employer develop a written Chemical Hygiene Plan (CHP), which is intended to protect employees from the health hazards associated with hazardous chemicals in the laboratory. This document is Saint Louis University's Chemical Hygiene Plan (CHP) and it is intended to highlight those laboratory practices that are necessary for protecting workers from exposure to hazardous chemicals. The CHP serves as a general safety document for all laboratories. In addition to having the CHP available in the laboratory, each laboratory shall develop and provide laboratory site-specific standard operating procedures and training for all hazardous chemical substances not specifically identified in this CHP.

## POLICY

Saint Louis University is dedicated to providing safe laboratory facilities for employees and students and to complying with federal, state, and local occupational health and safety standards. Principal investigators, laboratory managers, faculty, staff, and students all share the responsibility for minimizing their exposure to hazardous chemicals. Laboratory employees must not be exposed to chemicals in excess of the permissible exposure limits (PEL) specified in OSHA standard 29 CFR 1910, Subpart Z, Toxic and Hazardous Substances. This standard applies where "laboratory use" of hazardous chemicals occurs. OSHA defines laboratory use as handling or use of chemicals on a "laboratory scale" or when the work involves containers which can easily and safely be manipulated by one person, when multiple chemical procedures or chemical substances are used, and when protective laboratory practices and equipment are available and in common use to minimize the potential for employee exposures to hazardous chemicals. The Chemical Hygiene Plan (CHP) shall be reviewed and evaluated at least annually for its effectiveness, and updated as necessary. It shall be made available to all laboratory employees and employee representatives. Every laboratory must have access to a copy of the CHP. The electronic version of the CHP is located at https://www.slu.edu/research/faculty-resources/research-integrity-safety/environmental-health-safety/documents/chemical-hygiene-plan.pdf

## 1. GENERAL PRINCIPLES FOR WORK WITH LABORATORY CHEMICALS

### A. Minimize Chemical Exposures

It is prudent to minimize all chemical exposures and observe good laboratory practices by working in a chemical fume hood, wearing eye and hand protection, and a lab coat or apron. When handling hazardous chemicals in the lab, work should be performed in such a way to prevent exposure through inhalation, absorption, injection or ingestion. Quantities of vapors or dust should be prevented from entering the general laboratory atmosphere.

### B. Avoid Underestimation of Risk

All chemicals can be hazardous depending on the circumstances. Even for substances of no known significant hazard, exposure should be minimized. Appropriate precautions should be taken for work with substances that present special hazards. One should assume that any mixture would be more hazardous than its most hazardous component. After preparation and use of any chemical, it is important to maintain at least the same level of safe practice in the handling of the resulting chemical wastes and residues. All substances of unknown potential hazard must be considered hazardous until proven otherwise.

### C. Provide Adequate Ventilation

The best way to prevent exposure to airborne substances is to prevent their escape into the working atmosphere by use of fume hoods and other adequate ventilation devices. Operations such as chemical reactions, heating or evaporating solvents, and transfer of chemicals from one container to another should be performed in a fume hood when there is a reasonable potential for hazardous material exposure. Fume hoods should be kept clean and clear of items that impede proper air flow and normal operation. Environmental Health and Safety shall evaluate and certify fume hoods annually.

### D. Institute a Chemical Hygiene Program

Environmental Health and Safety will provide electronic access to the Chemical Hygiene Plan (CHP) for each laboratory and each laboratory shall make the CHP available to all employees in the laboratory. The CHP defines Saint Louis University's Chemical Hygiene Program and shall be followed by all laboratory employees, students and visitors. This includes individuals working in academic teaching laboratories and individuals entering laboratories on a frequent basis. The Saint Louis University Chemical Hygiene Program includes:

- Periodic monitoring of the performance of safety equipment
- Periodic safety inspections of laboratories
- Procedures that ensure proper disposal of chemical waste at regular intervals, and
- Training opportunities for everyone working in and around a laboratory.

Implementation of these CHP procedures is a regular, continuing effort requiring support from administration and faculty. All Saint Louis University faculty and staff working in laboratories shall follow the safety regulations and recommendations within the CHP to ensure that laboratories are safe.

## E. Observe the PELs and TLVs

The OSHA permissible exposure limits (PEL's) and the American Conference of Governmental Industrial Hygienists (ACGIH) threshold limit values (TLV's) for the airborne concentration of specifically cited hazardous chemicals should not be exceeded. This may be achieved through use of a combination of administrative and engineering controls. Use of a chemical fume hood is required when working with a volatile substance unless adequate procedures are followed to prevent exposure.

## 2. ROLES AND RESPONSIBILITIES

### A. Administration

The administration of the University is ultimately responsible for the health and safety of all Saint Louis University employees. The administration will fulfill these responsibilities by appointing qualified, responsible employees to develop and implement safety policies. The appointment of these individuals may be vested in the provosts, vice presidents and/or deans. The provosts, vice presidents and deans shall provide administrative and financial support for laboratory safety issues.

### B. Department Chairpersons

Department chairpersons shall be required by the provosts, vice presidents and deans to adhere to the CHP. Departmental chairpersons shall require principal investigators, laboratory managers, faculty, staff, students, and visitors to adhere to the CHP.

### C. Environmental Health and Safety

The Director of Environmental Health and Safety (EHS) is responsible for the training of EHS staff and providing appropriate facilities, supplies, references, instruments, etc., to survey and evaluate safety systems and processes. EHS will be responsible for:

- Annual and/or semi-annual laboratory safety inspections
- Annual inspections of chemical fume hoods
- Monthly and annual inspections of research laboratory fire extinguishers
- Serving as an advisory resource and creating safety policies for laboratory employees
- Providing and maintaining safety training records of all laboratory employees

### D. Facilities Management

The Facilities Management Department shall make repairs and maintenance of installed laboratory safety equipment a high priority. The Director of Facilities Management is responsible for the prioritization and performance of maintenance and repair of installed laboratory safety devices, for the training of service personnel, and for providing the service personnel with the necessary tools for installed safety system maintenance.

### E. Chemical Hygiene Officer

The Chemical Hygiene Officer (CHO) shall prepare the Chemical Hygiene Plan (CHP) and provide annual review and revisions. The CHO will work with laboratory faculty and staff to develop and implement chemical hygiene policies and procedures. The CHO will be responsible for:

- Providing all laboratories with a copy of the CHP.
- Providing technical assistance and consultation on laboratory chemical safety issues and other safety matters.

- Providing for the disposal of hazardous chemical waste.
- Assisting Facilities Management with incorporating chemical safety in new construction and renovations.
- Remaining current on regulatory issues.
- Completion of annual and/or semi-annual laboratory safety inspections to ensure safety and regulatory compliance.
- Providing Laboratory Safety and Compliance Training to all laboratory employees
- Providing disposal requirements and guidelines for both hazardous and non-hazardous chemical waste.
- Providing chemical hazard awareness training to ancillary employees.
- Conducting exposure assessments as needed, and upon request, for laboratory employees.
- Investigating reported workplace injuries from chemical exposures and incidents.

## F. Principal Investigators/Laboratory Managers (PI/LM)

The Principal Investigators and/or Laboratory Managers shall:

- Implement all provisions of the CHP for laboratory facilities under their control.
- Ensure all laboratory employees can easily access the CHP and review annually.
- Complete a laboratory specific training outline and document training for all laboratory personnel.
- Maintain a hazardous chemical inventory and ensure annual review of the inventory to maintain an accurate online chemical inventory database.
- Maintain a hard copy of each Safety Data Sheet (SDS) and update annually or as needed.
- Ensure that employees are familiar with the location of SDS in the laboratory.
- Provide appropriate personal protective equipment (PPE) for all laboratory employees.
- Notify EHS in advance when the need to use a respirator is identified.
- Ensure that designated eye wash stations for their laboratory are adequate and inspected weekly.
- Ensure that facilities, equipment, and materials are appropriate and adequate for intended use.
- Ensure adequate preparation, maintenance and implementation of written standard operating procedures (SOP) regarding safety and health considerations for each procedure involving hazardous chemicals.
- Train laboratory employees regarding the specific work practices and procedures according to the provisions of their laboratory specific SOPs.
- Complete or ensure completion of the Employee Report of Injury form and consult with Employee Health for all workplace injuries.
- Report to the Chemical Hygiene Officer (CHO) all workplace injuries relating to chemical exposures, laboratory incidents or other unsafe conditions.
- Report any use of or repair necessary for designated emergency equipment.

## G. Individual Researchers and Laboratory Employees

All new laboratory employees, students, visitors, minors, etc. are required to attend the Saint Louis University Laboratory Safety and Compliance Training prior to working with hazards in a laboratory. Laboratory Safety and Compliance Training is provided by EHS staff on a regular schedule and must be completed at least once during every twelve-month period. In addition, all laboratory employees shall:

- Follow the requirements of the Chemical Hygiene Plan (CHP).
- Report all workplace injuries, chemical exposures, incidents, or unsafe conditions to their PI/LM as soon as possible.
- Assist with the maintenance of the inventory of all hazardous chemical substances, and identification of Potentially Hazardous Substances (PHS) on the inventory.
- Maintain and update SDS files for their laboratory when new chemicals or updated SDS arrive.
- Contact PI/LM and/or the CHO when safety questions arise**.**
- Follow laboratory specific SOPs.
- Work with PI/LM to evaluate existing SOPs and develop new SOPs as needed.
- Review new procedures with PI/LM.
- Plan and conduct laboratory operations in accordance with Saint Louis University Chemical Hygiene Plan procedures.
- Develop and practice good personal chemical hygiene habits.

## 3. LABORATORY FACILITY

### A. Design

Saint Louis University laboratories in which hazardous chemicals are present or used shall have the following minimum safety features within the immediate area or close proximity:

- An appropriate general ventilation system with air intakes and exhausts located so as to avoid intake of contaminated air.
- Adequate, well ventilated stockrooms/storerooms.
- Local exhaust ventilation for chemical usage (laboratory fume hoods).
- Chemical storage areas and cabinets.
- Laboratory sinks.
- Safety showers and eye washes.
- Fire extinguishers.

### B. Maintenance

The Facilities Management Department ensures that laboratory safety systems are maintained in a serviceable condition, according to the manufacturer's specifications. Fire extinguishers are maintained under the management of EHS and Facilities Management. Work orders to repair or renovate laboratory facilities may be initiated by principal investigators, laboratory employees, EHS or Facilities Management staff.

### C. Usage

Work conducted in Saint Louis University laboratories is for research or instructional purposes. Work is laboratory scale in nature, and activities are conducted appropriate to the physical limitations of the laboratory facilities and safety equipment available, and especially appropriate to the quality of ventilation, including local exhaust systems. EHS shall be informed by the Principal Investigator and/or Laboratory Manager where chemical usage falls outside of typical laboratory scale operations.

### D. Ventilation

#### General Ventilation

General ventilation must not be relied upon to control chemical vapors, gases or mists, however, laboratory air must be continually replaced to prevent increases of air concentrations of toxic substances during the working day. Stockrooms used for chemical storage should have ventilation appropriate to the hazards and quantities of the materials in storage. Airflow shall be directed into the laboratory from non-laboratory areas and out to the exterior of the building.

## Laboratory Fume Hoods

Laboratory fume hoods shall be provided, installed and operated according to manufacturer specifications.

- When the hood sash is open approximately twelve inches, an average face velocity of 100 ft/min is required.
- The hood enclosure should be fire and chemical resistant.
- In new construction, consideration shall be given to locating the hood such that ambient air currents do not unacceptably reduce the containment efficiency of the hood.
- All fume hood modifications shall be approved by EHS; i.e., those that may potentially detract from the hood performance.
- In new construction:
    - The room in which the hood is located shall have a source of sufficient make-up air to replace the air that is exhausted out.
    - The hood shall have a monitoring device to measure airflow.
- It is recommended that the utility controls be outside of the hood.
- The fume hood should be appropriate for the material used within (e.g., perchloric acid usage).
- Airflow shall be such that contaminants within do not escape the fume hood. A smoke tube test may be performed to ensure airflow is adequate.
- Each laboratory fume hood at Saint Louis University is tested and certified annually for usage and performance. Where performance parameters fall outside specifications, work orders are initiated to repair the hoods. When appropriate, a notice is placed on the hood indicating that it is not to be used until its performance is within the specified performance parameters.
- Non-venting hoods (e.g., laminar flow hoods with in-room venting) shall be clearly labeled as such.
- No work with volatile hazardous chemicals shall be performed in hoods that do not vent outdoors. Exhaust air from glove boxes and isolation rooms should release into the fume hood exhaust system.

Laboratory fume hoods are designed to protect the individual from exposure to chemicals and noxious gases. However, some laboratory work is performed inside a biological safety cabinet that is designed to protect the employee and environment from biological agents and to protect research materials from contamination. It is important to know the difference between a biological safety cabinet and a chemical fume hood prior to use.

## Special Ventilation Devices

Procedures involving radioactive aerosols, powders or gaseous products, or procedures that could produce volatile radioactive effluents shall be conducted in an approved fume hood, glove box or other suitable closed system. Such fume hoods shall be designed with smooth, non-porous materials and possess adequate lighting to facilitate work within. The hoods shall have a minimum face velocity of 100 ft/min. Contact Radiation Safety for further information on fume hood use for radioactive materials.

**Modifications**

Laboratory hoods are not to be modified without consultation of the Chemical Hygiene Officer. Changes in airflow quantity and airflow patterns can significantly affect laboratory exposure potential. Therefore, the Chemical Hygiene Officer will ensure that modifications will not degrade the safety of the laboratory environment. Modified hoods must be evaluated and tested by EHS prior to use.

## 4. BASIC RULES AND PROCEDURES FOR WORKING WITH CHEMICALS

### A. General Principles

This Chemical Hygiene Plan requires that laboratory workers understand and follow basic procedures for working with chemicals. *Prudent Practices for Handling Hazardous Chemicals in Laboratories* may be used as a supplemental reference. The general principles listed below should be used for all laboratory work with chemicals.

**1. Accidents and Spills**

- Know the appropriate emergency response procedures.
- In the event of an accidental eye exposure, promptly flush the eyes with water for a prolonged period (15 minutes) and seek medical attention.
- After ingestion of a hazardous substance, encourage the victim to drink large amounts of water and seek medical attention as needed.
- Skin exposure to a hazardous substance requires prompt flushing of the affected area with water and removal of any contaminated clothing. If symptoms persist after washing, seek medical attention through Employee Health or the SSM Health Saint Louis University Hospital Emergency Room.

**2. Avoidance of "Routine" Exposure**

- Avoid tasting or smelling hazardous chemicals.
- Do not allow toxic substances to be released in cold rooms and warm rooms, since these areas have contained, recirculated atmospheres.

**3. Choice of Chemicals**

- Carefully read the label before using an unfamiliar chemical and review the Safety Data Sheet (SDS) for special handling information.
- Review the known hazards associated with the materials being used and never assume all hazards have been identified.

**4. Eating, Smoking, Etc.**

- There shall be no eating, drinking, smoking, gum chewing, application of cosmetics or contact lenses in areas where chemical materials are present.
- Wash hands before leaving the laboratory to conduct these activities.

**5. Equipment and Glassware**

- Always inspect equipment for leaks, tears and other damage before handling a hazardous chemical. This includes fume hoods, gloves, goggles, etc.
- Be familiar with the location of emergency equipment and/or supplies - fire alarms, fire extinguishers, emergency eyewash/shower stations and chemical spill kits.
- Use equipment and hazardous chemicals only for their intended purposes.
- Handle and store laboratory glassware with care to avoid damage.
- Inspect glassware before each use and do not use damaged glassware.

6. **Exiting**
    - Wash areas of exposed skin thoroughly with soap and water before leaving the laboratory.

7. **Horseplay**
    - Avoid distracting or startling other workers when they are handling hazardous chemicals.

8. **Mouth Suction/Mouth Pipetting**
    - Do not use mouth suction for pipetting or starting a siphon.

9. **Personal Housekeeping**
    - Keep the work area clean and uncluttered, with chemicals and equipment properly labeled and stored.
    - Clean up the work area on completion of an operation and/or at the end of each day.

10. **Personal Protection**
    - Wear adequate eye, face, hand and foot protection when working with chemicals or other hazards in the laboratory.
    - Assure that appropriate eye protection is worn by all persons, including visitors, where chemicals are in use or handled.
    - Wear appropriate gloves when the potential for contact with hazardous materials exists and remember to inspect gloves before each use.
    - Wear closed-toed shoes at all times in the laboratory.
    - Use appropriate respiratory protective equipment when air contaminant concentrations cannot be adequately managed by engineering controls, inspecting the respirator before each use.
    - Remove lab coats immediately upon significant contamination.
    - Remove gloves when exiting the laboratory or when handling clean items.
    - See Chapter 9 (Personal Protective Equipment and Apparel) for additional details.

11. **Planning**
    - Determine the potential hazards and use appropriate safety precautions before beginning any new operation. Ensure emergency procedures and emergency lab contact information are current and have been reviewed as part of Laboratory Specific Training.

12. **Use of Fume Hood**
    - Use a fume hood for operations which might result in release of toxic chemical vapors or dust.
    - Confirm adequate fume hood performance before use; keep fume hood closed at all times except when adjustments within the fume hood are being made.
    - Keep materials stored in fume hoods to a minimum and do not allow them to block vents or air flow.

13. **Vigilance**
    - Always be alert to unsafe conditions and actions and call attention to them so that corrective action can be taken as quickly as possible.

14. **Waste Disposal**
    - Follow established University chemical waste disposal procedures in accordance with guidance and requirements provided by EHS.
    - Do not discharge to the sewer concentrated acids or bases; highly toxic, malodorous (bad smelling), or lachrymatory (causing the shedding of tears) substances; or any substances which might interfere with the biological activity of waste water treatment plants, create fire or explosion hazards, cause structural damage, or obstruct flow.
    - See Chapter 14 (Hazardous Waste Disposal) of this plan for additional details.

15. **Working Alone**
    - Avoid working alone in the laboratory, particularly after normal business hours for safety and security reasons.
    - The PI/LM is responsible for determining and implementing procedures to provide for emergency notification and periodic checks of an individual working "alone" in the laboratory or any unattended laboratory experiment. The extent of these precautionary measures will depend on the nature of the laboratory work and the degree of potential hazard.

## B. Eating and Drinking in the Laboratory

Eating, drinking, smoking, handling contact lenses and applying cosmetics are strictly prohibited in areas where hazardous laboratory chemicals are used or are intended for use. Storage of food and beverages in areas that are intended or are used for storage of hazardous laboratory materials is prohibited. Items used in areas of the laboratory that are contaminated with chemicals should remain in those areas.

## C. Working with Allergens and Embryotoxins

**Allergens:** Wear suitable gloves to prevent hand contact with allergens or substances of unknown allergenic activity. Examples of allergens include diazomethane, isocyanates, bichromates and methyl methacrylate.

**Embryotoxins:** Women of childbearing age should only handle embryotoxins in a fume hood whose satisfactory performance has been confirmed. Always wear appropriate protective apparel (especially gloves) to prevent skin contact. Examples of embryotoxins include organomercurials (organic compounds containing mercury), lead compounds, and formamide.

Review the use of allergens and embryotoxins with the principal investigator or research supervisor prior to use and annually or whenever a procedural change is made. These substances must be properly labeled and stored in an adequately ventilated area in an unbreakable secondary container. Notify supervisors, EHS, and the Department of Public

Safety and Emergency Preparedness (DPSEP) of all incidents of exposure or spills. Consult the Employee Health physician or another qualified physician when appropriate.

## D. Working with Chemicals of Moderate Chronic or High Acute Toxicity

Any intended use or possession of chemicals of moderate chronic or high acute toxicity must be reported to EHS prior to use. Examples of chemicals of moderate chronic or high acute toxicity include, but are not limited to, diisopropyl fluorophosphate, hydrofluoric acid, and hydrogen cyanide. Supplemental rules to be followed in addition to those mentioned above include:

### 1. Preparation:

- Report the presence and intended use of these chemicals to EHS prior to initial use.
- Develop and document adequate training of all employees working with or in the presence of these chemicals.
- Minimize exposure to these toxic substances by any route using all reasonable precautions.

### 2. Location and Engineering Controls:

- Use and store these substances only in areas of restricted access with special warning signs.
- Always use a fume hood confirmed to exhibit adequate performance with a face velocity of at least 100 ft/min or other containment device (e.g. glove box or specially designed exhaust system), for procedures which may result in the generation of aerosols or vapors containing the substance.
- Trap released vapors to prevent their discharge by the fume hood exhaust.

### 3. Personal Protective Equipment and Practices:

- Always avoid skin contact by use of gloves and sleeve coverings (and other protective apparel as appropriate).
- Always wash hands and arms immediately after working with these materials.

### 4. Prevention of Spills and Accidents:

- Be prepared for accidents and spills.
- Use the "buddy system" and ensure that at least two people are present at all times if working with highly toxic chemicals or chemicals of unknown toxicity.
- Store breakable containers of hazardous substances in chemically resistant secondary containment.
- If a major spill occurs outside the hood, evacuate the area immediately. Call 314-977-3000 to initiate proper remediation by EHS.
- Dispose of contaminated clothing or shoes through EHS.
- Store contaminated waste in closed, suitably labeled, impervious containers (for liquids, in glass or plastic secondary containment bottles half-filled with vermiculite).

## E. Working with Chemicals of High Chronic Toxicity

Any intended use or possession of chemicals of high chronic toxicity must be reported to EHS prior to use. Examples of chemicals of high chronic toxicity include, but are not limited to, dimethylmercury, nickel carbonyl, benzo-a-pyrene, N-nitrosodiethylamine, and other human carcinogens or substances with high carcinogenic potency in animals.

Further supplemental rules to be followed in addition to all those mentioned above, for work with substances of known high chronic toxicity (in quantities above a few milligrams to a few grams, depending on the substance) include:

1. **Preparation:**
   - Report the presence and intended use of these chemicals to EHS prior to initial use.
   - Develop and document adequate training of all employees working with or in the presence of these chemicals.
   - Prepare a plan for use and disposal of these materials and obtain the approval of the laboratory supervisor and Chemical Hygiene Officer.

2. **Location and Engineering Controls:**
   - Conduct all transfers and work with these substances in a "controlled area" such as a restricted access hood, glove box, or portion of a lab designated for use of highly toxic substances for which all people with access are aware of the substances being used and all necessary precautions.
   - For a negative pressure glove box, the ventilation rate must be at least 2 volume changes/hour and pressure must be at least 0.5 inches of water. For a positive pressure glove box, thoroughly check for leaks before each use. In either case, trap the exit gases or filter them through a HEPA filter and then release them into the hood.
   - Protect vacuum pumps against contamination with scrubbers or HEPA filters and vent them into the hood. Decontaminate vacuum pumps or other contaminated equipment, including glassware, in the controlled area before removing them from the controlled area. Decontaminate the controlled area before normal work is resumed there.

3. **Personal Protective Equipment and Practices:**
   - On leaving a controlled area, remove any protective apparel (placing it in an appropriate, labeled container) and thoroughly wash hands, forearms, face, and neck.
   - Use a wet mop or a vacuum cleaner equipped with a HEPA filter instead of dry sweeping if the toxic substance was a dry powder.
   - If using toxicologically significant quantities of such a substance on a regular basis (e.g., 3 times per week), consult the Chemical Hygiene Officer, Environmental Health and Safety and the Employee Health physician concerning advisability of regular medical surveillance.

- Keep accurate records of the amounts of these substances stored and used along with the dates and names of users.
- Ensure that the controlled area is conspicuously marked with warning and restricted access signs and that all containers of these substances are appropriately labeled with identity and warning labels.

**4. Prevention of Spills and Accidents:**

- Ensure that contingency plans, equipment, and materials to minimize exposures of people and property in case of accident, are available.
- Store containers of these chemicals only in a ventilated, limited access area in appropriately labeled, unbreakable, chemically resistant, secondary containers.
- Use chemical decontamination whenever possible. Ensure that containers of contaminated waste (including washings from contaminated flasks) are transferred from the controlled area in a secondary container under the supervision of authorized personnel.

## F. Animal Work with Chemicals of Chronic Toxicity Including Carcinogens

Special facilities with restricted access are preferable when conducting animal work with chemicals of chronic toxicity. Other special precautions include:

**1. Preparation:**

- All work with animals shall be approved by Comparative Medicine and the Institutional Animal Care and Use Committee (IACUC) prior to use.
- All animal protocols involving carcinogens or other hazardous chemicals shall require specific standard operating procedures that are approved by the Chemical Hygiene Officer.

**2. Engineering Controls/Aerosol Suppression:**

- When possible, administer the substance by injection or gavage instead of in the diet. If administration is in the diet, use a caging system under negative pressure or in a certified Biological Safety Cabinet.
- Devise and utilize procedures to minimize formation and dispersion of contaminated aerosols, including those from food, urine, and feces (e.g., use HEPA filtered vacuum equipment for cleaning).
- Moisten contaminated bedding before removal from the cage.

**3. Personal Protective Equipment and Practices:**

- Wear appropriate gloves, clothing, respiratory protection, and eye protection while working in the animal room.

**4. Waste Disposal**

- Dispose of contaminated animal tissues, bedding and excreta properly and according to the protocol standard operating procedures.

## 5. CHEMICAL PROCUREMENT, DISTRIBUTION AND STORAGE

### A. Procurement of Chemicals

No chemical container shall be accepted without an adequate identifying label and delivery should be refused for any leaking containers. In order to minimize the presence of hazardous materials at the University, chemicals should be ordered in the smallest quantity needed to conduct the work. Limit the purchase of hazardous chemicals to containers equal to or less than five gallons each and consider using chemical from stocks already on campus. EHS shall be contacted in advance of any acquisition of chemicals that will not be purchased but donated or transferred to Saint Louis University from another institution, individual or organization.

### B. Stockrooms/Storerooms

Hazardous substances should be segregated by hazard class, following manufacturer recommendations. Containers of potentially hazardous substance (PHS) materials should be placed in unbreakable secondary containers. Stored chemicals shall be examined periodically (at least annually) for need of replacement, deterioration, label condition, and container integrity. Stockrooms and storerooms should not be used as preparation or repackaging areas.

### C. Chemical Transport

Sealed chemical containers shall be transported in secondary containment, or on a wheeled cart with a design capable of containing leakage or spillage and negotiating uneven surfaces (e.g. expansion joints or floor drains) without tipping the chemical container or cart. Chemicals or chemical products (e.g. tubes in ice buckets, open flasks) that are not sealed shall be in closed containment during transport. Chemicals should be transported on freight elevators where possible and should always be sealed during transport.

Compressed gas cylinders should always be transported on cylinder carts which are equipped with straps or chains. It is always prudent to keep the valve cover in place while in transport and until the cylinder is secured in place and ready for use.

### D. Laboratory Storage of Chemicals

Chemicals will be stored so that incompatible chemicals are separated by hazard class and shall be stored upright and not be double stacked. Compatibility information is available on the chemical's Safety Data Sheet (SDS) and/or original container label. Refrigerators used for storage of flammable liquids should be explosion proof. New construction shall follow NFPA 45 for guidelines on flammable and combustible liquid storage.

Cylinders of compressed gases shall be securely strapped or chained to a wall, bench top, or other sturdy structure. Close the gas cylinder valve at the top of the tank when not in use. Compressed gas cylinders shall be capped when in storage. All compressed gas cylinders and chemical containers should be stored away from heat sources and

direct sunlight. Chemical storage in fume hoods and on bench tops should be minimized.

## 6. ENVIRONMENTAL MONITORING

Regular instrumental monitoring of airborne concentrations is not usually necessary or practical on a routine basis in laboratories, but may be appropriate when testing or redesigning hoods or other ventilation devices, or when a highly toxic substance is used regularly (e.g., 3 times/week). All monitoring results shall be prominently posted and/or provided to applicable employees.

### A. Environmental Monitoring and Surveillance

Air sampling may be performed for any chemical process where the laboratory fume hood, filtered glove box or comparable exposure control device is not used to contain the contaminant. Air sampling will be performed where respiratory protection is required and/or will be performed upon the request of the Principal Investigator, Laboratory Manager or laboratory employee. Air sampling will be performed in any situation where there is reason to believe a PEL or similar exposure standard has been exceeded. Air sampling specifications, including frequency and test method, will be determined by the Chemical Hygiene Officer.

### B. Routine Sampling

Routine sampling will occur when initial monitoring results are at or above any applicable exposure limit or action level. National Institute of Occupational Safety and Health (NIOSH) or OSHA validated sampling methods, or equivalent methods, will be used to perform air sampling. Appropriate quality assurance will be used for all sampling and monitoring. Laboratory analysis shall be performed by an American Industrial Hygiene Association (AIHA) accredited laboratory.

### C. Non-routine Sampling

Non-routine sampling is conducted for short-term operations as necessary or when requested by laboratory employees.

## 7. HOUSEKEEPING, MAINTENANCE, AND INSPECTIONS

### A. Housekeeping

Safety comes from good housekeeping practices. Use the following guidelines to maintain an orderly laboratory:

- Keep work areas clean and uncluttered with chemicals, personal items, and equipment (e.g. bicycles, carts, tables).
- Clean up work areas upon completion of an experiment or procedure, or at the end of each work day.
- Dispose of waste regularly according to Section 14 (Waste Disposal Guidelines).
- A separate waste receptacle must be designated for non-contaminated broken glass. Follow SLU guidelines for disposal of contaminated glass.
- Clean non-hazardous spills immediately and thoroughly.
- Ensure a chemical spill kit is available and that employees know how to use the kit.
- Do not block exits, emergency equipment or controls or use hallways and stairways as storage areas.
- Assure hazardous chemicals are properly segregated into compatible categories.

Hallways, stairways and corridors shall not be used for storage. Access to exits, emergency equipment, and utility controls must never be blocked. Minimum egress routes must be maintained at all times.

### B. Maintenance

Facilities Management should be contacted if safety equipment is malfunctioning.

1. **Fume Hoods:** Malfunctioning fume hoods should be clearly marked with warning signs such as “Do Not Use” or “Needs Repair” if they are to be repaired. If the fume hood is not to be repaired, it should be labeled “Out of Service.” Prior to resuming use of a fume hood that has been repaired or has been out of service, contact EHS for re-certification.

2. **Eye Washes and Safety Showers:** Malfunctioning eyewashes and safety showers should be marked “Do Not Use." Laboratory personnel shall conduct and document weekly inspections of the eyewash stations in their laboratory or the designated eyewash in the nearest common area. The weekly inspection should consist of operating the eyewash for several minutes or until the water runs clear. EHS coordinates annual testing of all safety showers and the eye wash stations located in hallways and corridors.

### C. Inspections

EHS performs laboratory safety inspections periodically to ensure that adequate safety equipment is available and functioning, appropriate personal protective equipment is available and used properly, chemicals are properly handled and stored, SDS’s are readily accessible and good housekeeping is being practiced. These inspections are conducted semi-annually or annually.

Housekeeping and chemical hygiene inspections are recommended and should be routinely conducted by the principal investigator, laboratory manager, or appointed representative. Use of the Environmental Safety Laboratory Inspection Form is encouraged unless the laboratory PI or staff design a checklist specific to their laboratories.

## 8. MEDICAL PROGRAM

### A. Medical Consultation Determination

Medical consultations will be provided by Employee Health, upon request, to employees exposed to hazardous chemicals as a result of a spill, leak or explosion. The licensed Employee Health physician performing the initial consultation will identify the need for further medical examinations. Medical consultations will be required for documented exposures above established action levels or airborne concentrations above the PEL, TLV, or other recognized exposure limit and for any employee exhibiting signs or symptoms consistent with exposure to the chemicals with which they are working.

### B. Medical Examinations

The medical exam criteria will be determined by the Employee Health physician. Where medical exam guidance exists, such as, for OSHA regulated substances, these criteria will be included in the physician's exam. For examinations resulting from exposures to OSHA regulated substances, the examination frequency will be the period set within the OSHA standard. For examinations resulting from potential overexposure to other hazardous substances, the Employee Health physician will determine the examination frequency.

As part of the medical examination, the following information will be provided to the examining physician:

- SDS for the applicable hazardous chemical(s).
- A description of the conditions under which the exposure occurred, including monitoring data and accident reports.
- A description of the signs and symptoms of exposure that the employee is experiencing.

Upon completion of the exam, the physician will provide a medical report to the employee and a clearance to the employer on the condition of the employee and any restrictions placed on the employee as a result of the employee's exposure.

## 9. PERSONAL PROTECTIVE EQUIPMENT AND APPAREL

Personal protective equipment (PPE) is a term used to describe a variety of products worn by laboratory employees designed to protect those employees from safety and health hazards. Protective equipment is required anytime there is a possibility that the employee may be exposed to a hazardous chemical. The level of protection required depends on the specific hazards involved and the manner in which the material or materials are handled.

There are clear limitations to all types of PPE which must be considered when selecting equipment for any given task. Limiting factors for PPE protection include:

- Proper fit and selection
- Comfort vs. protection
- Restrictions to sight, hearing, touch, and movement
- Proper maintenance
- Equipment lifetimes

All laboratory employees should have access to adequate PPE and all PPE should be examined before use to ensure that the equipment will be able to provide the needed level of protection. The P.I. or Laboratory Manager, in conjunction with EHS and Employee Health, are responsible for assessing the risks present in their laboratory and determining the types and levels of protection required for the assigned tasks.

### A. Types of PPE

1. **Respiratory Protection:** When efficient engineering controls are not possible, suitable respiratory protection should be provided. Respirator use must be approved by EHS and Employee Health. Prior to respirator use, the wearer must be medically cleared, fit tested, and properly trained to ensure the respirator is adequate for the task and will function properly. All employees required to wear a respirator must be fit tested and trained annually for as long as they continue to have a need to wear a respirator.
2. **Lab Coats/Lab Aprons:** One of the main forms of general protection is the lab coat. Lab coats shall be worn whenever there is a possibility of splashes, spills, or other clothing contamination to laboratory personnel. In situations where the possibility of a splash is high, such as acid washes, plasticized aprons and shoe coverings should be worn.
3. **Eye Protection and Face Protection:** Eye and/or face protection shall be worn whenever there is a procedure being performed on the bench top, in the chemical fume hood, or where there is a risk of splashes, explosion, or implosion. At a minimum, eye protection is mandatory for all entries into a work area within a laboratory where hazardous chemicals are used. The Principal Investigator or Laboratory Manager will determine the appropriate level of eye protection required. All eye protection used should meet ANSI Z87.1 requirements.
4. **Hearing Protection:** Hearing protection will be provided for anyone working in an area where the sound levels exceed 85 dBa. Contact EHS for measurement of noise levels, recommendations for proper hearing protection, and to evaluate the need for noise reduction engineering controls.

5. **Gloves:** Wear appropriate gloves when the potential for contact with hazardous materials exists. Inspect the gloves before each use and replace them periodically. Gloves should not be worn outside of the laboratory. Disposable gloves should never be reused.
6. **Shoes:** Closed-toed shoes shall always be worn in laboratories to reduce the risk of injury to feet from spills, broken glass, or objects dropped in the laboratory.
7. **Pants:** Shorts should not be worn in the laboratory. Loose fitting long pants provide the best protection against accidental splashes. Legs should be covered entirely to the ankles.
8. **Shirts:** Shirts or tops should cover the entire midsection and easily accommodate a lab coat.

## 10. RECORDS

The Saint Louis University Risk Management and Insurance Department maintains all university illness and accident reports. Employee Health maintains all medical records relating to all reported chemical exposures and potential chemical exposures. EHS maintains all laboratory safety inspections, chemical fume hood certification records and all radiation dosimetry records.

## 11. SIGNS AND LABELS

### A. Basic Laboratory Signage

The following signs shall be prominently posted:

- Emergency telephone numbers (posted near the phone).
- Location signs for safety showers, eye washes, fire extinguishers, and first aid equipment.
- Warning signs at areas or equipment where special or unusual hazards exist.
- Laboratory entry hazard warning signs with emergency contact numbers.

### B. Refrigerator, Freezer, Cold Room and Microwave Signage

All standard laboratory refrigerators, freezers, cold rooms and microwaves used for chemical storage or preparation must have the following labels clearly posted:

- NOT FOR FOOD OR DRINK
- DO NOT STORE FLAMMABLES/SOLVENTS IN THIS REFRIGERATOR/ FREEZER

### C. Hazardous Materials Containers

The following rules for hazardous materials containers shall be followed:

- Labels on incoming containers of hazardous chemicals are not to be removed or defaced until the container is empty and triple rinsed.
- Secondary use containers (containers used for dispensing from bulk containers or containers of chemical mixtures prepared in the lab) should be labeled with complete chemical name, concentration, and the hazard class.

## 12. SPILLS, ACCIDENTS AND EMERGENCY RESPONSE

### A. Spills

Occasionally, and in spite of our best efforts to prevent them, accidents will occur in the laboratory. The most common accident in the laboratory is a chemical spill. For this reason, Saint Louis University has a Hazmat Response Team that is on call 24 hours a day, 7 days a week. This team is managed by EHS and can be reached by calling the Department of Public Safety and Emergency Preparedness (DPSEP) at 314-977-3000.

The following procedures should be followed in the event of a chemical spill in your laboratory:

- Personnel Decontamination: In the event of skin or eye exposure to a chemical, immediately flush the area with water for 15 minutes.
- Evacuate the immediate area of the spill and adjacent areas.
- Notify your supervisor and/or other employees in the area.
- Contact DPSEP at 314-977-3000 to report the spill and request assistance.
    1. State that you have had a chemical spill.
    2. Provide DPSEP with:
        a. correct spelling of the chemical name
        b. volume of chemical spilled
        c. exact location of the spill, including building name and room number
        d. contact phone number at which you can receive a return phone call
- Seek medical attention from the SSM Health Saint Louis University Hospital Emergency Department or Employee Health, if necessary. All injuries/illnesses should be reported on the Employee Report of Injury form.

### B. Accidents

Accidents involving fire or explosions will activate installed automatic alarm sensors and fire extinguishing systems. Where automatic systems do not exist, manual alarm pull stations are installed along egress routes and must be activated during evacuation.

Accidents involving hazardous chemical spills, fires, or explosions shall be immediately reported to Saint Louis University Department of Public Safety and Emergency Preparedness at 314-977-3000. DPSEP will contact the appropriate personnel. Reporting of accidents to DPSEP should be clear and concise, including the following information:

1. Nature of the accident, type of hazardous material involved (biological, chemical, or radioactive).
2. Specific hazardous material involved, if known (e.g. chemical name)
3. Nature of any injuries
4. Location (building and room number)
5. Name of the caller
6. Return call phone number where caller can be reached (outside of the danger area)

Personnel at the immediate scene of the accident should take actions, based on their training, which will mitigate the extent of the accident without jeopardizing their own health and safety. When in doubt, warn others in the area, evacuate the area, relocate to a safe location, and contact DPSEP.

## C. Accident Investigation and Reporting

Accidents involving injury or illness must be reported on the Employee Report of Injury form (available from Human Resources and/or Employee Health) and distributed as indicated on the form. All other accidents and near accidents (injuries, fires, spills, explosions) shall be reported in writing to EHS as soon as possible after the occurrence. EHS will analyze accidents and "near misses" and provide recommendations to the employee and report as necessary to the proper authorities.

## D. Emergency Response

The University Emergency Response Guide provided by the Department of Public Safety and Emergency Preparedness is available from EHS and should be posted in or near each laboratory. This document identifies the following response procedures:

- Fire
- Earthquake
- Tornado
- Police Emergency
- Bomb Threat
- Chemical Spill
- Radioactive Spill
- Loss of Utilities
- Medical Emergency
- Explosion
- Workplace Violence

## E. Emergency Safety Equipment

1. **Eyewashes:** Emergency eyewashes and showers are required through OSHA standard 1910.151(c) to be present in all areas where "the eyes or body of any person may be exposed to injurious corrosive materials."
    - Emergency eyewashes and showers should be located no more than 75 ft, or ten seconds travel time, from an area where hazardous materials are being used according to ANSI Z358.1-2004 (American National Standard for Emergency Eyewash and Shower Equipment).
    - Emergency eyewashes and showers should be clearly identified by a "highly visible sign."
    - Eyewashes shall be inspected and flushed at least weekly to clear any debris that might be present from the plumbing and to verify proper operation.
    - All labs are required to document a weekly inspection and testing of the eyewash. Documentation of this testing should be kept visible in the laboratory.

2. **Safety Showers:** A safety shower should be present in or near all laboratory areas in which there is a potential for a toxicologically significant quantity of a hazardous chemical to be splashed onto the body. Safety showers are inspected and tested annually by EHS.
3. **Fire Extinguishers:** A fire extinguisher must be present in or near each laboratory area. The fire extinguisher must be appropriate for the classes of fires possible in that particular laboratory. Fire extinguishers are inspected monthly and serviced annually by EHS or Facilities Services.

## 13. TRAINING

### A. Chemical Hygiene Plan Training

The purpose of Chemical Hygiene Plan training is to provide employees with general information about the physical and health hazards of hazardous chemicals in their work area and of the methods and procedures employees should follow to protect themselves from these materials. All employees must review the contents of the Chemical Hygiene Plan on their first day of employment in the laboratory or prior to the start of laboratory work. The Principal Investigator or Laboratory Manager is responsible for ensuring the training has been completed and documented.

### B. Laboratory Safety and Compliance Training

EHS provides Laboratory Safety and Compliance Training. All faculty, staff, students, volunteers and visitors working in a research or teaching lab are required to attend Laboratory Safety and Compliance Training prior to working with or around hazards in a laboratory. Laboratory Safety and Compliance Training is required once every twelve-month period. EHS provides opportunities to attend this training on a bi-weekly basis. Specially scheduled training may be provided upon request. The employee should receive this training at the first opportunity after being assigned to laboratory work. Departments requiring special training options or additional training dates should contact EHS at ehs@slu.edu. Ensuring that each employee obtains the necessary training will be the responsibility of the department and principal investigators/laboratory managers.

### C. Laboratory Specific Training

Principal Investigators/Laboratory Managers must ensure that Laboratory Specific Training is provided to each laboratory employee prior to the start of laboratory work and upon the introduction of any new significant laboratory hazards thereafter. Laboratory Specific Training should be specific to the hazardous materials and/or equipment to be used and/or stored in their laboratory. Laboratory employees should refer to the required Laboratory Specific Training Outline as needed. Laboratory Specific Training will need to be updated when a lab moves or acquires additional space, as the relative location of safety equipment to hazards will have changed.

## 14. CHEMICAL WASTE DISPOSAL

To prevent injury, minimize environmental impact, and meet regulatory requirements, SLU hazardous waste generators (laboratory employees, students and visitors) must comply with strict chemical waste disposal procedures. All laboratory faculty and staff are accountable for the waste generated and disposed of in their laboratory. The following information provides general guidance to ensure University waste is disposed of in a safe, environmentally responsible, and legal manner. Individuals may be held criminally liable for violations of applicable laws and regulations.

- Do not dispose of hazardous chemicals down the drain or with regular trash.
- Do not use fume hoods, ovens, or open containers to intentionally evaporate chemicals for the purpose of disposal.
- Do not store chemical waste outside the laboratory.
- Do not abandon chemical waste in cold rooms or common areas.

### A. Minimize Initial Generation

Review each experimental protocol to assure that hazardous chemicals are used efficiently and that excess purchases are minimized. Laboratory faculty and staff are encouraged to conduct microscale processes to minimize hazardous materials used and generated. Whenever possible, use substances which can be neutralized or stabilized, either physically or chemically. Prior to purchasing chemicals consider substituting with a less hazardous material when practical.

### B. Comply with Requirements for Waste Storage

All chemical wastes must be stored in appropriate containers compatible with their respective chemical hazards. Containers must be capped tightly and completely sealed to prevent spillage (no open-top glassware!). If building pressure is a concern, a waste container may be temporarily vented in secondary containment within a fume hood until pressure is no longer a concern. Liquid waste must be in screw top containers only. The outside surfaces of containers must be clean and free of any contamination. Store chemical waste in a designated location (low traffic, safe, secure, contained area, etc.).

### C. Appropriately Label Every Container

1. **Label as "Hazardous Waste":** All chemical waste containers must be identified and labeled with the words "Hazardous Waste".
2. **List all Chemical Components:** All chemical components must be listed. (Do not lose track of container contents! All unknowns must be analyzed and their hazardous components identified.) All constituents in solid and liquid mixtures must be identified, and to the extent possible their concentrations stated.
3. **Accumulation Start Date:** The accumulation start date must be specified on the label, including the month, day, and year (mm/dd/yyyy). Disposal is required within one year of this date. Contact EHS for proper disposal of the waste.

4. **Inadequate Labels:** Labels such as "Inorganic Waste" and "Organic Solvent Waste" are not adequate and would require listing of individual chemical components. Abbreviations can be ambiguous, and are not allowed. The identity of a waste container's contents must be unmistakable.
5. **Defacing of Original Labels**: Any original/existing labels must be defaced by either removal or clearly marking through the original label if or when the container is empty.

## D. Properly Segregate Hazardous Waste

Chemical waste must be segregated into the appropriate hazard classes (flammables, acids, bases, oxidizers, toxics, etc.). When possible, keep solids, liquids, and gases separate.

## E. Proper Chemical Waste Disposal

To request chemical waste removal from the laboratory, complete the online Chemical Transfer Form located at https://www.slu.edu/research/faculty-resources/research-integrity-safety/environmental-health-safety/waste-removal.php. EHS will not accept improperly labeled, improperly packaged and/or improperly segregated chemicals, unless special arrangements have been made prior to the request. Transferring chemical waste into appropriate containers is the generator's responsibility. Waste containers become the property of EHS and cannot be returned to the laboratory without prior arrangements. To discuss disposal procedures, options and/or projects related to hazardous waste disposal, contact EHS at chemwaste@slu.edu.

## F. Disposal of Non-hazardous Laboratory Waste Chemicals

Chemicals known to be non-hazardous and not RCRA regulated may be discarded in the normal trash or sanitary sewer. Landfill employees and housekeeping staff may not be familiar with and/or able to distinguish between non-hazardous and hazardous chemicals. Therefore, large amounts of non-hazardous chemicals should be disposed of through EHS. You may place small amounts of non-hazardous chemicals in the regular trash if they are sealed, and clearly marked as "non-hazardous". Non-hazardous liquids may be discarded via sanitary sewer in small volumes. If there are any questions or uncertainty about the hazardous nature of a waste chemical, contact EHS for clarification and proper disposal.

## 15. SAFETY DATA SHEET (SDS)

The Occupational Safety and Health Administration (OSHA) requires all chemical manufacturers, wholesalers, and distributors to provide Safety Data Sheets (SDS) for the products which they produce and sell. OSHA also requires that employers maintain in the workplace, copies of the SDS for each hazardous chemical. SDS are required to be accessible at all times work is being conducted. With any chemical, it is prudent to consult the SDS before use. In general, a SDS consists of the following sections:

1. Chemical Identification
2. Hazards Identification
3. Composition/Information on Ingredients
4. First-Aid Measures
5. Fire-Fighting Measures
6. Accidental Release Measures
7. Handling and Storage
8. Exposure Controls and Personal Protection
9. Physical/ Chemical Properties
10. Stability and Reactivity
11. Toxicological Information
12. Ecological Information
13. Disposal Considerations
14. Transport Information
15. Regulatory Information

Typically, SDS are shipped with the chemical order or you may contact the manufacturer to request the SDS. EHS maintains a SDS collection as a resource to all Saint Louis University employees, students and visitors.